CircuitPro PL 3.5

Online help

LPKF
Laser & Electronics

Translation of the German original document

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License level Basic

The license level Basic of the software provides the basic functions for using the system. If a function is not available, the following message is displayed:
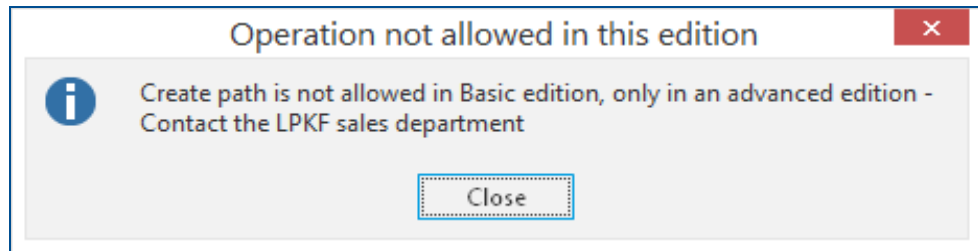

Fig. 1:   **Message *Operation not allowed in this license level***

License level Advanced

In the license level Advanced, the following functions are available in addition to the basic functions:

- Templates for non-laminated materials as well as multi-layers and ProMask templates
- Importing DXF files
- Multiply the layout with Step and repeat and create instance types
- Functions in the user guidance step *Layout* for creating and editing objects.
- Automatic fiducial creation

1 User interface

The user interface of your system software is divided in individual panes that can be shown or hidden as required. Additionally, you can move, minimize, and arrange the panes according to your needs. Thus, the user interface is variable and possibly structured differently.
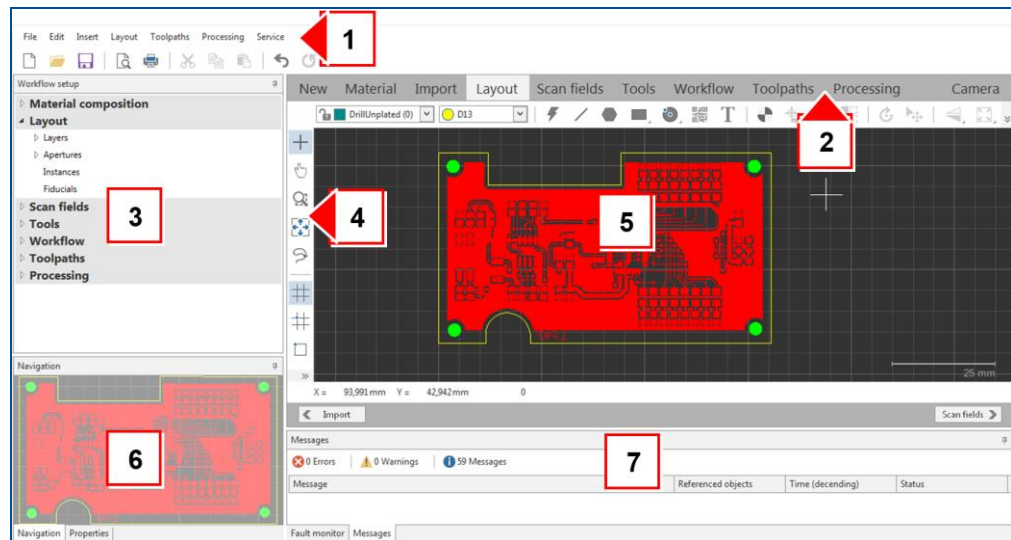
Fig. 2: **User interface**

The following table describes the individual areas of the user interface:

No.	Name	Description
1	Menu bar and toolbar	Contains menu items and provides fast access to frequently used functions.
2	User guidance steps	Contains several user guidance steps (New, Import, Layout, etc.), that guide you through the process.
3	Pane *Workflow setup*	Contains information on the tools, the scan fields, and other structures of the work file.
4	Toolbar View	Contains functions for displaying the objects.
5	Views	Contains a two-dimensional view of the workpiece that can be zoomed. Contains several switchable views with different functions.
6	Pane *Navigation*	Contains information on the objects or the current position.
	Pane *Properties*	Contains several panes with information on objects or the current position.
7	Pane *Fault monitor*	Contains a list of all errors.
	Pane *Messages*	Contains a list of messages.

Table 1: **User interface**

1.1 Pane *Workflow setup*

The pane *Workflow setup* contains information on the currently loaded processing data such as layer, scan fields, used tools, etc.

Most of the entries contain functions that can be activated via the context menu.
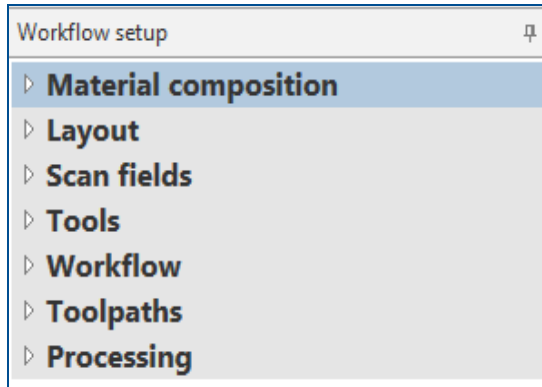
Fig. 3:   **Pane *Workflow setup***

The entries of the pane *Workflow setup* are described in the following table:

Name	Description
Material composition	Displays several information on the material set.
Layout	Displays the existing objects, fiducials, and apertures.
Scan fields	Displays the existing scan field sets and the computed scan fields.
Tools	Displays the existing tools and the tools that are assigned to the project.
Workflow	Displays the active and inactive work packages and the order of processing.
Toolpaths	Displays the computed toolpaths of the individual tools.
Processing	Displays the order how the active work packages are processed.

Table 2:   **Pane *Workflow setup***

1.1.1   Material composition

This section of the *Workflow setup* displays the existing layers according to the material surface.
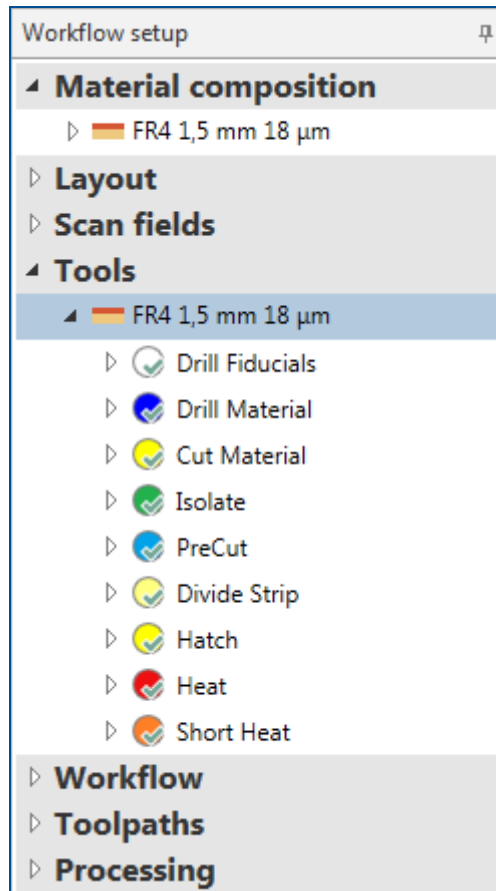
Fig. 4:   **Pane *Workflow setup* | *Material composition***

1.1.2   Layout

This section of the *Workflow setup* contains information on the different layers of the processing data and the contained objects.
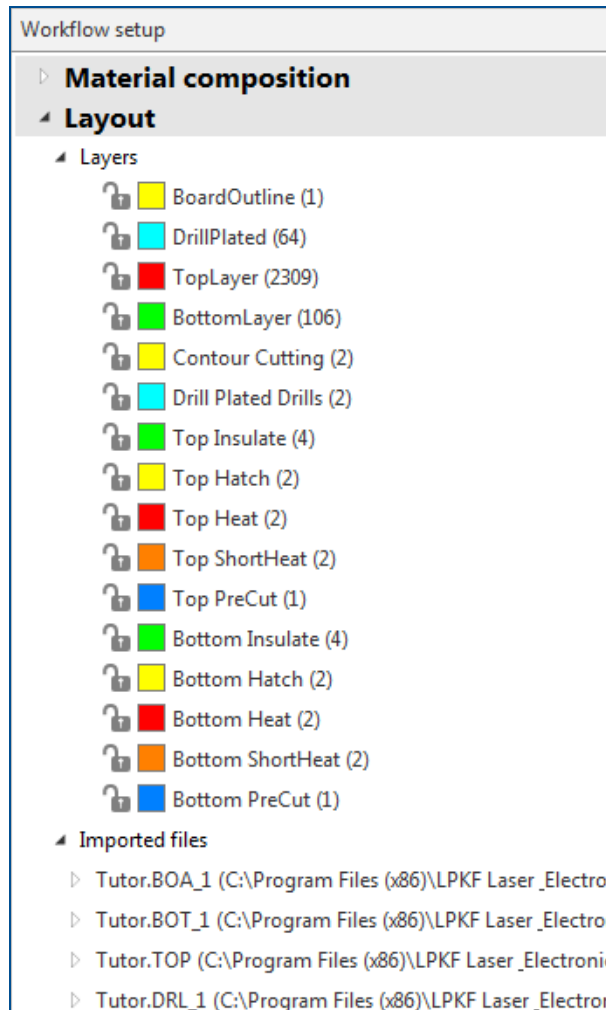
Fig. 5:   **Pane *Workflow setup | Layout***

The entries of the section *Layout* are described in the following table:

Name	Description
Layers	Contains all existing layers.
Apertures	Contains all existing apertures.
Instances	Contains all existing instances.
Fiducials	Contains all existing fiducials.

Table 3:   **Pane *Workflow setup | Layout***

In the context menu, specific functions of the individual items are available. Right-click to open the context menu.

The entries of the context menu are described in the following table:

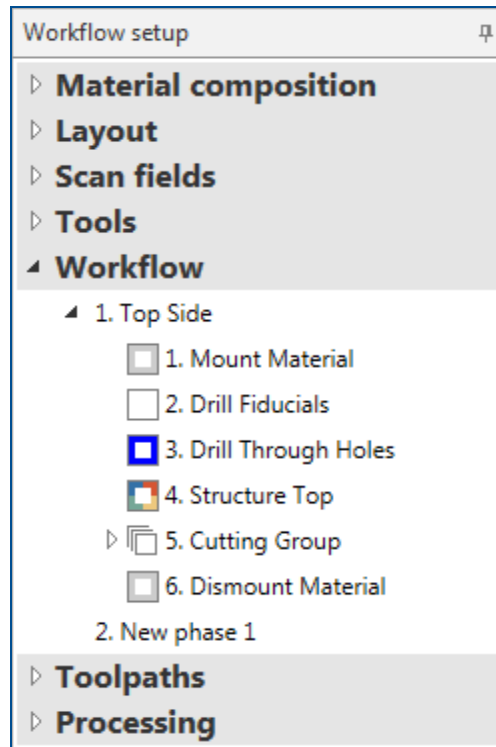| Section/Item	Name	Description
Layers	Add layer	Adds a new layer.
Selected layer	Color...	Changes the color of the objects within a layer in the view *CAM*.
	Visible	Shows/Hides the layer in the view *CAM*.
	Selectable	Disables/Enables editing objects within the selected layer.
	PCB layer	Assigns the layer to a PCB layer.
	Display mode	Sets how the objects are displayed in the view. • Thin line: Displays the objects as thin line. • Contour: Displays the objects as contour. • True width: Displays the objects in their true width.
	Technology	Assigns a technology to the layer. The selected technology determines which tools can be used.
	Inverse	Structures the source layer from the inside. Example: In a letter or a number the inner area is structured.
	Rename	Renames the selected layer.
	Delete	Deletes the selected layer.
Selected instance	Edit instance type	Opens the dialog *Edit instance type*.
	Dissolve instance type	Dissolves the selected instance type.
Selected fiducial	Edit fiducial	The selected group is reimported.
	Configure search strategy…	Opens the dialog *Configuration of search strategies*.
	Copy search strategy to	Assigns the search strategy of the selected fiducial to another fiducial.
	Assign to layer	Allows you to assign the fiducial to the layer *Fiducial.*

Table 4:   **Context menu *Layout***

Configuring search strategy

Opens a dialog to configure a search strategy.

Summary
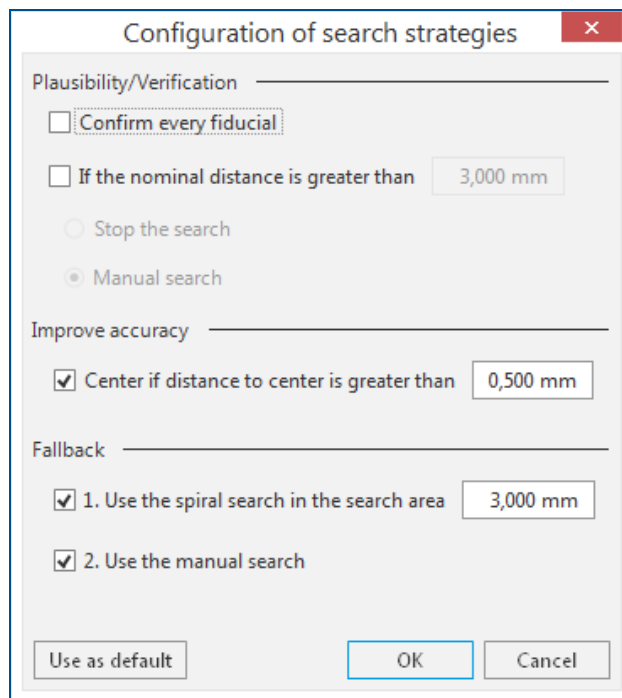
Use the *Configuration of search strategies* dialog to define the further procedure when the fiducial search finds no valid hits.

You can set several parameters that determine which hits are valid.

Plausibility/Verification

Enable this function to determine the behavior if the hit shall lie outside the set distance. In this case, the search can either be performed manually or canceled.

Improve accuracy

If this function is enabled, and the distance is greater than the set distance, the processing head moves over the target and the camera is focused again. This results in a better recognition of the fiducial but requires more time.

Fallback

If a fiducial is not located at the expected position, a spiral search can be performed in the defined area. This runs within a square spiral from the inside out while the search area is checked for valid hits. If no fiducial has been, a manual search can be executed as a last possibility.

1.1.3   Scan fields

This section of the *Workflow setup* displays the existing scan fields.
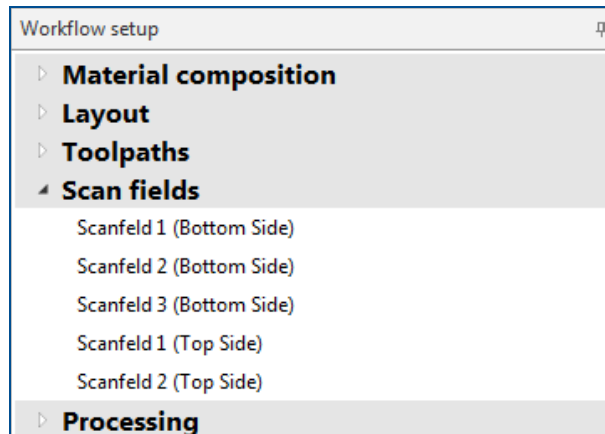
Fig. 6:   **Pane *Workflow setup* | *Scan fields***

The entries of the section *Scan fields* are described in the following table:

Name	Description
Scan field	Scan field name with consecutive numbering.

Table 5:   **Pane *Workflow setup* | *Scan fields***

In the context menu, specific functions of the individual items are available. Right-click to open the context menu.

The entries of the context menu are described in the following table:

Section/Item	Name	Description
Scan fields	Compute	Computes all scan fields.
	Create scan fields	Opens a dialog for creating a new scan field set.
Scan field	Compute	Computes the scan fields based on the selected scan field set.

Table 6:   **Context menu *Scan fields***

1.1.4   Tools

This section of the *Workflow setup* contains information on the different tools and their tasks.
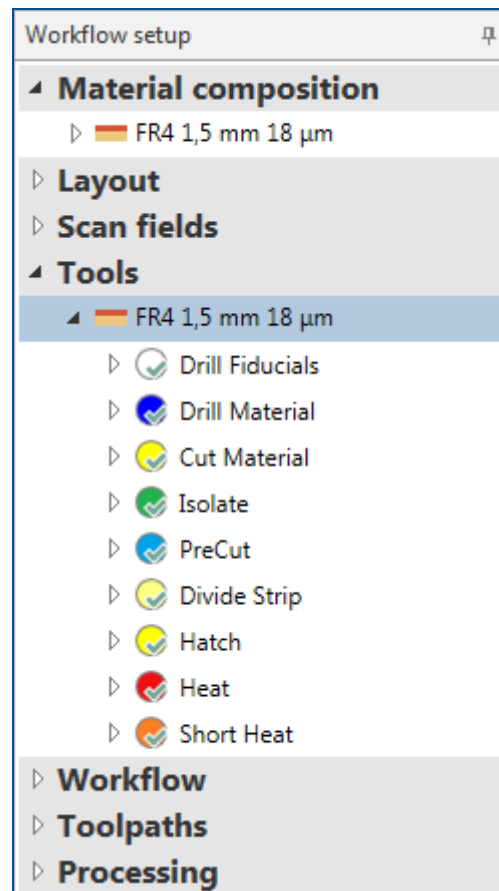
Fig. 7:   **Pane *Workflow setup | Tools***

1.1.5   Workflow

This section of the *Workflow setup* contains information on the work packages of the project. The work packages combine various information such as layers, tools, scan fields and technology and enable computing the toolpaths.

There are predefined work packages that already use the existing layers, tools and scan fields. If you are using customized data for your own layout, you should edit the work packages or create new ones.

Fig. 8:   **Pane *Workflow setup | Workflow***

In the context menu, specific functions of the individual items are available. Right-click to open the context menu.

The entries of the context menu are described in the following table:

Section/Item	Name	Description
Workflow	Add production phase	Creates a new production phase.
Phase	Computing toolpaths	Computes the toolpaths for the assigned layers and scan fields.
Work package	Cut	The selected work package is removed and copied into the clipboard.
	Copy	Copies the currently selected work package into the clipboard.
	Activated	Activates/Deactivates the work package during production.
	Process	Starts processing the selected work package.
	Process all	Starts processing the selected phase.
	Rename	Renames the work package.
	Delete	Deletes the work package.

Table 7:   **Context menu *Workflow***

1.1.6   Toolpaths

This section contains the computed toolpaths and their assigned work packages and tools. The toolpaths are used to show the movements of the processing head and to implement them during processing of the material.
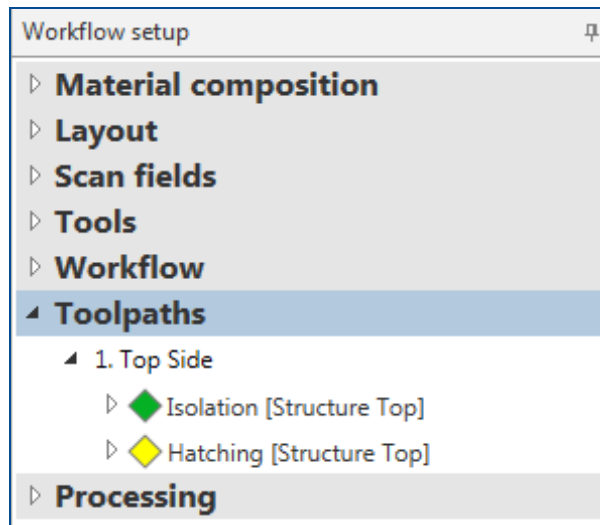
Fig. 9:   **Pane *Workflow setup | Toolpaths***

1.1.7   Processing

This section contains the work steps that are executed during production. These work steps comprise the loading and unloading process and the active work packages. The work packages can be processed as sorted either by tool or by scan field.
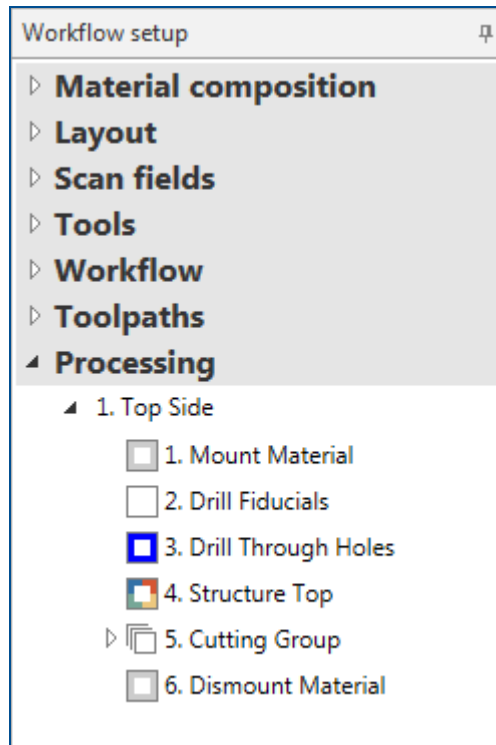
Fig. 10:   **Pane *Workflow setup | Processing***

In the context menu, specific functions of the individual items are available. Right-click to open the context menu.

The entries of the context menu are described in the following table:

Section/Item	Name
Selected processing side	
Check tool settings	Opens a dialog for checking the current tool settings.

Table 8:   **Context menu** *Processing*

1.2   Toolbar *View*

The toolbar *View* is a vertical bar that is available for all views. Depending on the view, the available functions can vary.

The toolbar *View* contains the following icons/functions:

Icon	Name	Description
	Selection	Selects a rectangular area by drawing with the mouse. All objects inside are marked.
	Pan	Moves the visible area of the processing data within the view by dragging with the mouse. This can also be activated by pressing the mouse wheel (if present).
	Zoom area	Zooms into the selected area.
	Fit all	Displays the whole layout. The view *Processing* displays the whole processing area.
	Polygonal selection	Marks objects by drawing a polygon.
	Show grid	Shows/Hides the grid.
	Snap to grid	Defines whether operations can only be used on grid points. This works also when the grid is hidden.
	Snap to object	Defines whether the mouse cursor can only be snapped to certain points on an object.
	Snap to angle	Defines that the mouse pointer is snapped to a specific angle when selecting a second point. Additional angles can be configured under *Snap to* in the options.

Table 9:   **Toolbar** *View*

In the view *Camera* the following functions are available:

Icon	Name	Description
	Crosshair overlay	Shows the crosshair in the camera view.
	Crosshair overlay with circle	Shows the crosshair with circle in the camera view.
	Crosshair overlay with rectangle	Shows the crosshair with rectangle in the camera view.

Table 10: **View** *Camera*

1.2.1 Selection

Selects objects and elements within the view.

Summary

The selection allows to select individual objects and several objects at the same time.
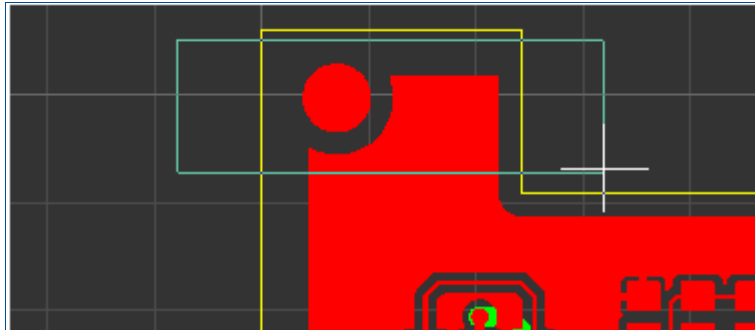
Fig. 11:   **Select objects**
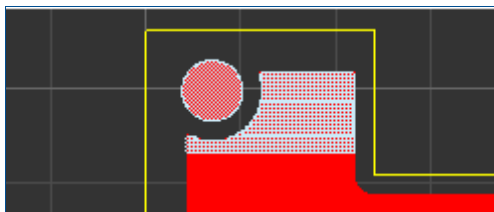
Fig. 12:   **Objects selected (hatched white)**

It is important for selection whether the selection rectangle is opened from top to bottom or from bottom to top.
Selection from top to bottom: Only those objects are selected that are completely within the selection rectangle.
Selection from bottom to top: All objects are selected that are (partly) within the selection rectangle.

1.2.2   Pan

Moves the entire displayed area by clicking and dragging the mouse.

You can also move the displayed area by clicking and dragging the mouse in the pane *Navigation*.
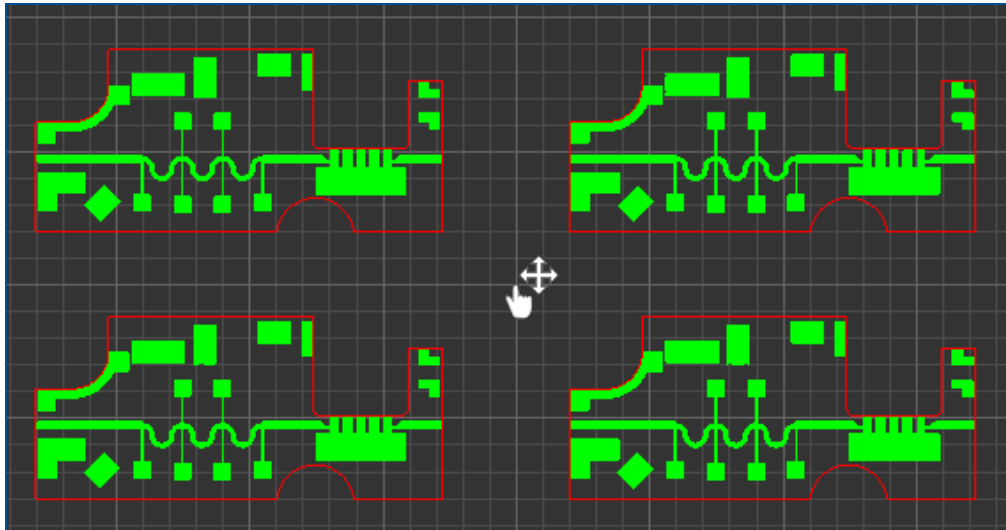
Fig. 13:   **Pan**

1.2.3   Zoom area

Selects a rectangular area by drawing with the mouse. The selected area is zoomed in.
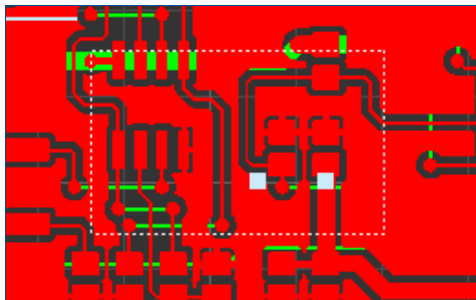
Fig. 14:   **Zoom area**
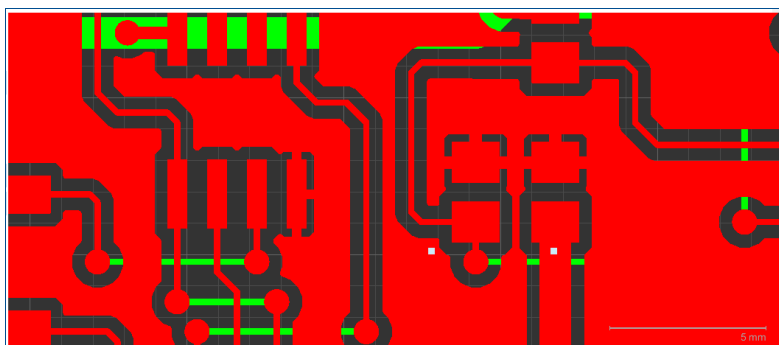
Fig. 15:   **Area zoomed in**

1.2.4   Fit all

Changes the displayed area so that all existing objects in the layer are completely displayed.

The function [Fit all] shows in the user guidance step *Processing* the entire processing area.
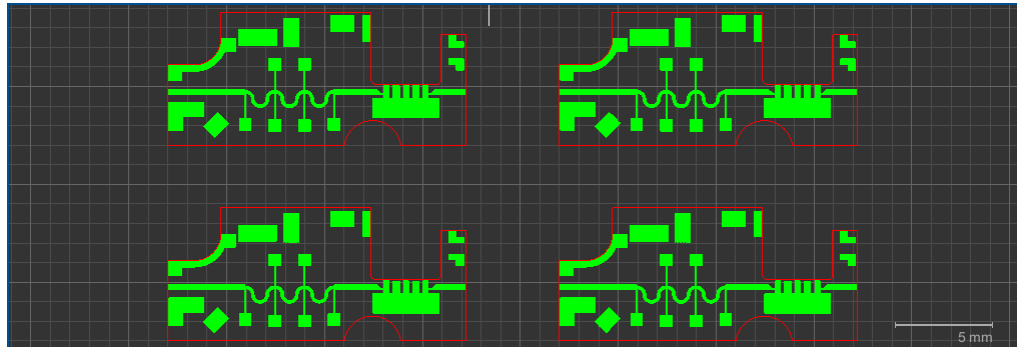
Fig. 16:   **Fit all**

1.2.5   Polygonal selection

Selects an area by clicking and drawing a polygon with the mouse. The marked objects within the polygon are selected.

Marks objects by drawing a polygon.
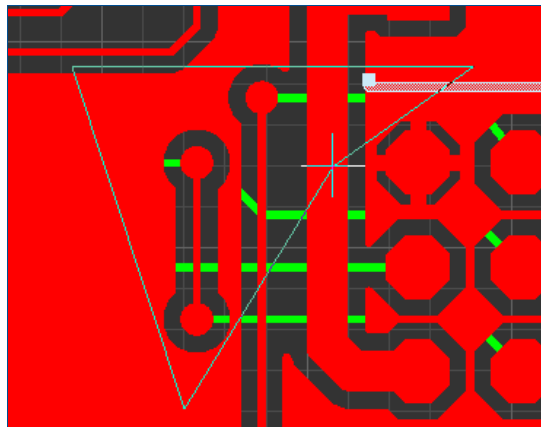
Fig. 17:   **Polygonal selection**
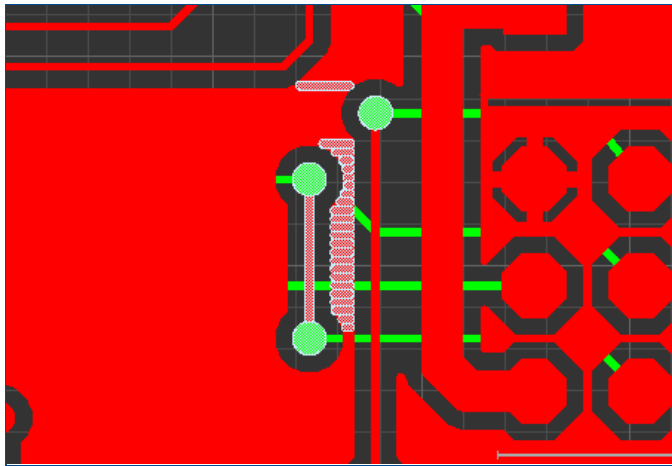
Fig. 18:   **Polygons selected**

1.2.6   Show grid

Shows/Hides the grid in the workpiece view.

The function [Snap to grid] can also be used when the grid is hidden.
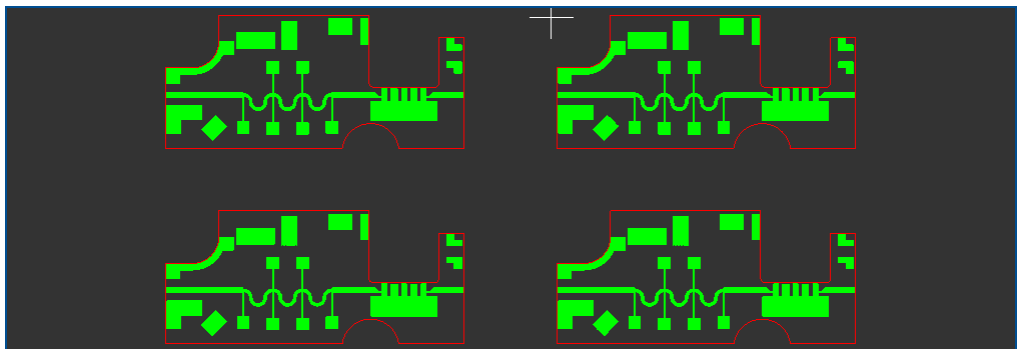
Fig. 19:   **Hide grid**
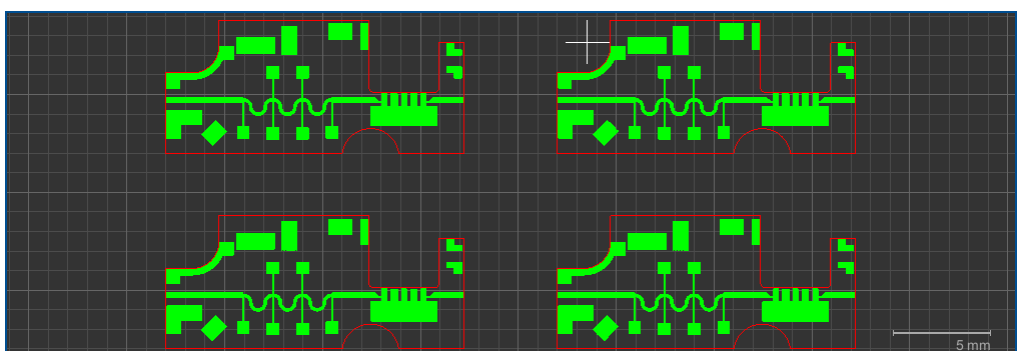
Fig. 20:   **Show grid**

1.2.7 Snap to grid

Defines whether objects can only be created/moved on grid points.

[Snap to grid] is not working when the grid is hidden.
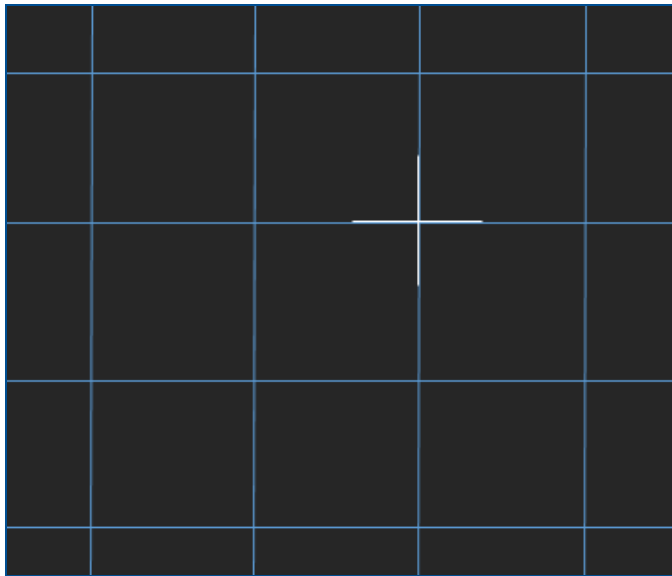
Fig. 21:   **Cursor (white crosshairs) on grid point**

1.2.8 Snap to object

Defines whether the mouse cursor can only be snapped to certain points on an object.

In *File > Options > General > Snap* you can make further settings for the function [Snap to object] in the tab *Snap to object*.

1.2.9 Snap to angle

Defines that the mouse cursor is only snapped onto angles.

In File > Options > General > Snap you can make further settings for the function [Snap to angle] in the tab Snap to angle.

1.3   Menu bar and toolbar

The pane *Menu bar and toolbar* contains important main functions of the software.

Fig. 22:   **Menu bar and toolbar**

The functions of the menu bar and toolbar are described in the following table:

Icon	Name	Description
	Create new project file based on a template	Navigates to the user guidance step *New*. You can start a new project there.
	Open existing project file	Displays the file system where you can open an existing project file.
	Save current project file	Saves the current project file in the file system.
	Print preview	Displays a print preview of the current layout.
	Print layout	Opens a dialog to configure the print settings.
	Cut selected objects	Cuts all selected objects and places them into the clipboard.
	Copy selected objects	Copies all selected objects into the clipboard.
	Paste objects from clipboard	Pastes all objects from the clipboard into the project.
	Undo last action	Undoes the last action performed.
	Redo last action	Redoes the last action undone.
	Delete selected objects	Deletes all selected objects.

Table 11: **Menu bar and toolbar**

1.4   Pane *Fault monitor*

The pane *Fault monitor* contains a list of all active faults. These can refer for example to error messages during workpiece production or to a problem while starting the system.
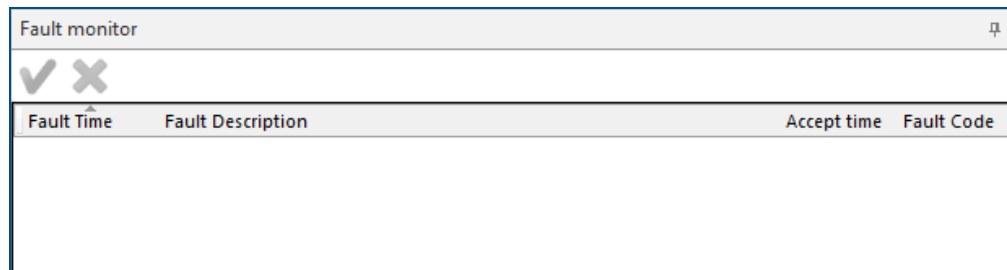

Fig. 23:   **Pane *Fault monitor***

The icons/functions are described in the following table:

Icon	Name	Description
✔	Accept all	Starts the troubleshooting procedure. All errors not yet acknowledged are acknowledged automatically.
✖	Clear all	Deletes all errors from the list that have already been acknowledged.

Table 12:   **Pane *Fault monitor***

The items of the pane *Fault monitor* are described in the following table:

Name	Description
Fault time	Displays the time and date when the error occurred.
Fault description	Displays a detailed description of the error that occurred.
Accept time	Displays the time when the error was acknowledged.
Fault code	Displays the corresponding fault code.

Table 13:   **Items of pane *Fault monitor***

1.5   Pane *Messages*

The pane *Messages* contains a list of all system messages. These are divided into *Errors*, *Warnings*, *Messages*, and *Service messages*.
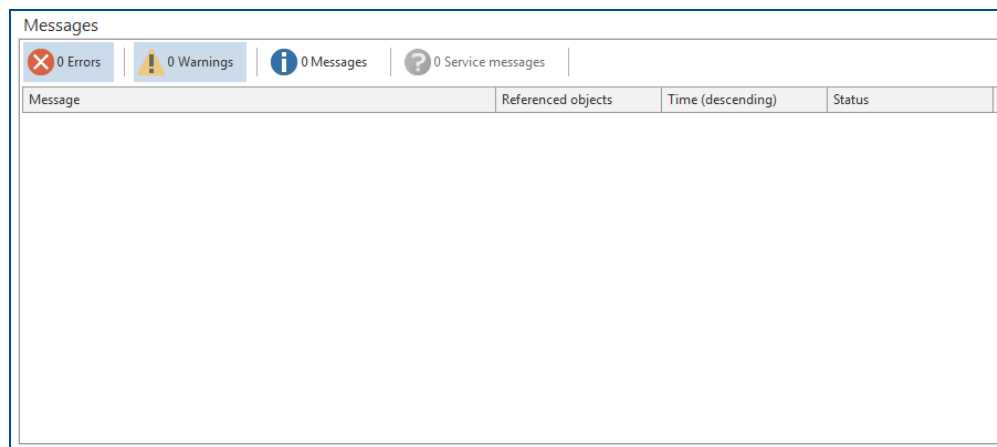
Fig. 24:   **Pane *Messages***

The areas of the pane *Messages* are described in the following table:

Name	Description
Fault	Errors are critical system software errors. The errors can be displayed or hidden by clicking on *Errors*.
Warnings	Warnings are due to input errors that the user has caused. For example, these can be information on canceled actions or actions that have not been executed properly and that can cause a restricted program operation. The warnings can be displayed or hidden by clicking on *Warnings*.
Messages	Messages present statistical information of the system software. These can be feedback of the system software on certain actions that have been executed. For example: *New document created* The messages can be shown or hidden by clicking on *Messages*.
Service messages	Service messages are displayed when maintenance of the system is due. Contact the LPKF service. The service messages can be displayed or hidden by clicking on *Service messages*.

Table 14: **Pane *Messages***

1.6   Pane *Navigation*

The pane *Navigation* displays the object to be processed in small format. The zoomed area in the view *CAM* is marked in the pane *Navigation* (**1**). By keeping the left mouse key pressed, the marked area can be moved.
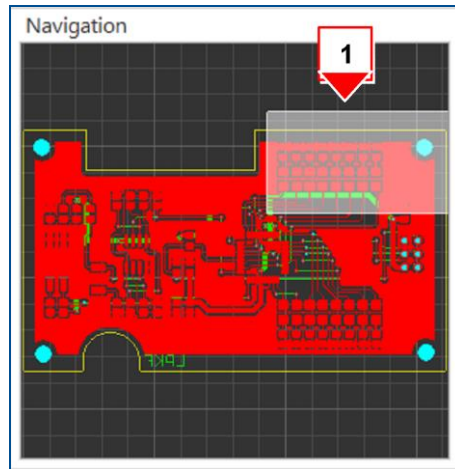
Fig. 25:   **Pane *Navigation***

1.7   Pane Properties

The pane *Properties* contains information on the loaded processing data. Depending on the selected entry in the pane *Workflow setup*, different information is displayed.

Fig. 26:   **Pane *Properties***

2   User guidance steps

The user guidance steps guide you through the process within the application. In order to ensure a safe process, you will be guided from the data preparation to the layout adjustment and to the production, if necessary. You have always the possibility to switch between the user guidance steps.

| New | Material | Import | Layout | Scan fields | Tools | Workflow | Toolpaths | Processing | Camera |
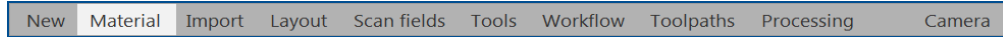
Fig. 27:   **User guidance steps and _Camera view_**

The user guidance steps are described in the following table:

Name	Description
New	Creates a new project or opens an existing project.
Material	User guidance step for selecting and defining the processing material.
Import	Imports selected files. These are displayed in the view of the user guidance steps _Layout_, _Scan fields_, and _Toolpaths_.
Layout	User guidance step for editing the processing data. You can create or edit objects here.
Scan fields	User guidance step for computing and arranging the scan fields.
Tools	User guidance step for creating new tools and editing the tool parameters.
Workflow	User guidance step for activating/deactivating and adapting the work packages. In this user guidance step, you can also assign the work packages to process groups and instance types.
Toolpaths	User guidance step for computing the toolpaths.
Processing	User guidance step for processing the material based on the computed toolpaths and scan fields.
Camera	This view can show the images of both cameras. Furthermore, the processing head can be moved manually.

Table 15:   **User guidance steps**

2.1   New

In the user guidance step *New*, already existing projects or templates can be opened. In addition, the recent projects are displayed.
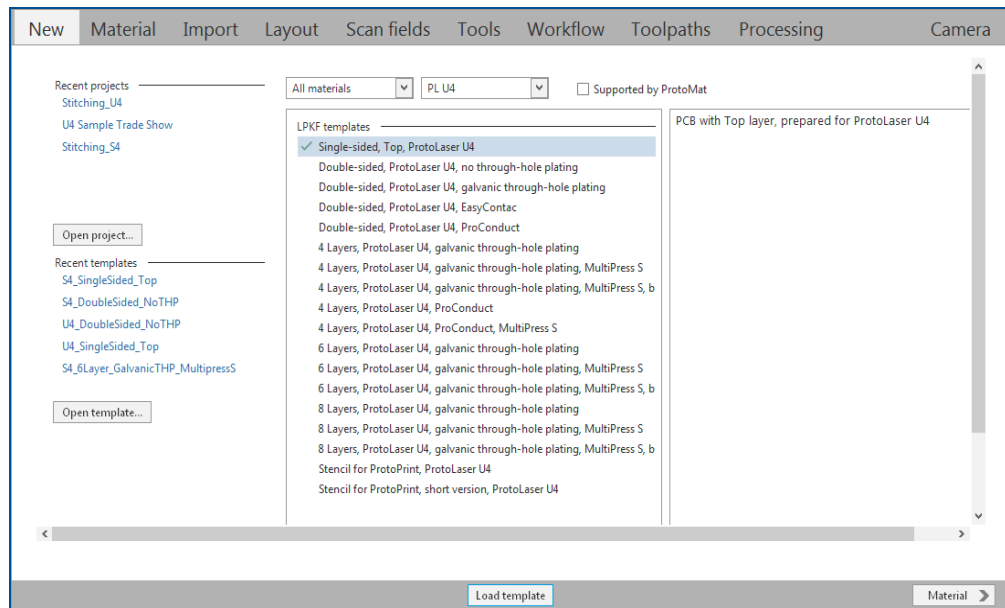
Fig. 28:   **User guidance step *New***

The buttons are described in the following table:

Button	Description
Recent projects	Shows the projects that have been used most recently.
Recent templates	Shows the templates that have been used most recently.
Supported by ProtoMat	Displays only the templates that are supported by ProtoMat, when activated
Open project	Opens a selection to search for a project in the folder system.
Open template	Opens a selection to search for a template in the folder system.
Load template	Loads the currently selected template from the list and switches to the user guidance step *Material*.
Material	Closes the currently opened dialog and switches to the user guidance step *Material*.

Table 16: **User guidance step *New***

2.2   Material

In the user guidance step *Material* you can define the processing material with its properties and select existing material profiles.
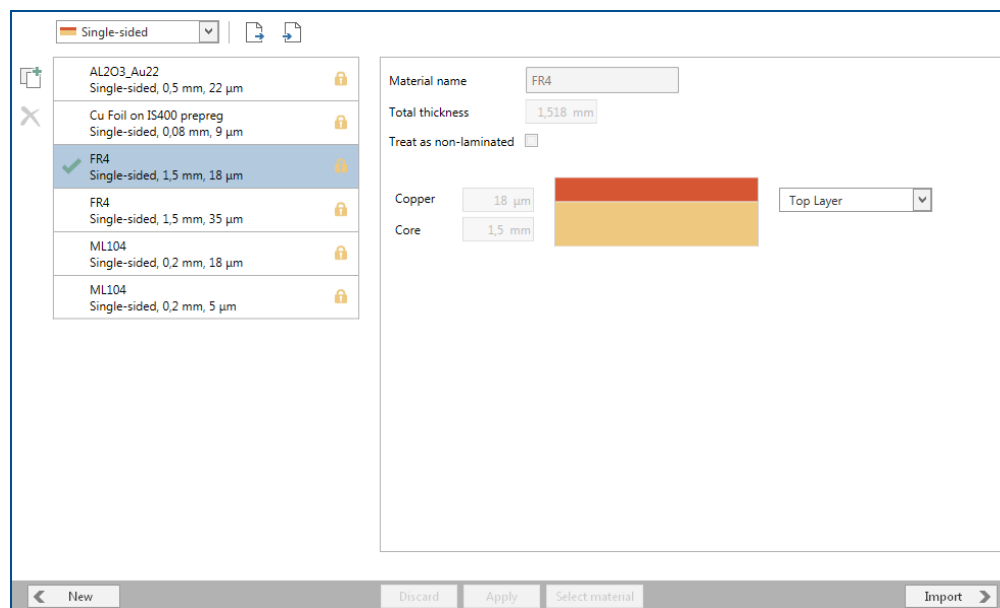
Fig. 29:   **User guidance step *Material***

The icons/functions of the dialog *Material* are described in the following tables:

Icon	Name	Description
All materials ▾	Material type	Selects the material list and only displays materials of a certain type.
	Duplicate material	Duplicates the selected material.
✕	Remove material	Deletes the selected material from the list.
	Export material	Exports the selected material with its properties into the file system.
	Import material	Imports a material from the file system.
Button	Discard	Removes all unspecified materials from the list.
Button	Save	Saves a new created material in the drop-down list.
Button	Select material	Selects the material that has been marked with a left-click.
Button	Import	Continues with the current settings and navigates to the user guidance step *Import*.

Table 17:   **User guidance step *Material***

2.3   Import

In the user guidance step *Import* you can import various file formats.

The following formats are supported:

Format	Description	Extension
BOA BOT DRL TOP	Native file formats	*.boa *.bot *.drl *.top
CAM	Native file format	*.cam
CP2D	Native file format for CircuitPro projects	cp2d
Excellon	File formats for drilling and milling PCBs.	*.drl; *.drd
Gerber	File format for PCB image files	*.gbr
Gerber X, Gerber X2	Enhanced file format for PCB image files	*.gbx
HPGL	File format for drawings, formerly used for operating pen plotters	*.plt
DXF	File format for drawings from the AutoCAD	*.dxf
Sieb & Meyer	File formats for drilling and milling PCBs.	*.drl *.sm1; *.sm2

Table 18:   **Import formats**
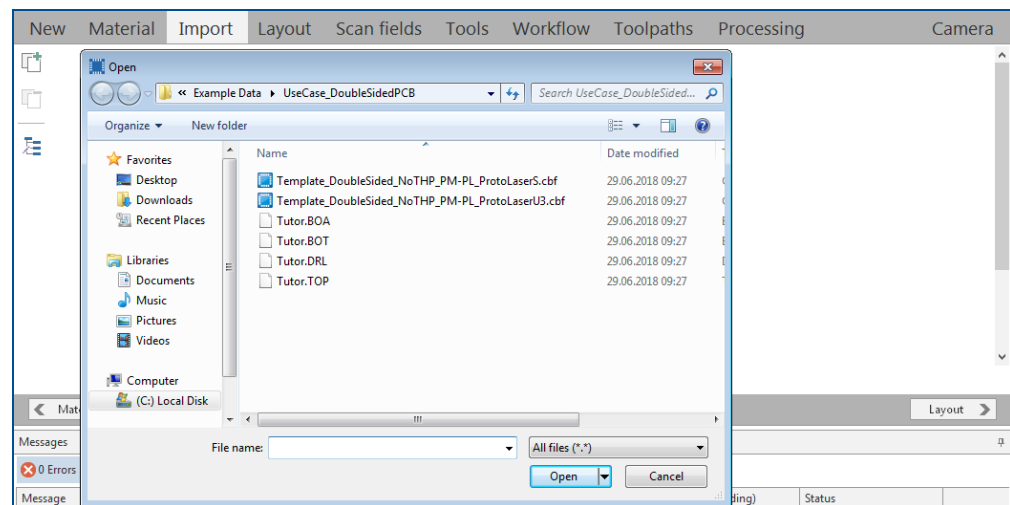
Fig. 30:   **User guidance step** *Import*

The icons and buttons are described in the following table:

Icon	Name	Description
	Add	Opens a drop-down list for importing files from the folder system.
	Discard	Removes the selected file.
	Run ATE	Starts the ATE (aperture template editor).
Button	Discard	Removes the selected file.

Icon	Name	Description
Button	Import	Imports the selected file and displays it in the user guidance step *Layout*.

After importing the desired files, the view is changed as follows:
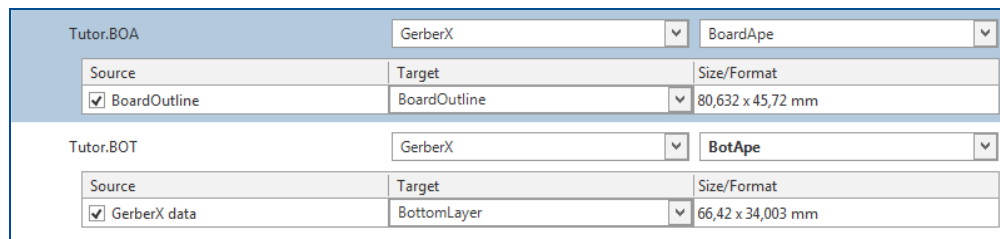
Fig. 31:   **File import**

The following information of the imported files is displayed:

Column	Description
File name	Displays the name of the file to be imported:
Format	Displays the format of the imported file. If the format is not recognized correctly, you can correct the format in the drop-down list.
Source	Indicates the names of the paths/3D elements within the imported file.
Target	Displays the layer to be assigned.
Size/Format	Displays the size/format of the layer.

Table 19: **File import**

The user guidance step *Import* contains the following tabs:

2D

Shows the design and the dimensions of the imported file:
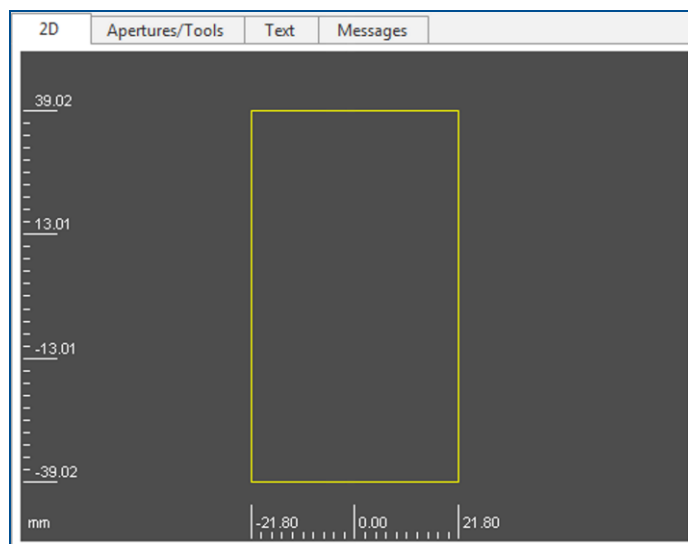
Fig. 32:   **Tab 2D**

Apertures/Tools

Displays a list of apertures and tools that you need for your imported project:

Fig. 33: **Tab *Apertures/Tools***

The columns have the following meaning:

Column	Description
Image	Displays the shape of the aperture.
Name	Displays the name of the aperture.
Mode	Displays whether the aperture has been imported as a drawn object ⬜ or as a flash ✳.
Rotation	Displays whether the aperture is rotated (circular apertures have 0° as default).
a-d	Show parameters that describe the size of the aperture. Depending on the aperture shape, not all parameters are necessary.

Table 20: **Tab *Apertures/Tools***

Text

Displays the ACSII text of the imported file:
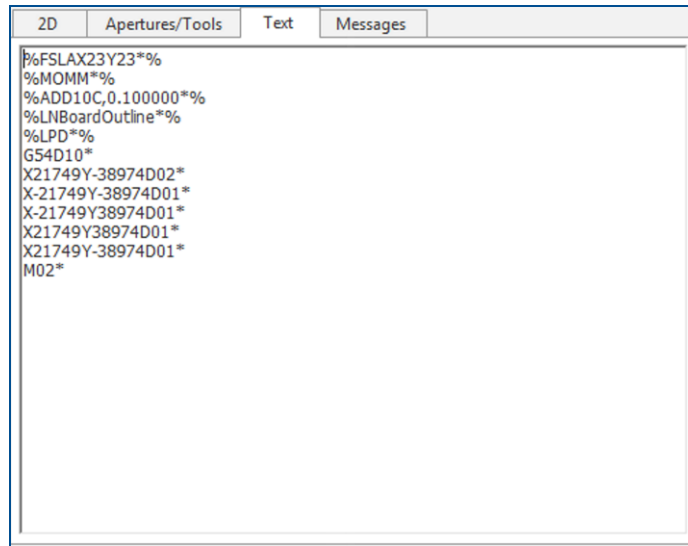
Fig. 34:   **Tab *Text***

Messages

Displays system messages about executed operations:
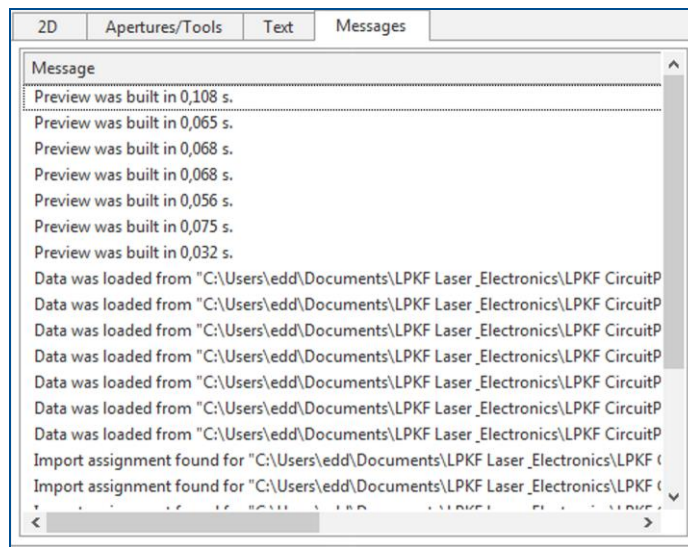
Fig. 35:   **Tab *Messages***

The dialog *Import* contains the following sub tabs, depending on which tab (*2D*, *Apertures/Tools*, *Text*, or *Messages*) is active:

File

Displays the measurements of the imported file:
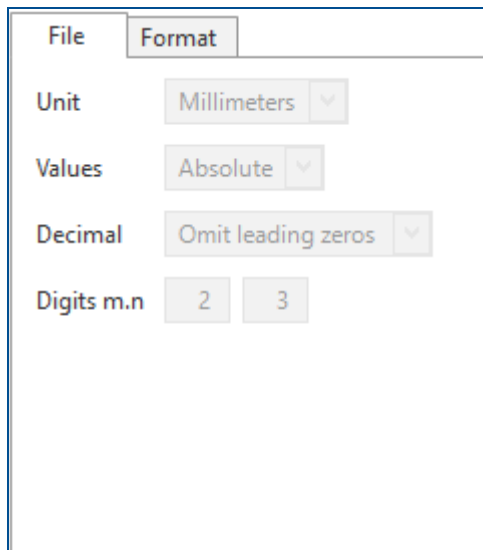
Fig. 36:   **Sub tab *File***

The following settings are possible:

Setting	Description
Unit	Specifies the measurement unit (millimeters or inches).
Values	Specifies whether absolute or relative values are used.
Decimal	Specifies whether leading or trailing zeroes are to be suppressed.
Digits m.n	Specifies the number of decimal places of the coordinates: m = places before the decimal point n = decimal places

Table 21: **Sub tab *File***

Format

Provides various options:
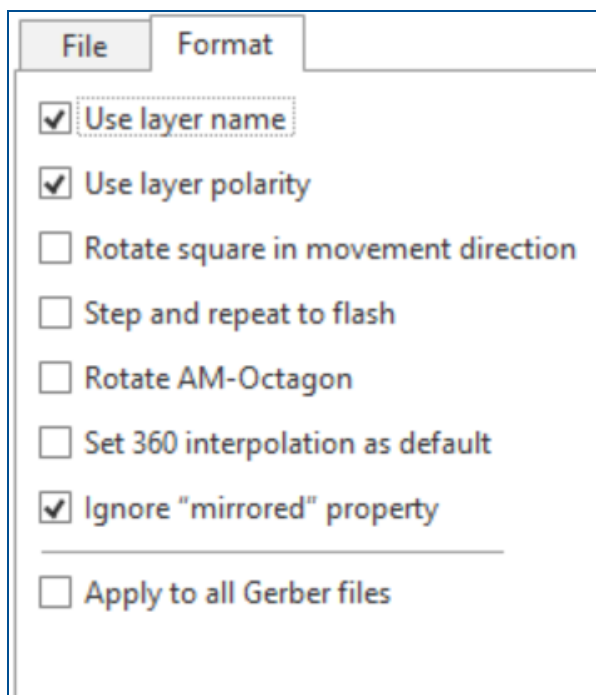
Fig. 37:   **Sub tab *Format***

The following settings are possible:

Setting	Description
Use layer name	Activates/Deactivates using the layer names defined in the Gerber file.
Use layer polarity	Activates/Deactivates the analysis of the layer polarity during Gerber import.
Rotate square in movement direction	Activates/Deactivates the automatic rotation of square objects during Gerber import.
Step and repeat to flash	Combines object collections to flash objects for *step-and-repeat* commands in the file.
Rotate AM-Octagon	Always aligns octagon edges to axes.
Set 360° interpolation as default	Activates the 360-degree interpolation for circles as default, regardless of corresponding commands in the file.
Ignore "mirrored" property	Ignores the property "mirrored" during import.
Apply to all Gerber files	Applies the settings to all imported Gerber files.

Table 22:   **Sub tab *Format***

Attributes

Is only displayed when the tab *Apertures/Tools* is active and shows the properties of the apertures and tools:
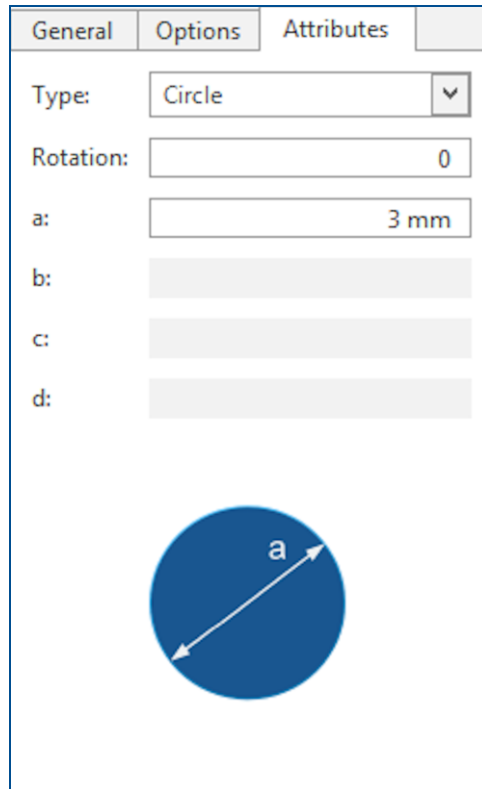
Fig. 38:   **Sub tab *Attributes***

The following settings are possible:

Attribute	Description
Type	Specifies the type of the aperture. The type can be changed via the drop-down list.
Rotation	Displays/Specifies the rotation of the aperture. Manual changes are possible.
a-d	Show parameters that describe the size of the aperture. Depending on the aperture shape, not all parameters are necessary.

Table 23: **Sub tab *Attributes***

■ **Importing CAD data**

1. Click on ⬚

2. In the dialog that is displayed, select the data for import.
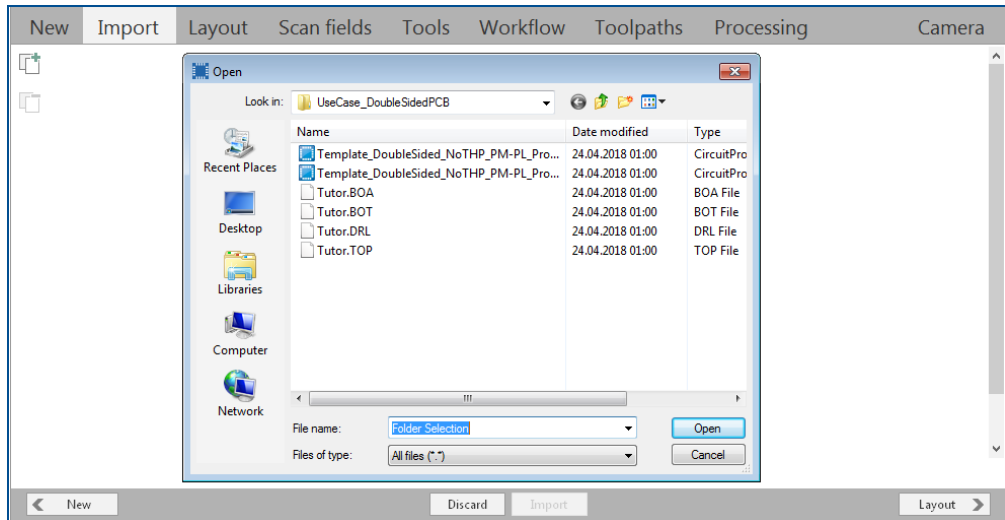
Fig. 39:   **User guidance step *Import***

3. Click on [Open].

☐ The following contents are displayed in accordance with your imported file (in this case a Gerber file):

Fig. 40:   **File import**

4. Check the imported data. If necessary, assign the associated layers.

5. In the navigation bar click on [Import].

☐ The CAD data are imported and displayed in the view of the user guidance step *Layout*.

☑ The CAD data have been imported.

2.4   Layout

In the user guidance step *Layout*, you can edit existing or imported data and generate new objects.
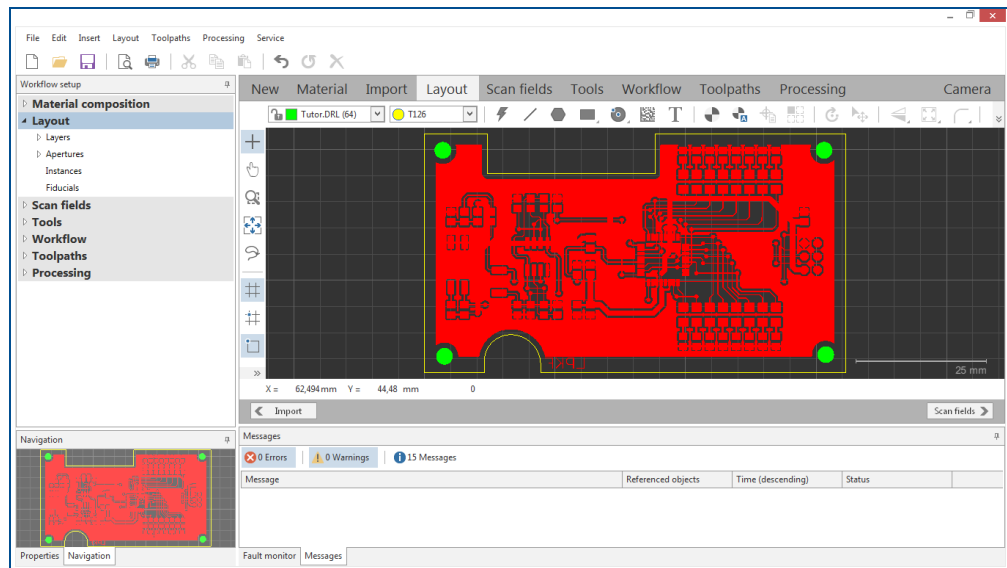
Fig. 41:   **User guidance step *Layout***

Icons with a small triangle (see following figure) can open a context menu with a right-click. It contains additional related functions.

The icons/functions of the toolbar are described in the following tables.

Icon	Name	Description
Drill Medium Hole	Selected layer	Displays the currently selected layer. You can change this by opening a drop-down list with a left-click and selecting a different layer from the list.
— Line	Aperture selection	Displays the currently selected aperture. Left-click to open the drop-down list and change the aperture by selecting another one.
⚡	Flash	Creates a flash based on the aperture currently selected.
/	Path	Creates a path in the current layer.
⬡	Polygon	Creates a polygon in the current layer.
▬	Rectangle	Creates a filled rectangle in the current layer.
▭	Rectangle path	Creates a rectangle path in the current layer.
◉	Circle by diameter	Creates a filled circle by defining a diameter.
◉	Circle by points	Creates a filled circle by setting three points.
◯	Circle path by diameter	Creates a circle path by defining a diameter.

Icon	Name	Description
	Circle path by points	Creates a circle path by setting three points.
	Create Data Matrix code	Creates a Data Matrix code
	Create text object	Creates a text object. Subsequently, new functions for modifying text are available.
	Fiducial	Creates a new fiducial.
	Automatic fiducial creation	Opens a dialog automatic fiducial creation.
	Create fiducial with defaults	Creates a fiducial with the default camera settings.
	Create instance type…	Creates an instance type from the selected objects where the objects are used as the primary instance.
	Rotate	Rotates one or multiple objects around a definable pivot point.
	Move object	Moves the marked object by a defined distance and direction.
	Mirror horizontal	Mirrors one or multiple objects around the horizontal axis of reflection (x axis).
	Mirror vertically	Mirrors one or multiple objects around the vertical axis of reflection (y axis).
	Scale	Scales up or scales down the marked object by the scale factor.
	Expand	Increases or decreases the marked object by a definable length.
	Round	Rounds the corners of the marked object.
	Chamfer	Chamfers the corners of the marked object.
	Merge	Merges adjoining or overlapping objects to a single geometrical object.
	Difference	Removes the area of a geometrical object that is overlapped by a second selected object.
	Split	Splits a marked object by using a predefined path.
	Add point	Adds a point on a marked line.
	Add mirror point	Adds two points with the same distance from the reference point.
	Move point	Moves a marked point.
	Split path	Splits the marked line segment of a path.
	Convert to polygon	Fills a marked closed path.
	Convert to closed path	Removes the filling of filled objects.

Icon	Name	Description
	Group	Groups marked objects.
	Ungroup	Ungroups grouped objects.
	Show/Hide processing area	Shows/Hides the processing area.
Context menu	Step and Repeat	Opens a dialog for multiplying the selected objects. Can be accessed via right-click in the user guidance step.
Context menu	Invert selection	Inverts the selection of objects in the 2D view.
Context menu	Close open path	Closes marked, open paths.
Context menu	Convert to flash	Converts drawn objects to flash objects and create new apertures
Context menu	Explode flash	Converts the flash into an object.
Context menu	Compare to flash	Compares the marked flash with objects on the same layer. Objects of the same shape are converted into a flash.
Context menu	Assign to layer	Opens a view of the existing layers. Thus, the selected object can be assigned to a specified layer.
Context menu	Copy to layer	Opens a view of the existing layers. Thus, the selected object can be copied to a specified layer.
Context menu	Create aperture	Creates an aperture. In the user guidance step *Layout* the new tab *Aperture* is displayed.
Context menu	Select by aperture	Marks all objects that refer to the selected aperture.
Context menu	Select by geometry	Marks all objects with similar properties.
Context menu	Select by layer	Marks all objects of the same layer.
Context menu	Measure	Measures the distance between two points.
Context menu	Cancel	Closes the current function.
Button	Import	Opens the user guidance step *Import*.
Button	Scan fields	Opens the user guidance step *Scan fields*.

Table 24: **User guidance step *Layout***

2.4.1 Flash

Creates a flash based on the aperture currently selected.

Summary

Use the function [Flash] to create a flash on the basis of the apertures in the aperture library. If no aperture is selected the first aperture in the library is used.

The flash is assigned to the currently selected layer.

2.4.2   Path

Creates a path in the current layer.

Summary

Apply the [Path] function to create open and closed paths in the user guidance step *Layout*. These paths are automatically assigned to the currently selected layer and use the selected aperture or path. Only circular apertures can be used for paths.

To close a path, you must create the last point, then select [Close open path] in the context menu. The paths are automatically connected to close the shape.
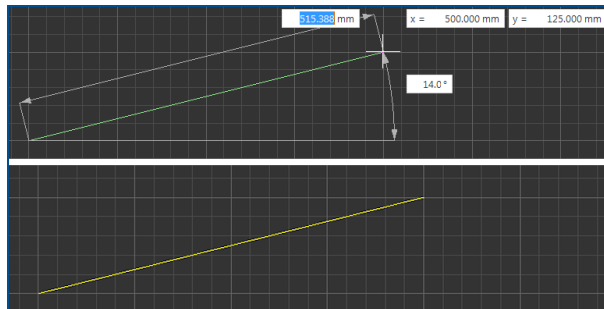

Fig. 42:   **Creating a path**

2.4.3   Polygon

Creates a polygon in the current layer.

Summary

Use the function [Polygon] to create polygons in the user guidance step *Layout*. These polygons are automatically assigned to the currently selected layer. The individual lines can be created as straight lines or as arcs. Once the element is finished, it is filled automatically.

Open the context menu and click on [Finish] or press ⌷Enter⌷ to close the polygon.
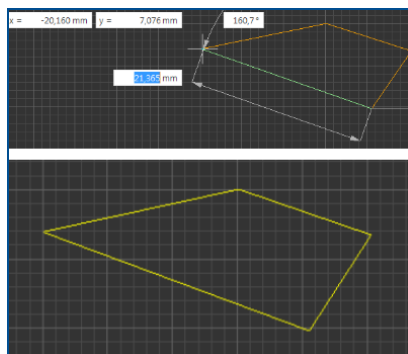

Fig. 43:   **Create polygon**

2.4.4   Rectangle

Creates a filled rectangle in the current layer.

Summary

Use the function [Rectangle] to create filled rectangles in the user guidance step *Layout.* The objects are automatically assigned to the currently selected layer.
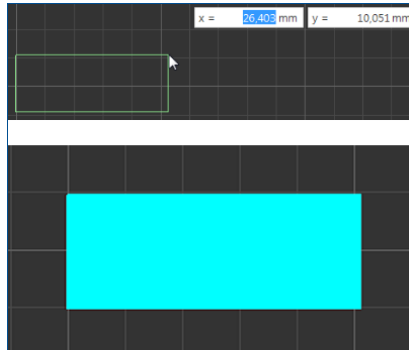

Fig. 44:   **Creating a rectangle**

2.4.5   Rectangle path

Creates a rectangle path in the current layer.

Summary

Use the function [Rectangle path] to create rectangle paths in the user guidance step *Layout.* The objects are automatically assigned to the currently selected layer.
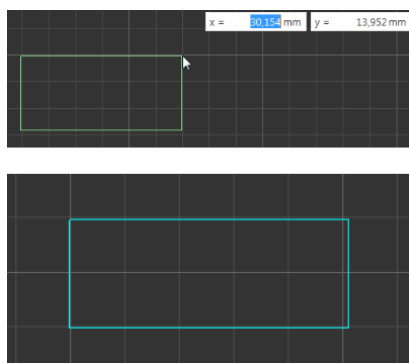

Fig. 45:   **Creating a rectangle path**

2.4.6   Circle by diameter

Creates a filled circle of a defined diameter.

Summary

With [Circle by diameter] you can create circles in the user guidance step *Layout*. After creation, the circles are automatically filled and assigned to the currently selected layer.
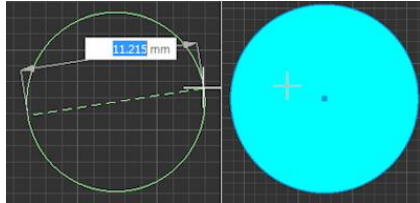

Fig. 46:   **Creating circle by diameter**

2.4.7   Circle by points

Creates a filled circle by setting three points.

Summary

Use the function [Circle by points] to create circles in the user guidance step *Layout*. After the circles have been created, they are automatically filled and assigned to the currently selected layer.
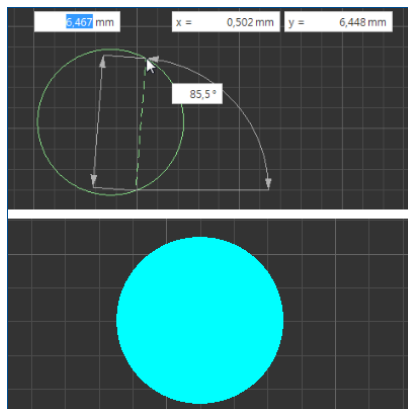

Fig. 47:   **Creating a circle by points**

2.4.8   Circle path by diameter

Creates a circle path by the defined diameter.

Summary

With [Circle path by diameter] you can create circle lines in the user guidance step *Layout*. Once created, the circle paths are automatically assigned to the active layer.
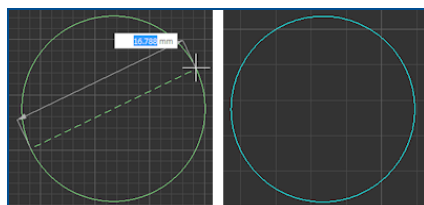

Fig. 48:   **Creating circle path by diameter**

2.4.9   Circle path by points

Creates a circle path by setting three points.

Summary

Use the function [Circle path by points] to create circle paths in the user guidance step *Layout*. After the circle paths have been created, they are automatically assigned to the active layer.
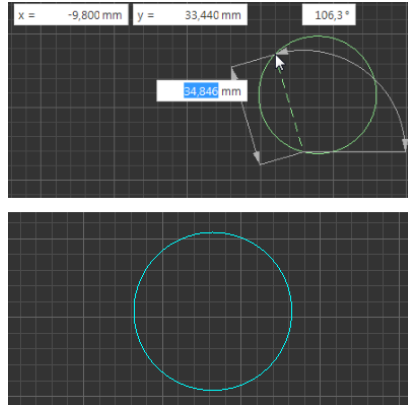

Fig. 49:   **Create circle path by points**

2.4.10 Create Data Matrix code

Creates a Data Matrix code in the current layer

Summary

Use the function [Create Data Matrix code] to create a 2D code in a rectangular matrix in the user guidance step *Layout*. This code can be read using a camera.
The Data Matrix codes are automatically assigned to the currently selected layer.
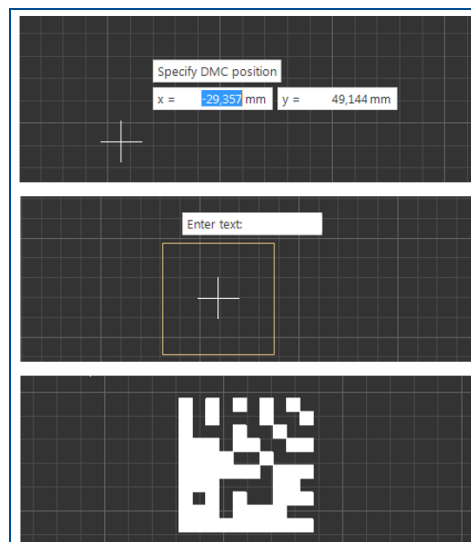

Fig. 50:   **Create Data Matrix code**

With the functions in the right toolbar, variable contents can be displayed as Data Matrix code. These values are not static but are adjusted at a certain point in time. Click on ➕ to add a variable of a specific data format (*Number*, *Text*, or *Date*). Variables of the format *Number* can be additionally assigned a type (*Serial number*, *Batch*, or *Lot*). Click on 🔲 to insert the variable into the text field.
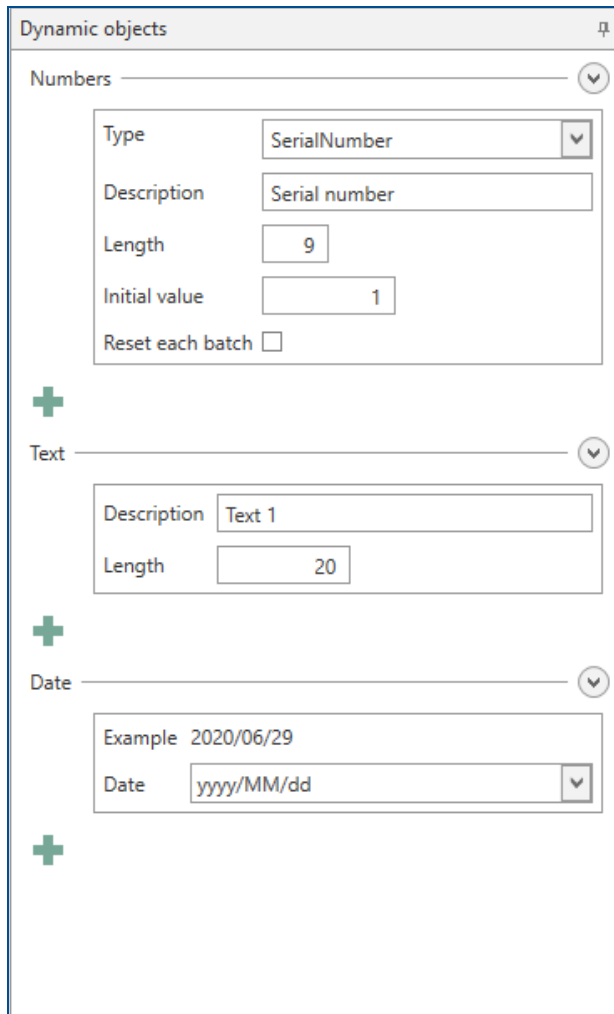

Fig. 51: **Settings for Data Matrix code with dynamic contents**

Name	Description
Number	
Type	Defines the type of the variable. You can select one of the following types: • Serial number At the start of each production, the serial number is incremented by one value. If there are several serial numbers and the length is changed, this value changes for all serial numbers. • Batch The value is incremented by 1 when the maximum number of serial numbers (length) has been reached. • Lot Indicates the number of fully produced batches. The value is incremented by 1 when the maximum

Name	Description
	number of batches has been reached.
Description	Defines the description of the variable.
Length	Defines the maximum number of digits for this variable. **Example:** At a length of **3** the maximum value is **999**.
Initial value	Defines the initial (starting) value of the variable.
Reset each batch	Activates/Deactivates resetting the count after each batch.
Batch size	Defines the maximum batch size. A batch has been produced, when the maximum serial number has been reached.
Reset each lot	Activates/Deactivates resetting the count after each batch.
Lot size	Defines the maximum lot size. A lot has been produced, when the maximum batch size has been reached.
Text	
Description	Defines the description of the variable.
Length	Defines the maximum character length of the variable.
Date	
Example	Displays an example of the date according to the selected format.
Date	Defines the format used for displaying the date.

Table 25: **Functions for dynamic Data Matrix codes**

2.4.11 Create text object

Creates a text object in the current layer.

Summary

Use the function [Create text object] to create text objects in the user guidance step *Layout*. In addition to conventional texts and numbers, the text objects can also contain the serial number, the current date, and variables.

The texts are automatically assigned to the currently selected layer.

Fig. 52:   **Create text**

Fig. 53:   **Toolbar *Create text object***

Icon	Name	Description
	Selected layer	Displays the currently selected layer. You can change this by opening a drop-down list with a left-click and selecting a different layer from the list.
	Font	Displays the currently selected font. You can change this by opening a drop-down list with a left-click and selecting a different font from the list.
3 mm	Font size	Displays the currently selected font size. Enter the desired value for the font size into the input field.
B	Bold	Displays the currently selected text in bold letters.
I	Italic	Displays the currently selected text in italics.
T	Outline	Displays the currently selected text as an outline.
	Left	Aligns text objects to the left of the input field.
	Center	Aligns text objects to the center of the input field.
	Right	Aligns text objects to the right of the input field.

Table 26:   **Functions *Create text object***

With the functions in the right toolbar you can insert variable contents into the text object. Their values are not static but are adjusted at a certain point in time. Click on ➕ to add a variable. Variables of the format *Number* can be additionally assigned a type (*Serial number*, *Batch*, or *Lot*). Click on 🖼️ to add the variable into the text field.

Fig. 54:   **Settings for text objects with dynamic contents**

Name	Description
Number	

Type	Defines the type of the variable. You can select between the following types:
	• Serial number
	  At the start of each production, the serial number is incremented by one value. If there are several serial numbers and the length is changed, this value changes for all serial numbers.
	• Batch
	  The value is incremented by 1 when the maximum number of serial numbers (length) has been reached.
	• Lot
	  Indicates the number of fully produced batches. The value is incremented by 1 when the maximum number of batches has been reached.

Description	Indicates the description of the variable.
Length	Defines the maximum number of digits for this variable. **Example:** At a length of **3**, the maximum value is **999**.

Name	Description
Initial value	Defines the initial (starting) value of the variable.
Reset each batch	Activates/Deactivates resetting the serial number after each batch.
Batch size	Defines the maximum batch size. A batch has been produced, when the maximum serial number has been reached.
Reset each lot	Activates/Deactivates resetting the count after each lot.
Lot size	Defines the maximum lot size. A lot has been produced, when the maximum batch size has been reached.
Text	
Description	Specifies the description of the variable.
Length	Indicates the maximum character length of the variable.
Date	
Example	Displays an example of the date according to the selected format.
Date	Defines the format used for displaying the date.

Table 27: **Functions for dynamic text objects**

When adding dynamic objects, the user guidance step *Layout* only displays example values.

2.4.12 Fiducial

Displays a fiducial at the cursor position. Left-click to determine the center of the fiducial and to create the fiducial.

Summary

The total size of the fiducial can be defined by the diameter in *Options > Miscellaneous> Fiducial > Diameter*.

2.4.13 Automatic fiducial creation

Opens a dialog for automatic fiducial creation.

Summary

The dialog *Automatic fiducial creation* allows you to change the settings for the automatic fiducial creation.

Fig. 55:   **Dialog *Automatic fiducial creation***

The following settings are available:

Name	Description
1, 2, 3, 4	Selects the fiducials that are to be created automatically.
Position style	Selects the criterion according to which the fiducials are to be placed. **Highest accuracy:** The fiducials are placed in a way that they can be captured with high accuracy in the camera image. **Material efficient:** The fiducials are placed so that the material is optimally used.
Distance	Indicates the (outer) distance between source layer and fiducials in x and y.
Source layer	Indicates the layer where fiducials are to be created.
Delete fiducials	Selects how to handle existing fiducials. **None**: The existing fiducials remain. **All:** All existing fiducials are deleted. **Overlapping:** Remaining fiducials that are automatically overlapping due to automatic creation are deleted.

Table 28:   **Dialog *Automatic fiducial creation***

2.4.14 Create fiducial with defaults

Creates a fiducial with standard camera settings.

Summary

To change standard values, open the user guidance step *Camera* and click [Library]. Select the entry marked as *Standard* and adopt the current camera settings by using [Apply] or [OK].

2.4.15 Create instance type…

Creates an instance type with the selected objects as a primary instance.

Summary

An instance type consists of a primary instance and at least one instance. Instances are references to the primary instance. The primary instance is produced at the position of the individual instance during processing.

Subsequent changes to the primary instance are applied only partially. Once you remove an object, this is applied immediately to the instance. If you want to add new objects, you have to dissolve the instance type and create it anew with the added objects

The fiducials contained in the primary instance are created as local fiducials and are also multiplied during processing.

Fig. 56:   **Instance type (with primary instance and three instances)**

You have to assign an instance type to an instance group in the user guidance step *Workflow* to be able to create toolpaths for it.

Instances provide several advantages over multiplied data (step and repeat):

- They require less memory. Thus, the data are loaded faster and their computation is accelerated.

- Toolpaths are computed only for the primary instance and are reused for the further instances. This accelerates the computation of the toolpaths significantly.

The created instances are displayed in the pane *Workflow setup*:
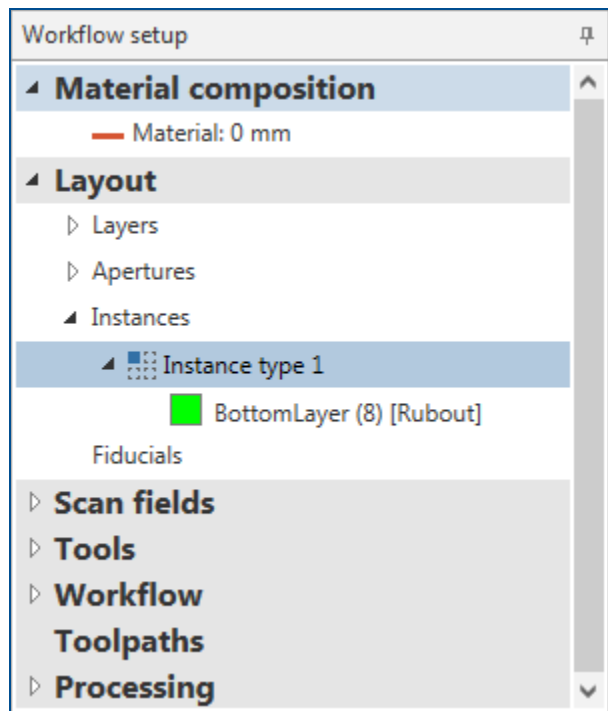
Fig. 57:   **Workflow setup | Create instance type**

2.4.16 Rotate

Rotates one or multiple objects around a definable pivot point.

Summary

The marked objects/contours are rotated around one point. Thereby, you choose the position of the angle point and the rotation angle.
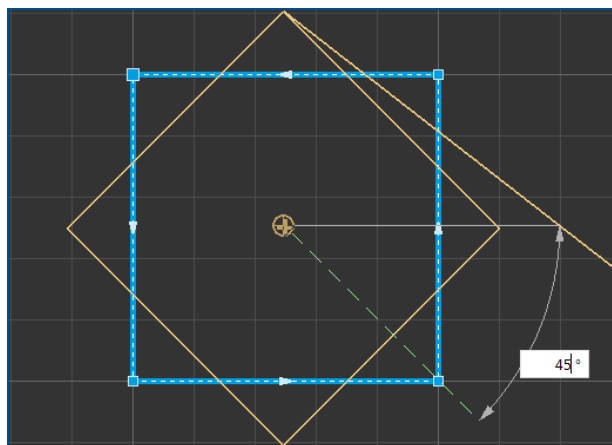
Fig. 58:   **Rotating an object/a contour**

2.4.17 Move object

Moves the marked object by a defined distance and direction.

Summary

Before moving, a reference point has to be specified. This point can also be located outside of the marked object/marked contour or even be created on other objects/contours. After the reference point is specified, the distance and direction can be defined.
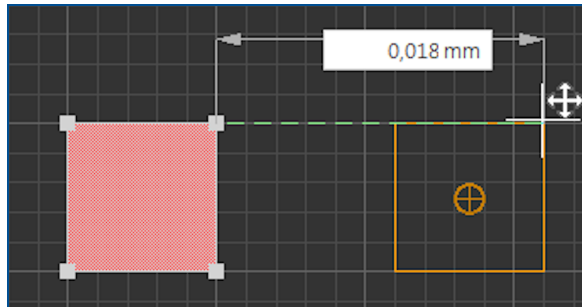
Fig. 59:   **Moving an object/a contour**

2.4.18 Mirror horizontal

Mirrors one or multiple objects around the horizontal axis of reflection (x axis).

Summary

The axis of reflection is located at the centroid of area of the selected object. If multiple objects are selected, a common centroid of area is calculated that is used for the reflection. The centroid of area can even be located outside of the objects.
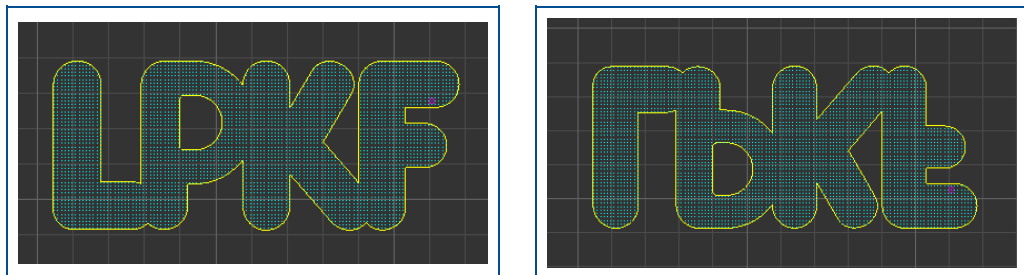
Fig. 60:   **Mirror object horizontal**

2.4.19 Mirror vertical

Mirrors one or multiple objects around the vertical axis of reflection (y axis).

Summary

The axis of reflection is located at the centroid of area of the selected object. If multiple objects are selected, a common centroid of area is calculated that is used for the reflection. The centroid of area can even be located outside of the objects.
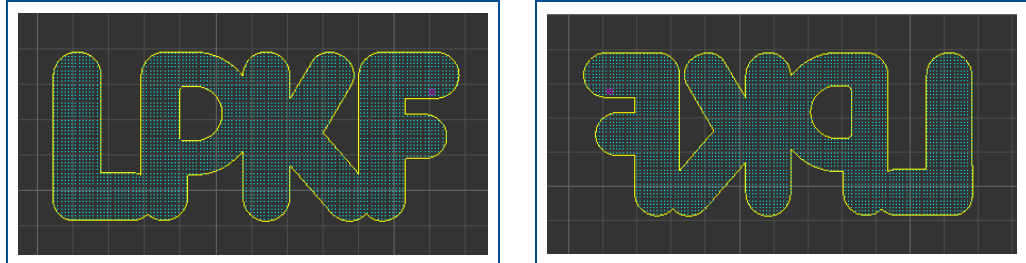
Fig. 61:   **Mirror object vertical**

2.4.20 Scale

Scales up or scales down the marked object by the scale factor.

Summary

All lines of the object are scaled uniformly so they keep their shape even after increasing/reducing the size.
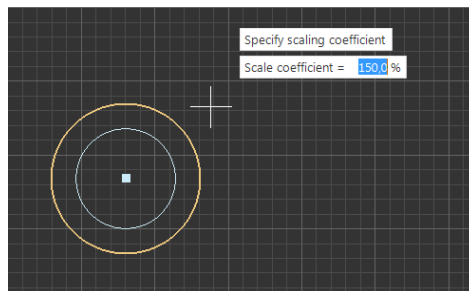
Fig. 62:   **Scaling an object**

2.4.21 Expand

Increases or decreases the marked object by a definable offset to the contour.

Summary

The marked object is increased or decreased uniformly around all sides. Increasing the object can cause a significant change of the shape.
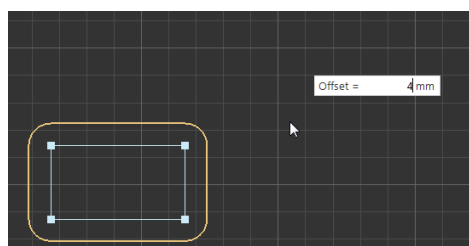
Fig. 63:   **Expanding an object**

The function is only available if a single object is marked. Multiple objects cannot be expanded at the same time.

2.4.22 Round

Rounds the corners of the marked object.

Summary

You can determine the radius of the rounding and select the corners to be rounded.

There is a differentiation between the outer and the inner corners.
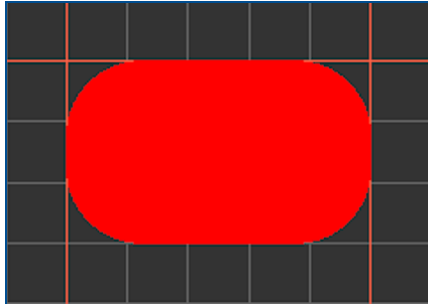
Fig. 64:   **Rounding corners**

Outer angles have an angle that is smaller than 180° within the geometrical object.
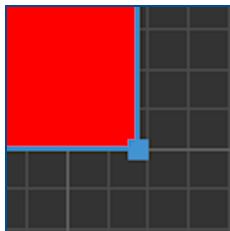
Fig. 65:   **Outer angles**

Inner angles have an angle that is greater than 180° within the geometrical object.
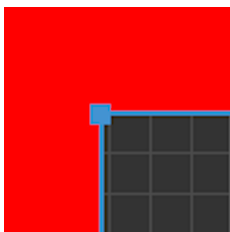
Fig. 66:   **Inner angles**

2.4.23 Chamfer

Chamfers the corners of the marked object.

Summary

You can determine the length of the sides to be chamfered and the angles to be chamfered.

There is a differentiation between the outer and the inner angles.
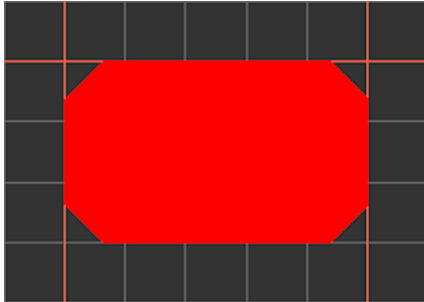
Fig. 67:   **Chamfer angles**

Outer angles have an angle that is smaller than 180° within the geometrical object.
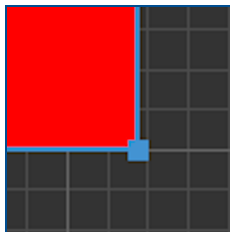
Fig. 68:   **Outer angles**

Inner angles have an angle that is greater than 180° within the geometrical object.
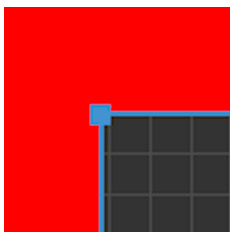
Fig. 69:   **Inner angles**

2.4.24 Merge

Merges adjoining or overlapping objects to a single geometrical object.

Summary

[Merge] is only available if at least two geometrical objects are marked.

Merged objects can only be restored to the previous state with [Undo].
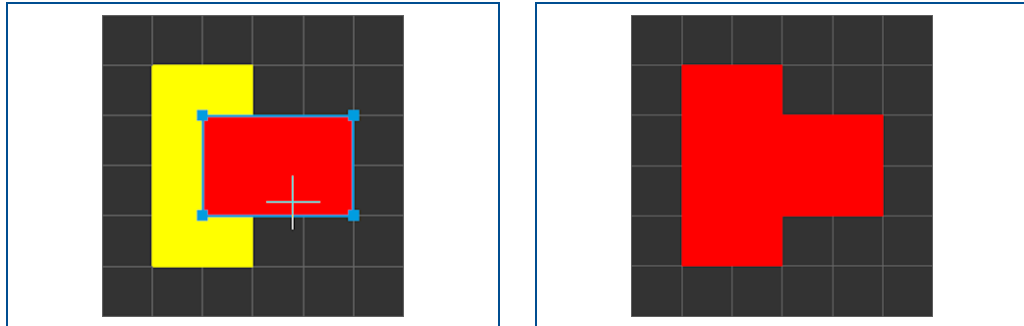
Fig. 70:   **Merge objects**

The created object is assigned to the layer of the objects used. If the objects are located on different layers, the newly created object is assigned to the upmost layer used.

2.4.25 Difference

Removes the area of a geometrical object that is overlapped by a second selected object.

Summary

[Difference] is only available if a filled object is selected. If the function is activated, a second object has to be selected. The area where the objects are overlapping is deleted.

After using this function, the second object is deleted by default. This setting can be changed in the options.

Objects that have been edited with [Difference] can only be restored to the previous state with [Undo].
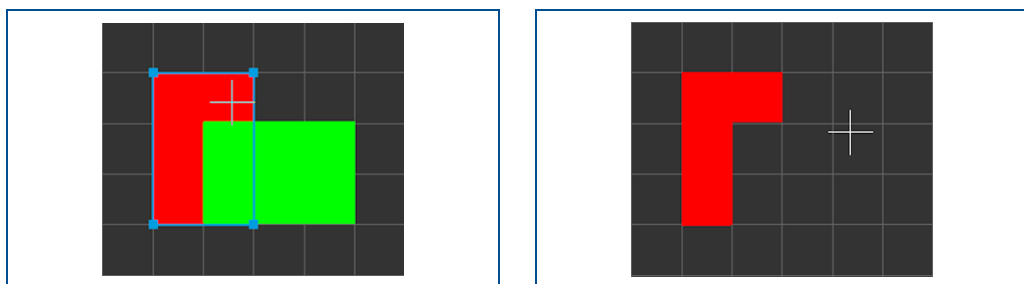
Fig. 71:   **Difference**

2.4.26 Split

Splits a marked object by using a predefined path.

Summary

When splitting, the line located on the object to be split is drawn first. Later, this line shall be used as a dividing line. Then select the object and enable the [Split] function. Click the line to split the object at the position of the line.
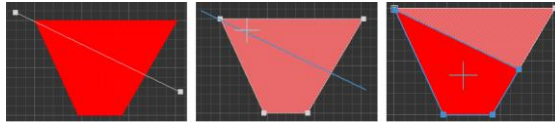
Fig. 72:   **Splitting an object**

2.4.27 Add point

Adds a point on a marked line segment.

Summary

[Add point] is only available if a line or a point of a segment is marked.
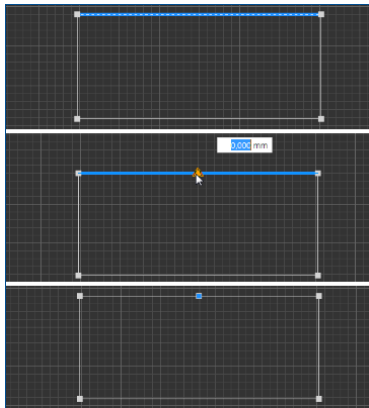
Fig. 73:   **Add point**

2.4.28 Add mirror point

Adds two points with the same distance from the reference point.

Summary

[Add mirror point] is only available if a line or a point of a segment is marked.
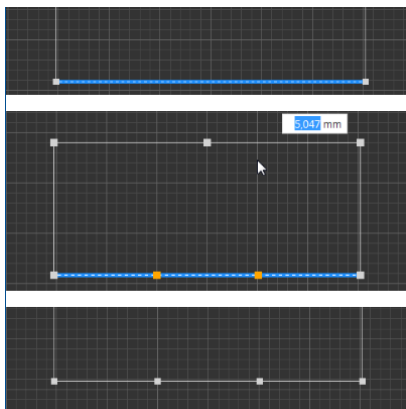
Fig. 74:   **Add mirror point**

2.4.29 Move point

Moves a marked point.

Summary

The marked point can be moved by using the mouse or by entering the relative coordinates. Multiple points can be marked as long as they are within the same object.
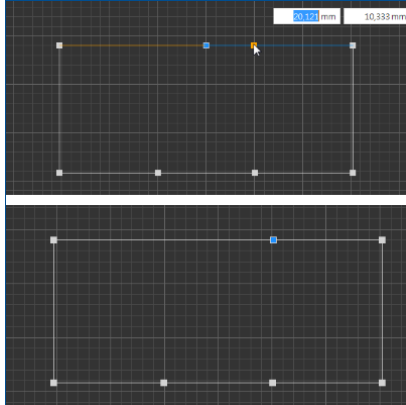
Fig. 75:   **Move point**

2.4.30 Split path

Splits the marked line segment of a path.

Summary

The line segment can be split at the mouse position or by entering relative coordinates referring to the center of the path or the selected point.
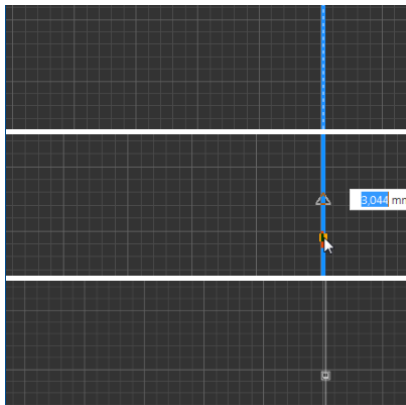
Fig. 76:   **Split path**

[Split path] cannot be used for filled objects.

2.4.31 Convert to polygon

Fills a marked closed path.

Summary

[Convert to polygon] is only available if a closed path is marked.
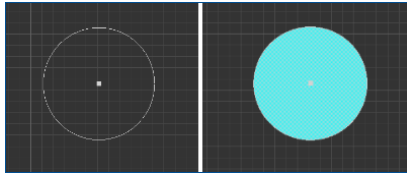
Fig. 77:   **Converting object to polygon**

2.4.32 Convert to closed path

Removes the filling of filled objects.

Summary

[Convert to closed path] is only available for marked and filled objects.
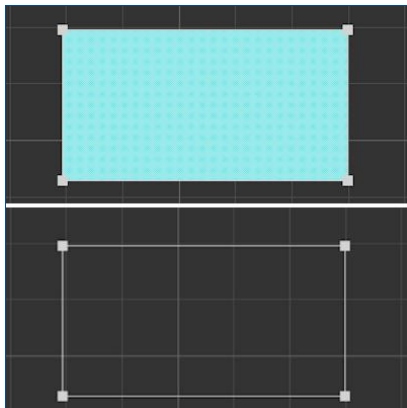
Fig. 78:   **Converting object to closed path**

2.4.33 Group

Groups marked objects.

Summary

[Group] is only available if at least two objects are marked.
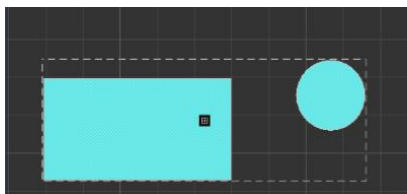
Fig. 79:   **Group objects**

2.4.34 Ungroup

Ungroups objects.

Summary

[Ungroup] is only available if grouped objects are marked exclusively.

2.4.35 Show/Hide processing area

Shows/Hides the processing area.

Summary

The processing area is shown as blue square.
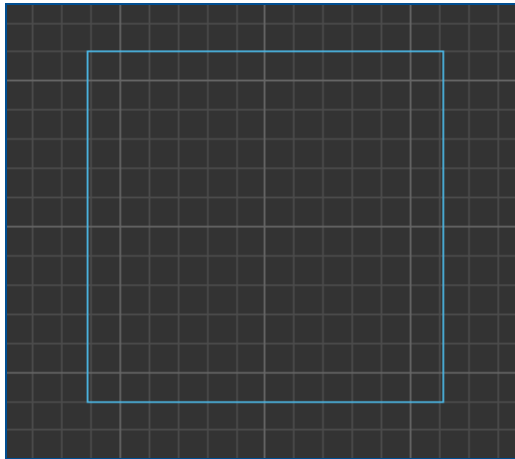
Fig. 80: **Processing area**

2.4.36 Step and Repeat

Multiplies selected objects. The spacing and the number of instances can be set.

Summary

In the dialog *Step and repeat*, the fields *Count* and *Distance* can be used to define how often and with what distance the copies are to be created. Different values for the copies in the x- and y-direction can be entered.
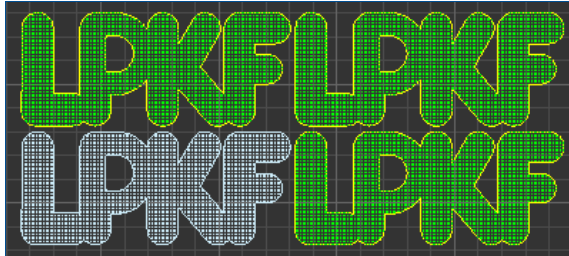
Fig. 81:   **Step and repeat**
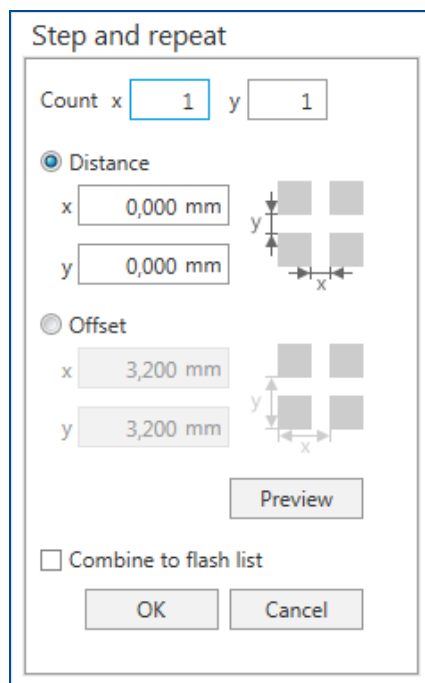
Fig. 82:   **Dialog *Step and Repeat***

Name	Description
Count	Shows the overall count of the objects in x and y direction including the original data.
Distance	Defines the distance between two created objects. The length and width of the original data are used as the initial values. If you do not change these values, the copies are right next to each other. Higher values create a space between the copies, lower values cause the copies to overlap.
Offset	Defines the offset between two created objects.
Preview	Displays a preview of the objects to be created.
Combine to flash list	Combines the original data to a flash list.

Table 29: **Settings *Step and Repeat***

2.4.37 Invert selection

Inverts the selection and selects all objects outside the selection area.

Summary

The selection is inverted and all objects outside the selection area are selected.
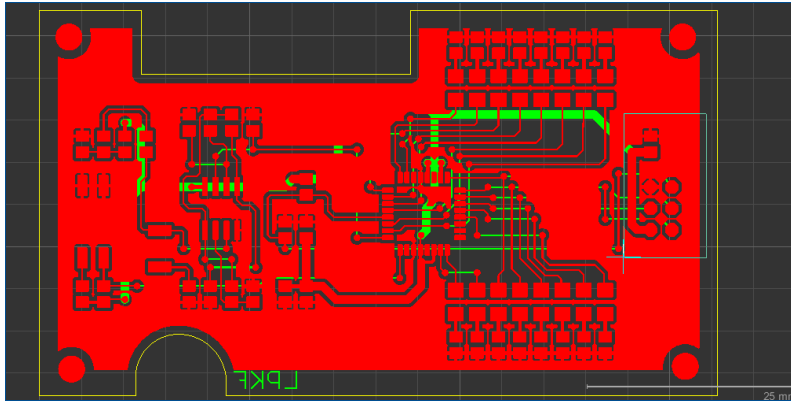
Fig. 83:   **Selection area**
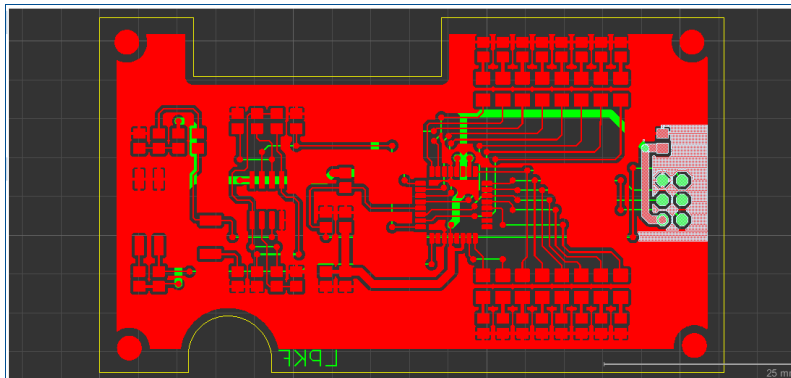
Fig. 84:   **Selection area highlighted**
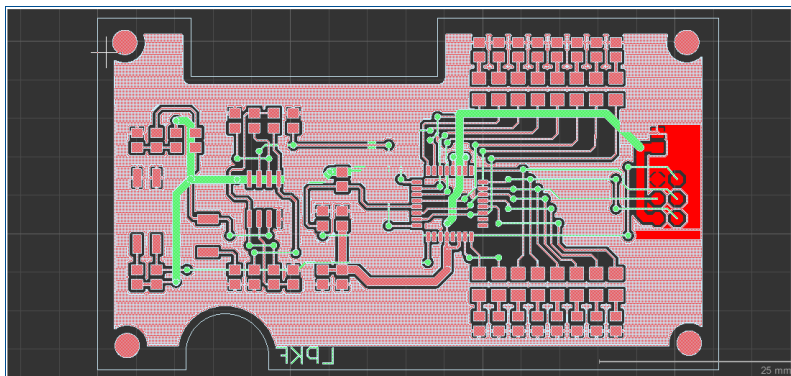
Fig. 85:   **Invert selection**

2.4.38 Close open path

Connects both end points of an open path with a line.

Summary

[Close open path] is only available if an open path is marked. The marked object is converted to a closed path.
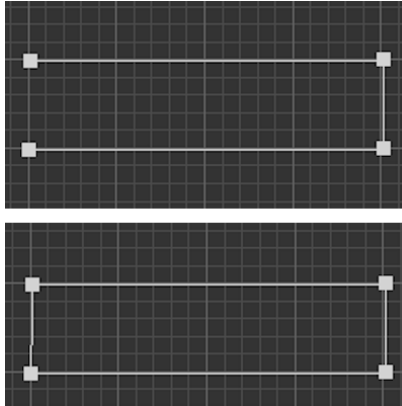
Fig. 86:   **Close open path**

2.4.39 Convert to flash

Converts a marked object into a flash.
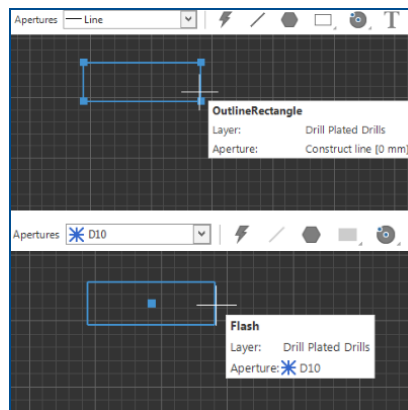
Fig. 87:   **Converting an object into a flash**

2.4.40 Explode flash

Converts the flash into an object.

2.4.41 Compare to flash

Compares the marked flash with objects on the same layer. Objects of the same shape are converted into a flash.

Summary

Smaller deviations of the object's size and angles can be adapted by entering tolerance values in the dialog.

2.4.42 Create aperture

Opens the view *Aperture* to create a new aperture.

Summary

The marked objects are displayed in the view *Aperture* and can be edited before the aperture is saved.
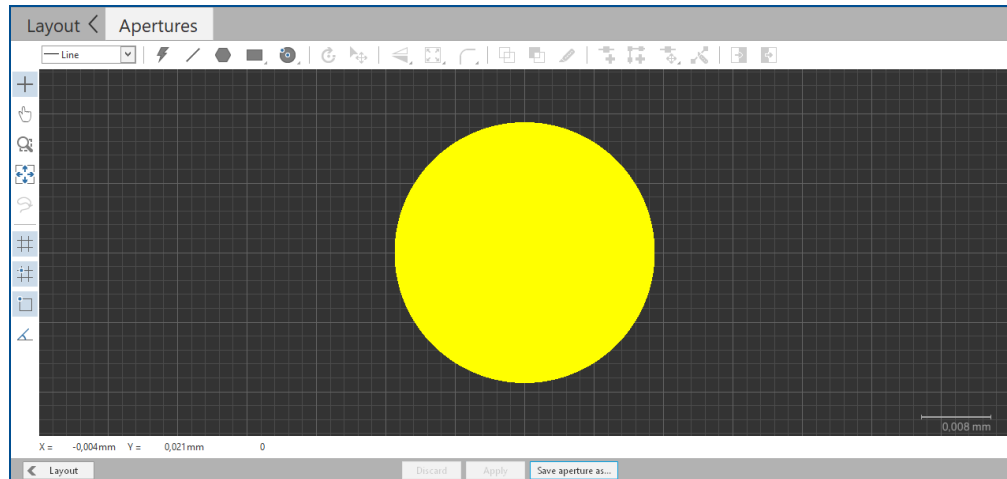
Fig. 88:   **View *Aperture***

2.4.43 Measure

Measures the distance, starting from the selected position.

Summary

The selected position is used as the initial point for measurement. As soon as you select another position, it is used as initial point for measurement.
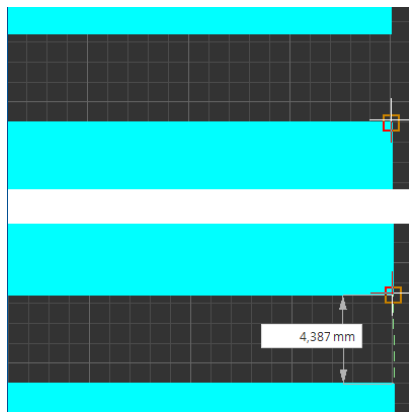
Fig. 89:   **Measure from point to point**

2.5   Scan fields

In the user guidance step *Scan fields* you can compute scan fields for existing scan field sets and arrange them automatically or manually.
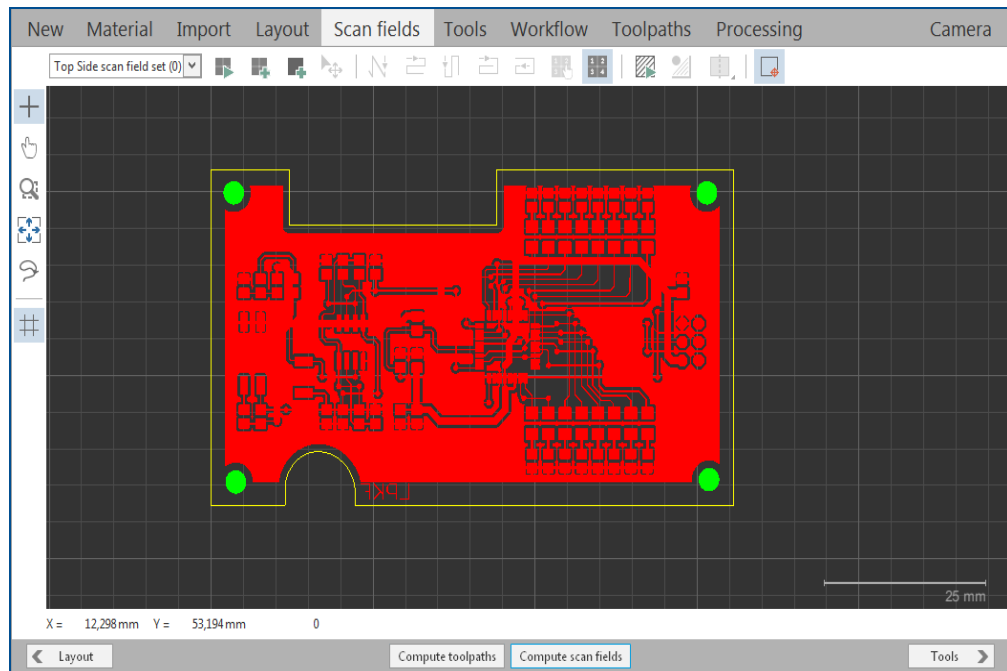
Fig. 90:   **User guidance step *Scan fields***

Icons with a small triangle (see following figure) can open a context menu with a right-click. It contains additional related functions.

The icons/functions of the toolbar are described in the following tables.

| Icon	Name	Description
Common scan fields (7)	Selected scan field	Selects the scan field to be computed.
	Compute scan fields	Computes the scan fields for the layers defined in the scan field set.
	Creating a scan field set	Creates a new scan field set. At least one layer must be assigned to the set.
	Create scan field manually	Allows you to create scan fields at the cursor position.
	Move object	Moves the marked object by a defined distance and direction.
	Special ProtoLaser sorting	Arranges the order of the scan fields automatically from the right upper side to the lower left side.
	Meander sorting in x	Arranges the order of the scan fields from top to bottom alternatingly in both x directions.
	Meander sorting in y	Arranges the order of the scan fields from left to right alternatingly in both y directions.
	Spiral sorting inwards	Arranges the order of the scan fields in an inward spiral.

Icon	Name	Description
	Spiral sorting outwards	Arranges the order of the scan fields in an outward spiral.
	Manual sorting of scan fields	Defines the processing order of the existing scan fields by clicking on them.
	Display scan fields	Displays the numbering of the scan fields.
	Compute all...	Computes the toolpaths based on the existing scan fields.
	Show/Hide the toolpaths	Shows/Hides the computed toolpaths.
	Display mode *True width*	Shows the objects in their real dimensions. Filled objects are displayed as filled.
	Display mode *Outline*	Shows the objects in their real dimensions. Filled objects are displayed only as paths.
	Display mode *Thin line*	Shows filled objects only as paths. Lines are displayed only as thin lines regardless of their actual line width.
	Show/Hide processing area	Shows/Hides the processing area.
Context menu	Step and repeat…	Multiplies selected scan fields.
Button	Computing toolpaths	Computes the toolpaths based on the existing scan fields.
Button	Computing scan fields	Computes the scan fields for the layers defined in the scan field set.

Table 30: **User guidance step *Scan fields***

2.5.1 Move object

Moves the marked object by a defined distance and direction.

Summary

Before moving, a reference point has to be specified. This point can also be located outside of the marked object/marked contour or even be created on other objects/contours. After the reference point is specified, the distance and direction can be defined.

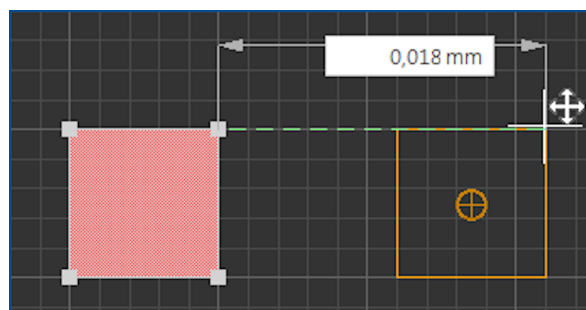Fig. 91: **Moving an object/a contour**

2.5.2 Compute all…

Computes the toolpaths based on the computed scan fields and work packages.

2.5.3 Show/Hide processing area

Shows/Hides the processing area.

Summary

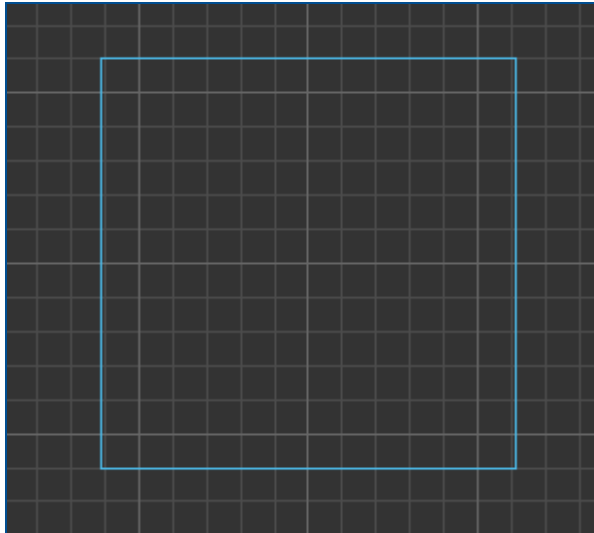The processing area is shown as blue square.

Fig. 92:   **Processing area**

2.5.4 Step and repeat...

Multiplies selected scan fields. The spacing and the number of the multiplied scan fields can be set.

Summary

In the dialog *Step and Repeat*, you can define in the fields *Count* and *Distance* how many copies of the scan fields are created and the distance between them.

The values for the copies in x direction and y direction can be different. The objects within the scan fields are not multiplied.
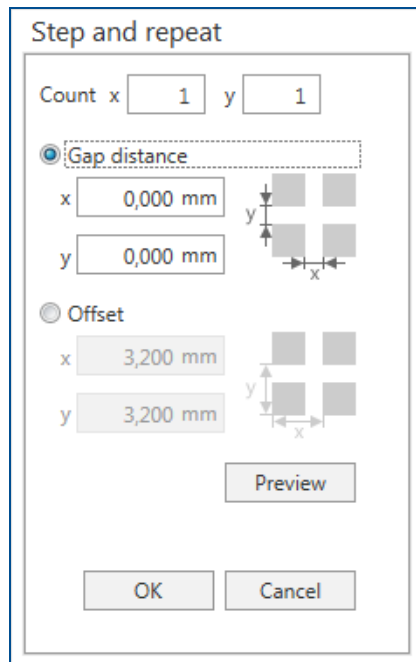
Fig. 93:   **Dialog *Step and Repeat***
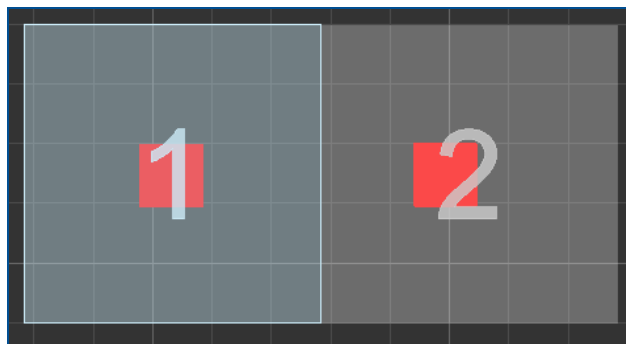
Fig. 94:   **Scan field multiplied with *Step and Repeat***

2.6   Tools

In the user guidance step *Tools*, you can create and edit cutting, structuring, and isolation tools. You have to define tasks for the individual tools. Assign different parameter values to the tasks. These include:

- Drilling parameters
- Laser parameters
- Process parameters
- Common parameters
- Scanner parameters
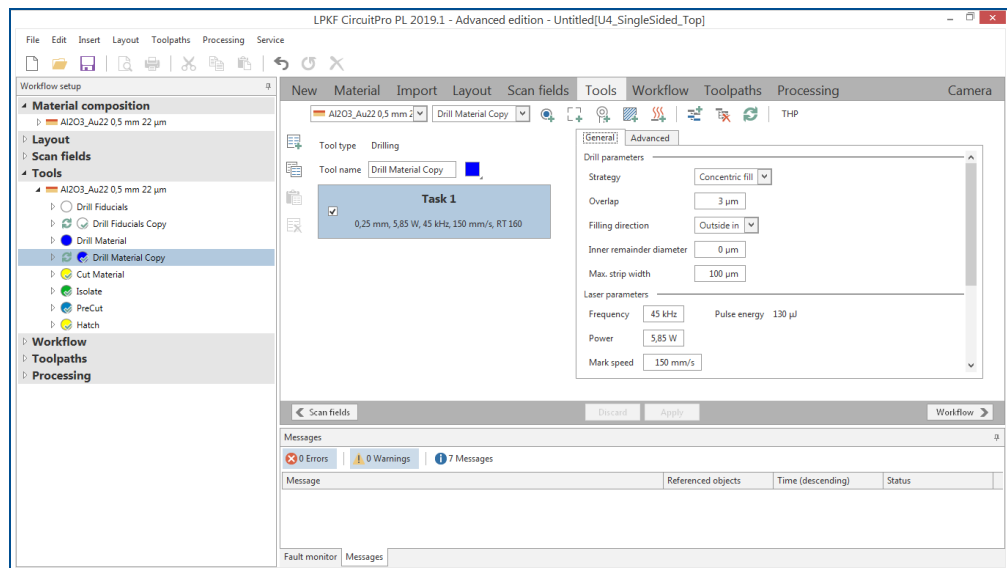
Fig. 95:   **User guidance step *Tools***

Changes have to be saved with [Save] before switching to another user guidance step.

The icons/functions of the toolbar are described in the following table.

Icon	Name	Description
	Drilling tool	Creates a new drilling tool.
	Cutting tool	Creates a new cutting tool.
	Isolation tool	Creates a new isolation tool.
	Hatching tool	Creates a new hatching tool.
	Heating tool	Creates a new heating tool.
	Duplicate tool	Creates a copy of the selected tool.
	Remove tool	Removes a tool copy.
	Copy tool to the global catalog	Copies the local tool to the global catalog.
	Through hole plating	Opens the tab *THP Settings*.

Icon	Name	Description
	Create new task	Creates a new task with the currently selected tool.
	Duplicate existing task	Copies the currently selected task into the clipboard.
	Paste task	Pastes a task from the clipboard.
	Remove existing task	Deletes the currently selected task.
Button	Scan fields	Navigates to the previous user guidance step *Scan fields*.
Button	Discard	Restores the state that was saved last. Any changes that have not been saved are lost.
Button	Apply	Saves the current settings.
Button	Workflow	Navigates to the following user guidance step *Workflow*.

Table 31: **Symbols/Functions in the user guidance step *Tools***

General

The following table describes the tool and process parameters of the tab *Advanced*:

Name	Description
Laser parameters	
Frequency	Sets the pulse frequency of the laser in [kHz].
Power	Sets the power of the laser in [W].
Mark speed	Sets the mark speed of the laser in [mm/s].
Drilling parameters	
Strategy	Defines how the drill holes are processed. The following strategies can be applied: • *Outline*: The outline of the hole is processed. • *Concentric fill*: Several circle paths with the same center but different radius are executed to fill the drill hole. • *Spiral*: The drill hole is filled with a spiraling movement.
Overlap	Defines how far the laser beam overlaps the previous pass when filling the drill holes.
Filling direction	Defines the processing direction of the fill. You can define whether the drill holes are filled *from the edge inwards* or *from the center outwards*.
Inner remainder diameter	Defines the inner remainder diameter of the circle in [µm]. If the value is 0, the circle area is processed completely. Any higher value produces an area in the center of the circle that is not processed.
Max. strip width	Shows the maximum strip width in [µm].
Process parameters	
Focused	Activates/Deactivates focusing.
Focus offset	Changes the height of the laser focus in addition to the material height and table height. Changing this value may cause the focus point to be no longer exactly on the

Name	Description
	material.
Repetition	Determines the number of repetitions of the task.
Delay	Determines the length of the pause between two repetitions of a task in [ms].
Use repetitions	Defines how processing is repeated. • Repeat each hole separately • Repeat each hole in each repetition
Enable air flow	Enables the air flow for the tool.

Table 32: **Tool parameters | *General***

Advanced

The following table describes the parameters of the tab *Advanced*:

Name	Description
Common parameters	
Beam diameter	Determines the beam diameter in [µm].
Skywriting	Activates the skywriting function. This computes the toolpaths in such a way that the start moves (blue) and end moves (green) are outside the paths to be processed. This causes a slight increase in processing time.
Polygon mode	Activates the skywriting function not only for starting and leaving the toolpath but also for structuring corners.
Scanner parameters	
Jump speed	Sets the maximum speed of the jump movements in [mm/s].
Jump delay	Defines the delay to be compensated for a jump in [µs].
Laser on delay	Determines the delay of the laser source that is to be compensated at the start of a structuring in [µs].
Laser off delay	Determines the delay of the laser source that is to be compensated at the end of a structuring in [µs].
Mark delay	Determines the delay to be compensated for the drag error in [µs].
Polygon delay	Determines the delay of the laser source that is to be compensated for polygons in [µs].

Table 33: **Tool parameters | *Advanced***

2.7   Workflow

In the user guidance step *Workflow* you can create and activate the work packages. Furthermore, you can arrange them in production groups and instance groups. These allow a more precise configuration of the processing order.
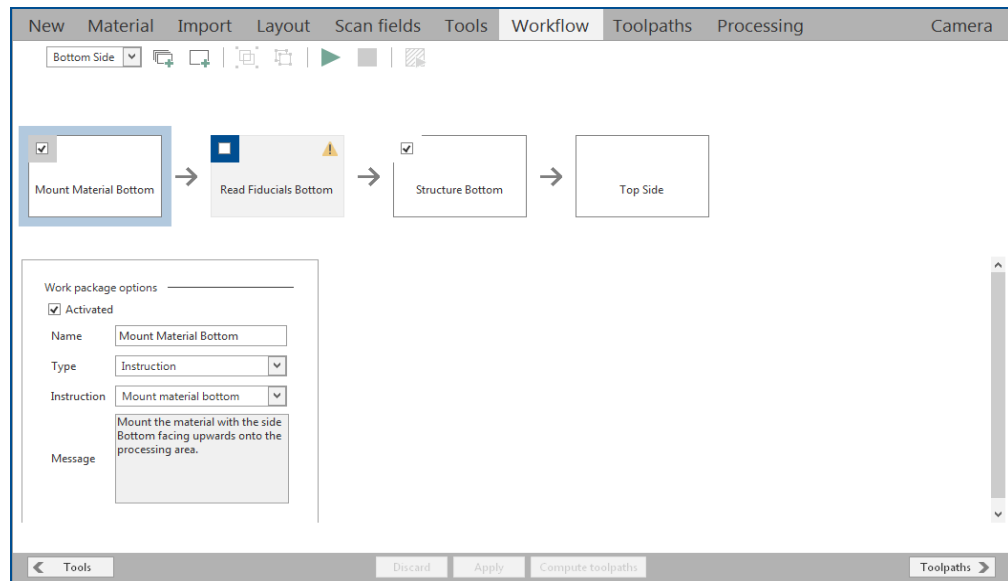
Fig. 96:   **User guidance step *Workflow***

The icons/functions of the user guidance step *Workflow* are described in the following tables.

Icon	Name	Description
	Add phase	Adds a new workflow phase.
	Add work package	Adds a new work package behind the current selection. In the work package, the tool or the action for the task can be selected. The following actions and tools are available. – Instruction – Drilling – Read fiducials – Expose fiducial – Cutting – Structuring
	Group work packages	Groups the selected work packages to a processing group.
	Ungroup work packages	Ungroups the selected processing group.
	Process selected objects	Processes the selected objects.
	Stop processing	Stops the current processing.
	Compute toolpaths	Computes the toolpaths of the processing group /of the work package.
Button	Tools	Navigates to the user guidance step *Tools*.
Button	Discard	Restores the state that was saved last. Any changes that have not been saved are lost.

Icon	Name	Description
Button	Save	Saves the current settings.
Button	Compute toolpaths	Computes the toolpaths based on the existing scan fields.
Button	Toolpaths	Navigates to the user guidance step *Toolpaths*.

Table 34: **User guidance step *Workflow***

The different types of work packages are explained in the following.

The following table describes the functions of the work package *Instruction*:

Name	Description
Activated	Activates/Deactivates the work package. Deactivated work packages are not executed during production.
Name	Indicates the name of the work package.
Type	Defines the type of the work package. The type of the work package determines which tools and functions are available.
Instruction	Assigns a suitable instruction from a predefined list to the work package.
Message	Displays an additional explanation for the instruction.

Table 35: **Work package type *Instruction***

The following table describes the functions of the work package *Drilling*:

Name	Description
Activated	Activates/Deactivates the work package. Deactivated work packages are not executed during production.
Test tool settings	Enables/Disables checking the tool settings.
Name	Indicates the name of the work package.
Type	Defines the type of the work package. The type of the work package determines which tools are available.
Tool	Defines the tool that will be used for processing the active input layers.
Input layer	Displays the layers that can be processed with the selected tool. These must be set to the appropriate technology. Only active layers are processed.
Scan field set	Displays the scan field set that is used.

Table 36: **Work package type *Drilling***

The following table describes the functions of the work package *Read fiducials*:

Name	Description
Name	Indicates the name of the work package.
Type	Defines the type of the work package. The type of the work package determines which tools are available.
Scan field set	Displays the scan field set that is used.
Dynamic alignment	
Fiducial	Selects up to four fiducials from the drop-down list. Depending on the number of fiducials, different transformations (e.g. move, rotate and scale) can be applied.
Scale	Scales the layout data for processing based on the fiducials or based on a fixed factor (in x and y direction). The original data are not modified, only processing is modified based on these values.

Table 37: **Work package type *Read fiducials***

The following table describes the functions of the work package *Expose fiducials*:

Name	Description
Activated	Activates/Deactivates the work package. Deactivated work packages are not executed during production.
Test tool settings	Enables/Disables checking the tool settings.
Name	Indicates the name of the work package.
Type	Defines the type of the work package. The type of the work package determines which tools are available.
Tool	Defines the tool that will be used for processing the active input layers.
Input layer	Displays the layers that can be processed with the selected tool. These must be set to the appropriate technology. Only active layers are processed.
Scan field set	Displays the scan field set that is used.

Table 38: **Work package type *Expose fiducials***

The following table describes the functions of the work package *Cutting*:

Name	Description
Activated	Activates/Deactivates the work package. Deactivated work packages are not executed during production.
Test tool settings	Enables/Disables checking the tool settings.
Name	Specifies the name of the work package.
Type	Specifies the type of the work package. The type of the work package determines which tools are available.
Tool	Defines the tool that will be used for processing the active input layers.
Input layer	Displays the layers that can be processed with the selected tool. These must be set to the appropriate technology. Only active layers are processed.
Scan field set	Displays the scan field set that is used.
Parameters	
Position	Specifies whether processing has to be performed *Inside*, *Outside*, or at the *Center*.
Channel width	Specifies the channel width in [µm].
Target beam overlap	Specifies the target value of the beam overlap in [%].
Actual beam overlap	Indicates the actual value of the beam overlap in [%].
Sorting	Selects between the sorting methods *Inside out* and *Outside in*.
Unidirectional	If this check box is checked, sorting can only be performed in one direction.
Tabs position	Selects between the following tab positions: – NoGaps – Indefinite – Corners – AllSides – VerticalSides – HorizontalSides
Tab width	Indicates the tab width in [mm].
Distance	Indicates the distance in [mm].

Table 39: **Work package type *Cutting***

The following table describes the functions of the work package *Structuring*:

Icon/Name	Description
Isolate	
Input layer	Selects from a list the layers to be processed with the tool *Isolate*.
Isolation width	Indicates the isolation width in [µm].
Pad isolation	Indicates the pad isolation in [µm].
Target beam overlap	Specifies the target value of the beam overlap in [%]. 0% means no beam overlap.
Actual beam overlap	Indicates the actual value of the beam overlap in [%].
Isolation distance scan field to scan field	Specifies the isolation distance between the scan fields.
Printed circuit board	
Restrict by PCB boundaries	Activates/Deactivates a boundary for structuring.
Outline layer	Specifies the layer that contains the outline of the printed circuit board.
Hatching	
Generate	Activates structuring.
Hatching layer	Specifies the layer where the hatching is to be generated.
Pattern	Selects the pattern according to which the hatching is to be generated.
Hatching grid	Specifies the hatching grid in [µm].
Use pre-cut lines for scan fields	Activates/Deactivates using pre-cut lines for scan fields.
Align to global grid	Activates/Deactivates the alignment to the global grid. This ensures that toolpaths are structured in parallel, e.g. in case of overlapping scan fields.
Hatching contour overlap	Specifies the overlap of the contour when hatching. 0% means no overlap.
Tools	
+	Adds a new tool.
✎	Inserts a production splitter between the tools.
▬	Deletes the selected tool.
Drop-down list	Selects between the following tools: – Isolate – Hatch – Divide – Heat – ShortHeat – PreCut

Table 40: **Work package type Structuring**

A processing group is created with the function [Group] when at least two work packages are selected.

Name	Description
Group options	
Activated	Activates/Deactivates the work packages within a processing group. Deactivated processing groups are not executed during processing.
Name	Defines the name of the processing group to be computed.
Sorting policy	Specifies the sorting method for the processing group. A **scan field oriented** processing causes the scan field to be completely processed with all tools. A **tool oriented** processing causes all scan fields to be processed with the current tool. Only when all scan fields have been processed with this tool, processing continues with the next tool.

Table 41: **Processing group options**

2.7.1   Computing toolpaths

Computes the toolpaths of the production group/of the work packages.

2.8   Toolpaths

In the user guidance step *Toolpaths*, you can compute the toolpaths for existing work packages and edit the points on the toolpaths.
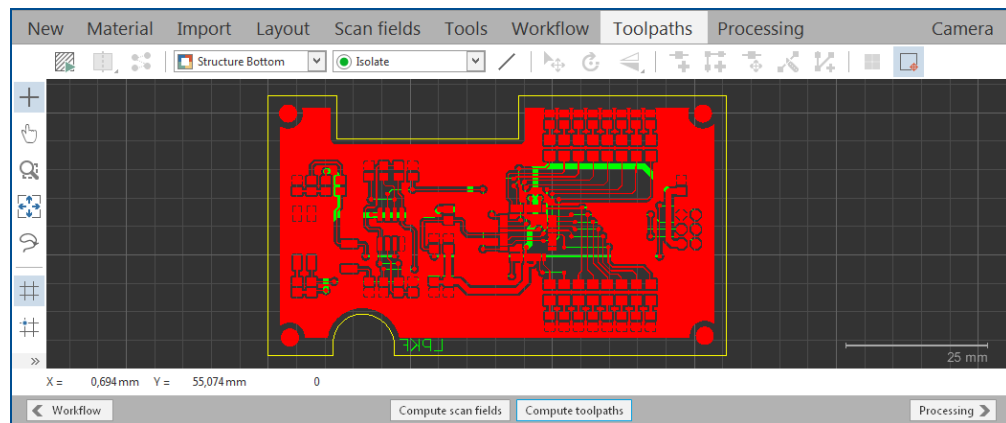
Fig. 97:   **User guidance step *Toolpaths***

Icons with a small triangle (see following figure) can open a context menu with a right-click. It contains additional related functions.

The icons/functions of the toolbar are described in the following tables.

Icon	Name	Description
	Compute all...	Computes the toolpaths based on the existing scan fields and work packages.
	Display mode *True width*	Shows the objects in their real dimensions. Filled objects are displayed as filled.
	Display mode *Outline*	Shows the objects in their real dimensions. Filled objects are displayed only as paths.
	Display mode *Thin line*	Shows filled objects only as paths. Lines are displayed only as thin lines regardless of their actual line width.
	Show jump lines	Shows/Hides the jump lines of the computed toolpaths.
	Work package	Selects a work package. New toolpaths are created in the selected work package.
	Show/Hide work package	Shows/Hides all objects in the view that are in the work package.
	Tool	Selects a tool. New toolpaths are created with the selected tool.
	Create toolpath	Creates a toolpath.
	Move object	Moves the selected object by a defined distance and direction.
	Rotate	Rotates one or multiple objects around a definable pivot point.
	Mirror horizontally	Mirrors one or multiple objects around the horizontal axis of reflection (x axis).

Icon	Name	Description
	Mirror vertically	Mirrors one or multiple objects around the vertical axis of reflection (y axis).
	Add point	Adds a point on a selected line.
	Add mirror point	Adds two points with the same distance from the reference point.
	Move point	Moves a selected point.
	Split path	Splits the selected line segment of a path.
	Combine paths	Combines two paths.
	Show/Hide scan fields	Shows/Hides the scan fields.
	Show/Hide processing area	The processing area is shown/hidden.
Button	Workflow	Navigates to the previous user guidance step *Workflow*.
Button	Compute scan fields	Computes the scan fields for the layers defined in the scan field set.
Button	Compute toolpaths	Computes the toolpaths based on the existing scan fields.
Button	Processing	Navigates to the following user guidance step *Processing*.

Table 42:　**User guidance step *Toolpaths***

2.8.1　Compute all…

Computes the toolpaths based on the computed scan fields and work packages.

2.8.2　Show jump lines

Displays the laser jump lines of the computed contour.

Summary

The resulting jump movement of the laser is a positioning movement from one point to be processed to the next point to be processed. In the meantime, the laser is switched off.
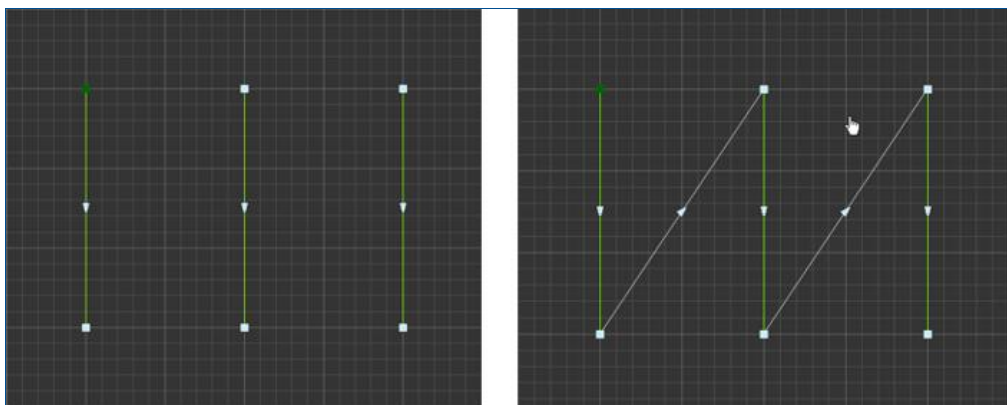
Fig. 98:　**Show/Hide jump lines**

2.8.3   Create toolpath

Creates a toolpath in the current layer.

Summary

You can use the function [Create toolpath] to create toolpaths in the user guidance step *Toolpaths*. The objects are automatically assigned to the currently selected layer.
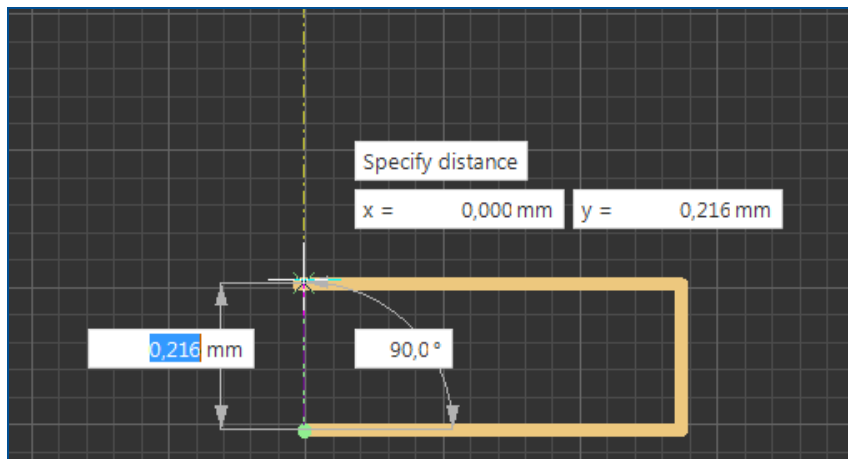
Fig. 99:   **Create toolpath**

2.8.4   Move object

Moves the marked object by a defined distance and direction.

Summary

Before moving, a reference point has to be specified. This point can also be located outside of the marked object/marked contour or even be created on other objects/contours. After the reference point is specified, the distance and direction can be defined.
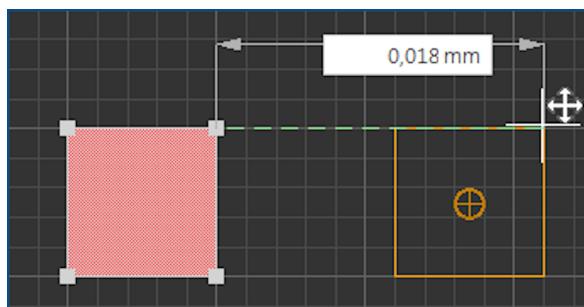
Fig. 100:   **Moving an object/a contour**

2.8.5   Rotate

Rotates one or multiple objects around a definable pivot point.

Summary

The marked objects/contours are rotated around one point. Thereby, you choose the position of the angle point and the rotation angle.
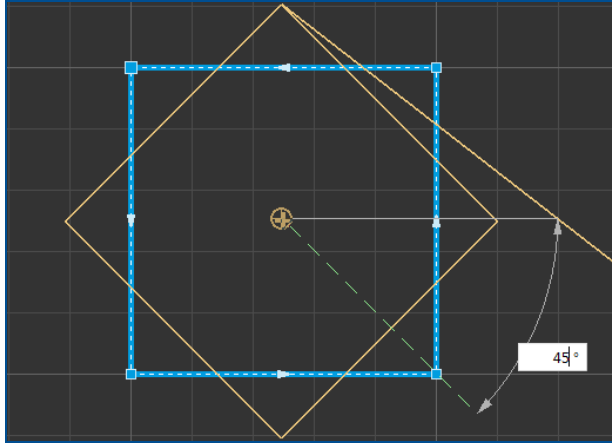
Fig. 101:   **Rotating an object/a contour**

2.8.6   Mirror horizontal

Mirrors one or multiple objects around the horizontal axis of reflection (x axis).

Summary

The axis of reflection is located at the centroid of area of the selected object. If multiple objects are selected, a common centroid of area is calculated that is used for the reflection. The centroid of area can even be located outside of the objects.
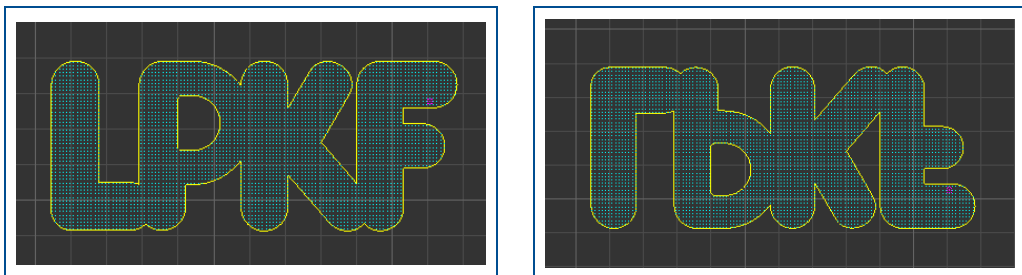
Fig. 102:   **Mirror object horizontal**

2.8.7   Mirror vertical

Mirrors one or multiple objects around the vertical axis of reflection (y axis).

Summary

The axis of reflection is located at the centroid of area of the selected object. If multiple objects are selected, a common centroid of area is calculated that is used for the reflection. The centroid of area can even be located outside of the objects.
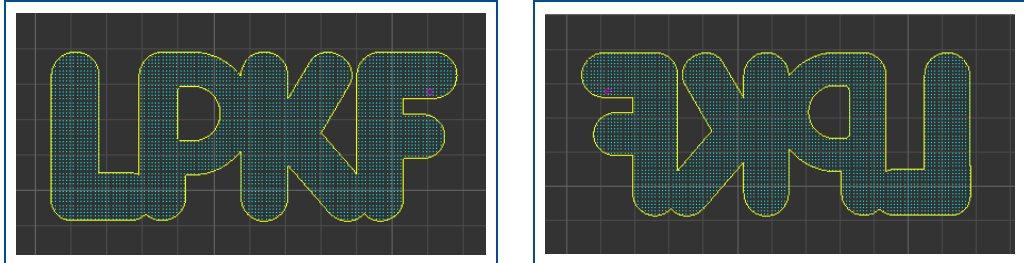
Fig. 103:   **Mirror object vertical**

2.8.8   Add point

Adds a point on a marked line segment.

Summary

[Add point] is only available if a line or a point of a segment is marked.
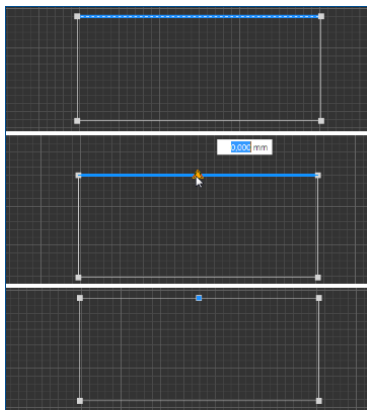
Fig. 104:   **Add point**

2.8.9   Add mirror point

Adds two points with the same distance from the reference point.

Summary

[Add mirror point] is only available if a line or a point of a segment is marked.
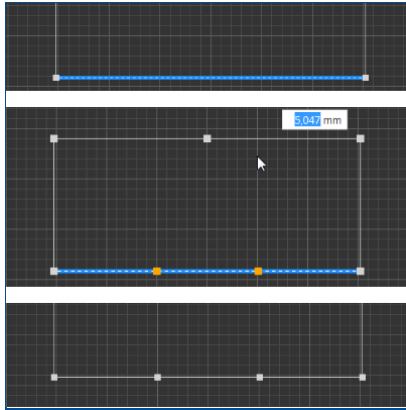
Fig. 105:   **Add mirror point**

2.8.10   Move point

Moves a marked point.

Summary

The marked point can be moved by using the mouse or by entering the relative coordinates. Multiple points can be marked as long as they are within the same object.
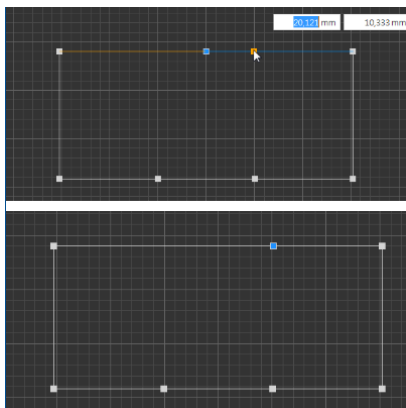
Fig. 106:   **Move point**

2.8.11 Split path

Splits the marked line segment of a path.

Summary

The line segment can be split at the mouse position or by entering relative coordinates referring to the center of the path or the selected point.
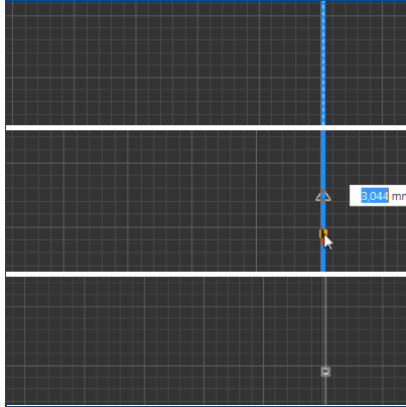
Fig. 107:   **Split path**

[Split path] cannot be used for filled objects.

2.9   Processing
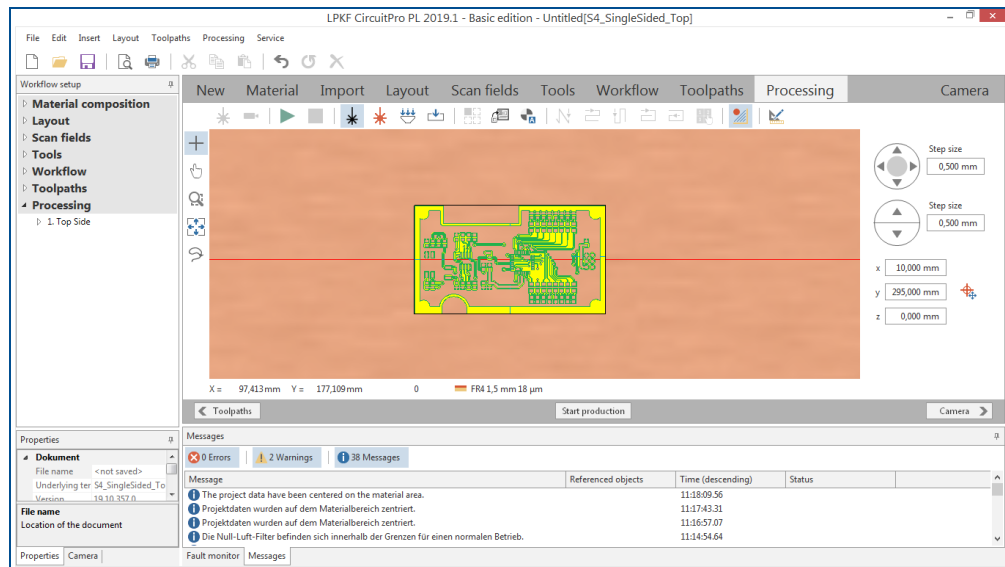
Fig. 108:   **User guidance step** *Processing*

The icons/functions of the toolbar are described in the following tables:

Icon	Name	Description
▶	Process all	Starts processing the toolpaths and work packages.
■	Stop processing	Stops the current processing.
✳	Activate pilot laser	Activates the pilot laser.
✳	Activate the laser	Activates the laser during production. Material can only be processed while the laser is activated. Deactivating the laser can be used for measuring production times.
↓↓↓	Switch on/off the extraction system	Switches the extraction system on and off.
↓	Move the system to the loading position	Moves the system to the loading position.
▪▫	Create instance type	Creates an instance type from the selected objects where the objects are used as the primary instance.
	Placement...	Opens a dialog where the settings for placing the processing data in the processing area can be adjusted
	Automatic fiducial creation	Opens a dialog for automatic fiducial creation.
N↓	Special ProtoLaser sorting	Sorts the order of scan fields in the specific ProtoLaser sorting.

Icon	Name	Description
	Meander sorting in x	Arranges the order of the scan fields from top to bottom alternatingly in both x directions.
	Meander sorting in y	Arranges the order of the scan fields from left to right alternatingly in both y directions.
	Spiral sorting inwards	Arranges the order of the scan fields in an inward spiral.
	Spiral sorting outwards	Arranges the order of the scan fields in an outward spiral.
	Manual sorting of scan fields	Defines the processing order of the existing scan fields by clicking on them.
	Show/Hide information layer	Shows/Hides the objects that are on the information layer.
	Power measurement	Opens the dialog *Power measurement*.
Button	Toolpaths	Navigates to the user guidance step *Toolpaths*.
Button	Start processing	Starts the processing of the toolpaths and work packages.
Button	Camera	Navigates in a submenu to the view of the Camera.

Table 43: **User guidance step *Processing***

Tab *Navigation*

You can use the functions in the tab *Navigation* to move the processing point manually in x and y direction.

Clicking on the following buttons moves the processing point in x and y direction. The processing point is moved in the entered step size which can be adjusted as well.
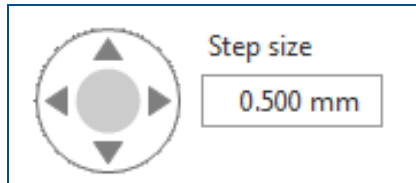
Fig. 109:   **Moving in x and y direction**

Clicking on the following buttons moves the processing point in z direction.
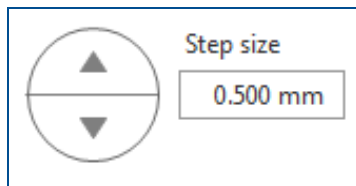
Fig. 110:   **Movement in z direction**

Using the button ⊕ you can move the processing point to the position entered in the fields *x*, *y*, and *z*. The current zero point is used as reference point (0, 0, 0) for this.
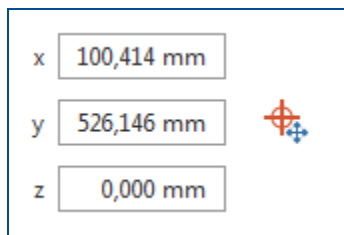
Fig. 111:   **Positioning to x, y, and z value**

2.9.1   Process all

Starts the production of all processing data.

2.9.2   Stop processing

The current processing procedure is stopped.

2.9.3 Create instance type…

Creates an instance type with the selected objects as a primary instance.

Summary

An instance type consists of a primary instance and at least one instance. Instances are references to the primary instance. The primary instance is produced at the position of the individual instance during processing.

Subsequent changes to the primary instance are applied only partially. Once you remove an object, this is applied immediately to the instance. If you want to add new objects, you have to dissolve the instance type and create it anew with the added objects

The fiducials contained in the primary instance are created as local fiducials and are also multiplied during processing.

Fig. 112:   **Instance type (with primary instance and three instances)**

You have to assign an instance type to an instance group in the user guidance step *Workflow* to be able to create toolpaths for it.

Instances provide several advantages over multiplied data (step and repeat):

- They require less memory. Thus, the data are loaded faster and their computation is accelerated.

- Toolpaths are computed only for the primary instance and are reused for the further instances. This accelerates the computation of the toolpaths significantly.

The created instances are displayed in the pane *Workflow setup*:
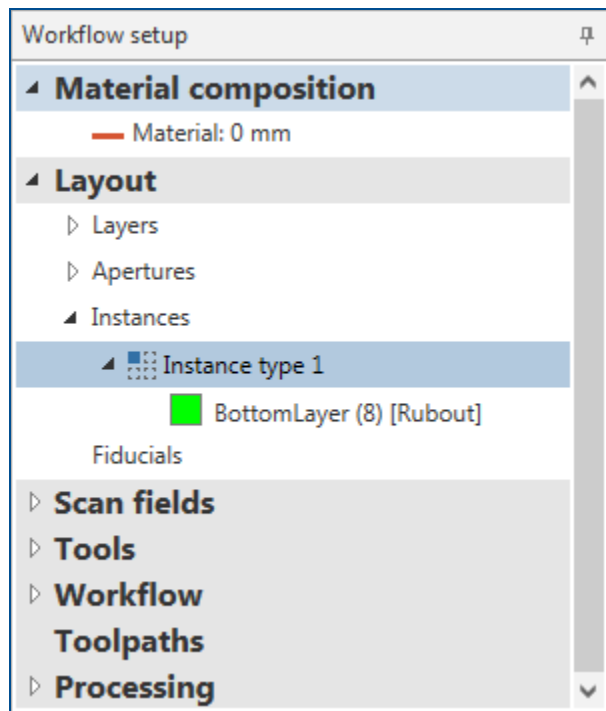
Fig. 113:   **Workflow setup | Create instance type**

2.9.4 Placement...

Opens the dialog *Placement* for rotating and moving the processing data.

The dialog *Placement* allows correct placement of the material. Once the toolpaths and scan fields have been generated, the tab *Processing data* is also displayed.

Fig. 114: **Dialog *Placement***

The button [Measure material thickness] starts the automatic measurement of the material thickness. This function is used for unconventional material thicknesses and is only available if the required sensor is present in the system.

The following functions are available in the tab *Material*:

Name	Description
Material	
Width	Specifies the width of the material.
Length	Specifies the length of the material.
Set default size	Resets the width and length to the initial value.
Material thickness	Specifies the material thickness.
Measure material thickness	Measures the thickness of the material. You can find more settings for the thickness measurement in the menu *Processing* under *Material thickness measurement setting*.

Table 44: **Dialog *Placement* | Tab *Material***

Fig. 115:   **Dialog *Placement* | Tab *Processing data***

The following functions are available in the tab *Processing data*:

Name	Description
Center of processing data	Specifies the center of the processing data in x and y direction.
Angle	Rotates the processing data by a definable angle.
Use information layers	Takes the information layers into account when placing the processing data.
Center on material	Positions the processing data on the center of the material.
Processing head	
Center on data	Positions the processing head at the center over the machining data.
Show bounding box	Shows the bounding box of the processing data.

Table 45:   **Dialog *Placement* | Tab *Processing data***

2.9.5 Automatic fiducial creation

Opens a dialog for automatic fiducial creation.

Summary

The dialog *Automatic fiducial creation* allows you to change the settings for the automatic fiducial creation.

Fig. 116: **Dialog *Automatic fiducial creation***

The following settings are available:

Name	Description
1, 2, 3, 4	Selects the fiducials that are to be created automatically.
Position style	Selects the criterion according to which the fiducials are to be placed. **Highest accuracy:** The fiducials are placed in a way that they can be captured with high accuracy in the camera image. **Material efficient:** The fiducials are placed so that the material is optimally used.
Distance	Indicates the (outer) distance between source layer and fiducials in x and y.
Source layer	Indicates the layer where fiducials are to be created.
Delete fiducials	Selects how to handle existing fiducials. **None**: The existing fiducials remain. **All:** All existing fiducials are deleted. **Overlapping:** Remaining fiducials that are automatically overlapping due to automatic creation are deleted.

Table 46: **Dialog *Automatic fiducial creation***

2.9.6   Power measurement

Opens the dialog *Power measurement*.

Summary

The laser power of the system can be measured here.

Fig. 117:   **Dialog *Power measurement***

Name	Description
Laser emission settings	
Frequency [kHz]	Defines the frequency for operating the laser.
Control value [%]	Defines the control value for operating the laser.
Internal power sensor settings	
Position [mm]	Displays the position of the laser power sensor.
Calib. offset	Displays the calibration offset of the laser power measurement.
Calib. factor	Displays the calibration factor of the laser power measurement.
Internal sensor power measurement	
Power [W]	Click on [Measure] to display the laser power measured by the laser power sensor.
Powermap measurement	Starts the power measurement for creating a powermap.

Table 47:   **Dialog *Power measurement***

2.10 Camera

In the view *Camera*, the camera image is displayed. The camera image can be moved by manually entered values or via double-click.
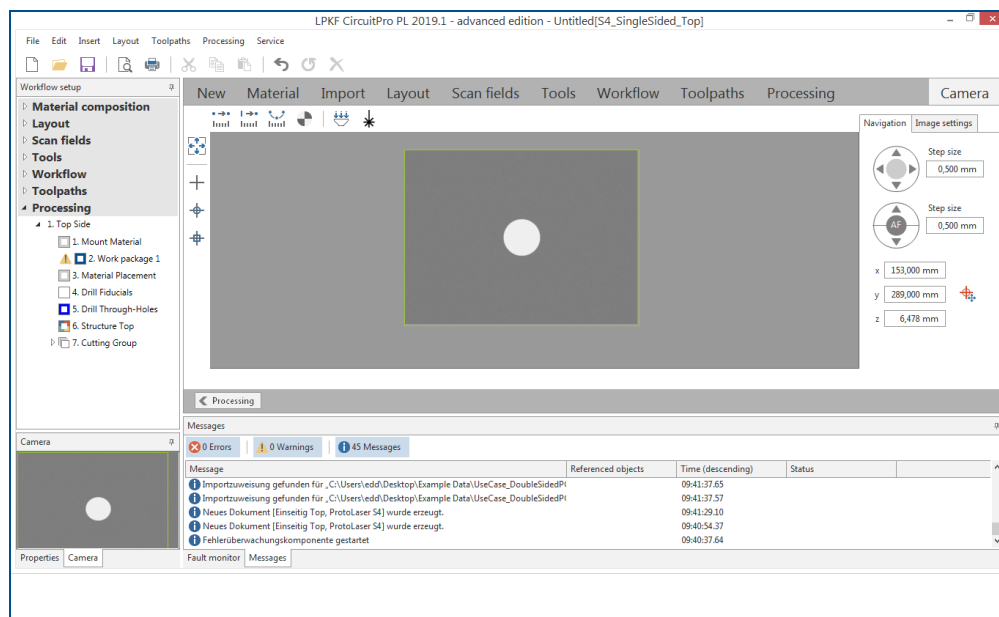
Fig. 118:   **View *Camera***

The icons/functions of the toolbar are described in the following table:

Icon	Name	Description
	Measure point to point	Measurement of the distance between two points.
	Measure point to line	Measurement of the distance between a line and a point. First, the line is defined by two points and then the point is positioned.
	Measure circle by 3 points	Measure circle The circle is computed by selecting three points on the circle.
	Fiducial search	The fiducials are searched in the current camera image.
	Extraction system turn on/off	Switch on/off the extraction system. Switching on the extraction system produces a vacuum that fastens the material.
	Activate pilot laser	Activates/Deactivates the pilot laser

Table 48:   **Toolbar view *Camera***

Using the functions on the right side of the view *Camera* the processing point can be manually moved in the directions x, y, and z.

The following button moves the processing point in x and y direction. The processing point is moved in the entered step size which can be changed arbitrarily.
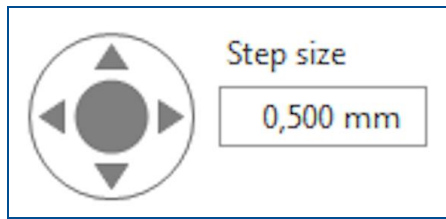
Fig. 119:   **Moving in x and y direction**

The following button moves the processing point in x and y direction. The processing point is moved in the entered step size which can be changed arbitrarily.

The button [AF] activates the autofocus that tries to focus on the image automatically.
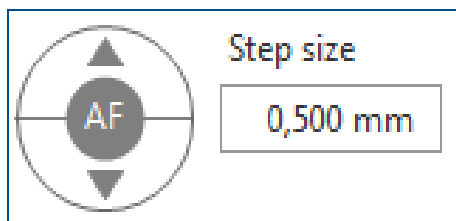
Fig. 120:   **Movement in z direction**

The button ⊕ moves the image center to the position entered in the fields *x*, *y*, and *z*.
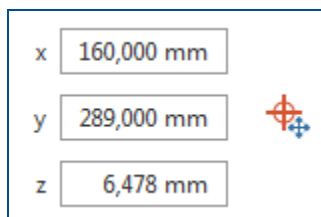
Fig. 121:   **Positioning the image center to x, y, and z value**

Tab image settings

In the tab *Image settings*, you can adjust the parameters for the current camera image. The changes are immediately displayed in the camera image.
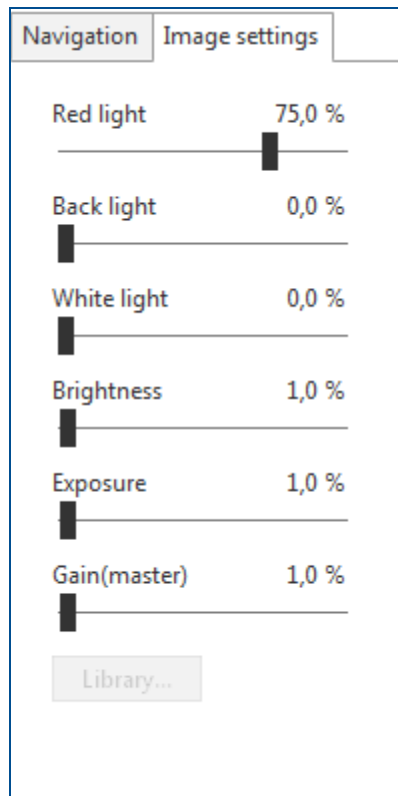
Fig. 122:   **View Camera | Tab *Image settings***

3   Menus

The entries of the menu bar are described in the following table:

Name	Description
Menu *File*	Contains the standard functions of the application.
Menu *Edit*	Contains functions to edit objects and their properties.
Menu *Insert*	Contains functions to create objects in the user guidance step *Layout*.
Menu *Layout*	Contains functions to edit geometric objects in the user guidance step *Layout*.
Menu *Toolpaths*	Contains various settings for toolpaths.
Menu *Processing*	Contains functions to process the previously defined processing data.
Menu *Service*	Contains various password-protected menu items that are only available for the LPKF Service.

Table 49:   **Menus**

3.1 Menu *File*

This menu contains the standard functions of the application.
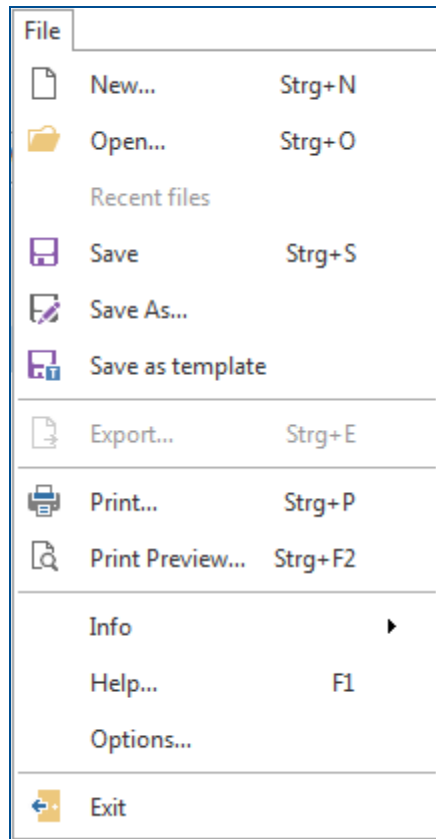
Fig. 123: **Menu *File***

The entries of the menu *File* are described in the following table:

Icon	Name	Description
	New...	Starts a new project from a selected template or opens a project that is already existing (file extension *.cbf or *.cp2d).
	Open…	Opens an existing project file (file extensions *.cbf and *.cp2d).
	Recent files	Displays the files that have been opened/edited recently.
	Save	Saves the currently edited project file containing all changes with the same name and storage location.
	Save as...	Saves the currently edited project file containing all changes with a different name and/or storage location.
	Save as template	Saves the currently edited document with all changes as template so it can be used when creating a new document.
	Export	Exports the current project.
	Print...	Prints the current layout. Use the diverse settings to optimize your print result.
	Print preview...	Displays the preview of the print results using the current print settings.
	Info	Contains information on software and hardware.
	Help...	Displays the detailed help.
	Options...	Contains application settings, such as language settings.
	Exit	Exits and closes the current application.

Table 50: **Menu *File***

3.1.1   New

Starts a new project from a selected template or opens a project that is already existing (file extension *.cp2d or *.cbf).

Summary

The command *New* enables you to create a new project file based on an existing, installed template or to search on your computer for a custom template that is suitable. The tab *Projects* lists the recently edited projects.

3.1.2   Open

Opens an existing project file (file extensions *.cp2d and *.cbf).

Summary

In the dialog to be displayed, navigate to the desired file and click on *Open.* The data are displayed in the user guidance step *Layout*.

3.1.3   Recent files

Displays the files that have been recently opened/edited.

3.1.4   Save

Saves the currently edited project file containing all changes with the same name and storage location.

3.1.5   Save as

Saves the currently edited project file containing all changes with a different name and/or storage location.

3.1.6   Save as template

Saves the actual edited project file with all changes as a template.

3.1.7   Export

Exports data to an *.LMD file.

Summary

The LMD file is used for data transfer between LPKF software products.

■ **Exporting a project**

1. Click on *File > Export...*

2. The following dialog is displayed:
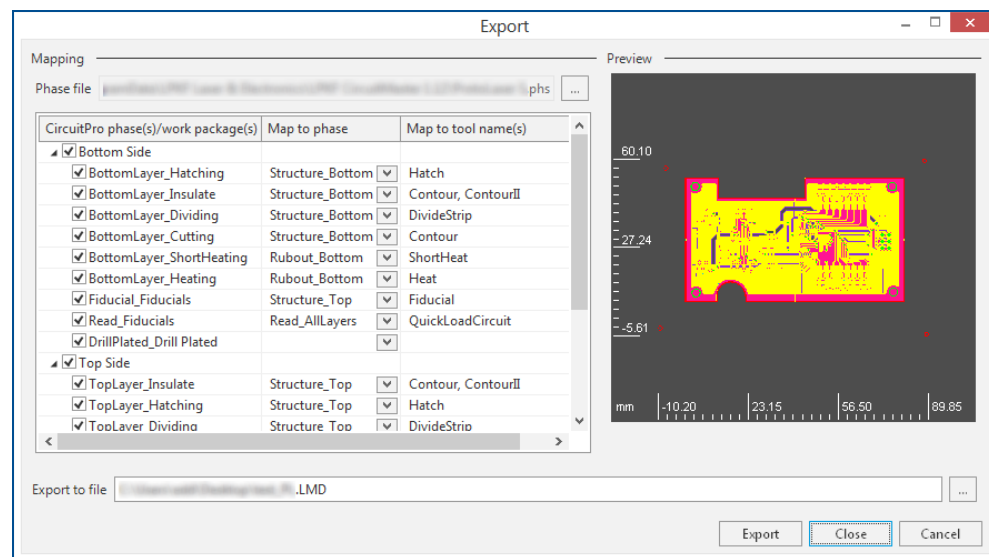
Fig. 124:   **Dialog *Export***

☐ The phase file is attached automatically. The columns *CircuitPro phase(s)/work package(s), Map to phase*, and *Map to tool name(s)* are filled with the required information from the phase file.

ℹ️ If the phase file is not attached automatically you can find it in the installation folder of CircuitMaster or BoardMaster.

3. In the field *Export to file*, enter a name for the LMD file and select a location for saving.

4. Click on [Export].

☑ The project has been exported.

3.1.8   Print

Prints the current layout. Use the diverse settings to optimize your print result.

Summary

Click on [Print], to start the print process with the current settings.

To change the print options, various tabs are available.

Tab *General*

Contains general settings for the print process (number of pages, page range, etc.).
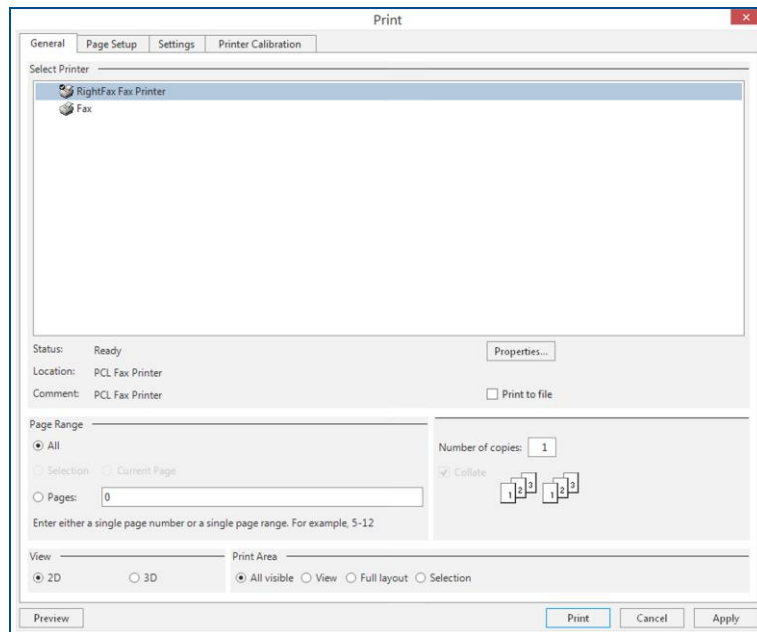
Fig. 125:   **Tab *General***

Select Printer

Select in this group the printer that is to be used for executing the print job. Use the button [Properties], to change the settings for the printer.

Page Range

In this group, select the pages to be printed. As soon as you want to print more than one copy, the option *Collate* is activated. This setting ensures that a complete copy is printed, before the next copy is started to be printed.

View

Here, you can define which view is to be printed.

Print area

Define in this group if the current view, the entire layout, the marked areas, or all is to be printed.

Tab *Page Setup*

Contains general settings for the page to be printed (paper size, orientation).
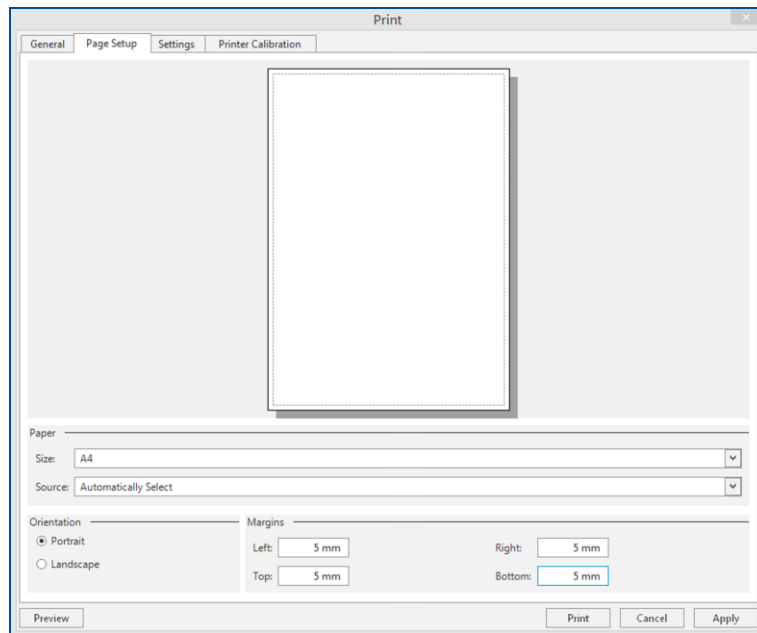
Fig. 126:   **Tab *Page Setup***

Paper

Select the paper size and the paper tray of the printer.

Orientation

Select the orientation of the paper (portrait, landscape).

Margins

Defines the size of the margins.

Tab *Settings*

Contains settings for the layout of the image to be printed (scaling, mirroring etc.).
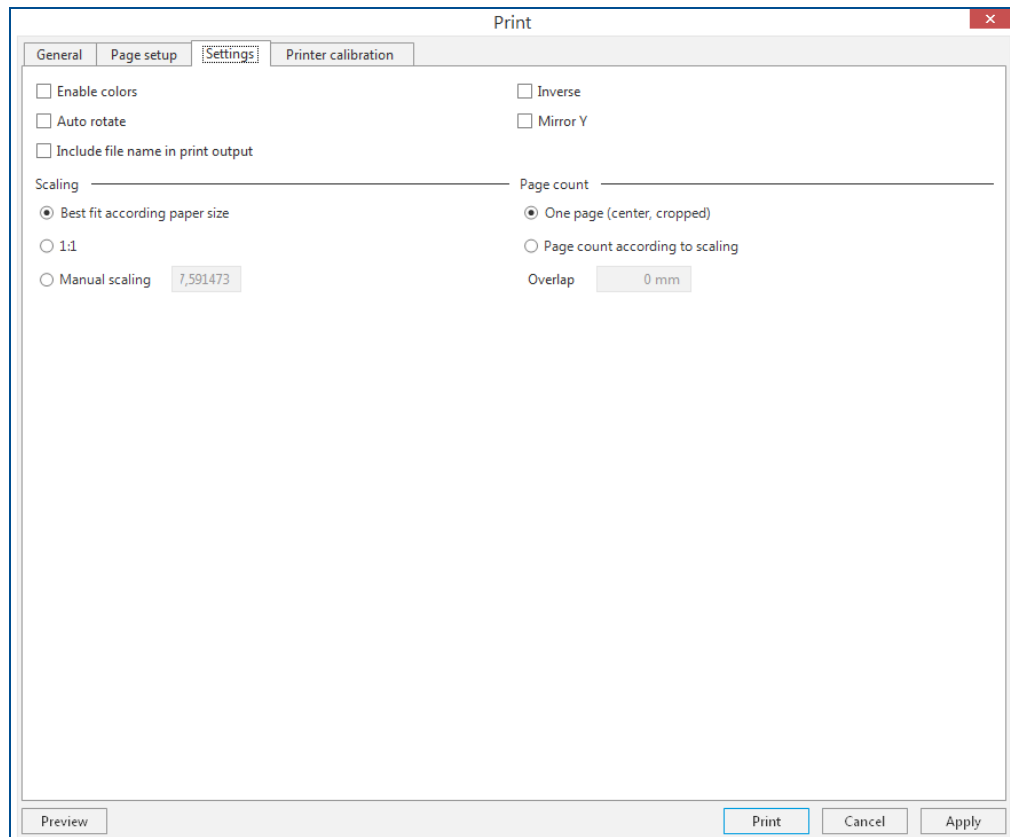
Fig. 127:   **Tab** *Settings*

This group offers the following options:

– *Enable colors*
  Activates color printing

– *Auto rotate*
  Adjusts the page orientation according to the orientation set in the printer properties.

– *Include file name in print output*
  Prints the file name of the project on every sheet.

– *Inverse*
  Causes a display inversion of the rubout area, i.e. the area that is removed during production (e.g. rubout area) is not printed.

– *Mirror y*
  Mirrors the object to be printed along the y axis.

Scaling

This group offers the following options:

– *Best fit according paper size*
Automatically adjusts the printout to the preselected paper size.

– *1:1*
Causes that the printout is printed in the actual size. There is no scaling/adjusting to the actual paper size. Large graphics can be spread across several sheets. Small graphics can be too small and may thus be unreadable in some circumstances.

– *Manual scaling*
Scales the printout according to the entered value.

Page count

In this group, you can define which view is to be printed.

– *One page (center, cropped)*
Prints the graphic centered on one page, i.e. that possibly enlarged graphics that would be printed on several sheets are trimmed.

– *Page count according to scaling*
Prints the pages exactly in accordance with the specified number of pages in the print preview.

Tab *Printer Calibration*

Contains parameters (rectangle size, printed size etc.) for calibrating the printer.
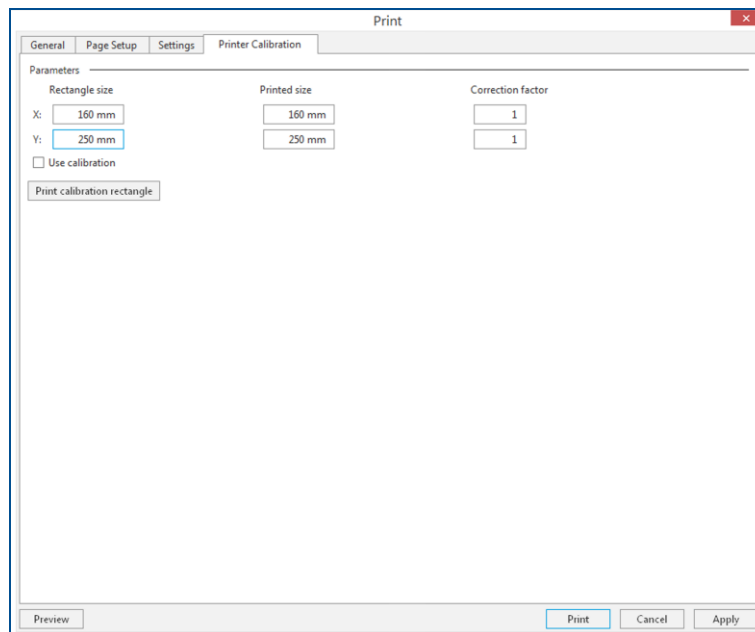
Fig. 128:   **Tab *Printer calibration***

Parameters

This group provides the following options:

– *Rectangle size:*
Defines the size of the calibration rectangle by entering values for x and y.

– *Printed size:*
Used for the entry of the actual printed rectangle size.

– *Correction factor:*
Automatically displays the difference between the *Rectangle size* and the entered size in the *Printed size*.

3.1.9   Print preview

Displays a preview of the printed layout.

Summary

The print preview enables you to check the layout to be printed on the screen and to change the display via various settings.
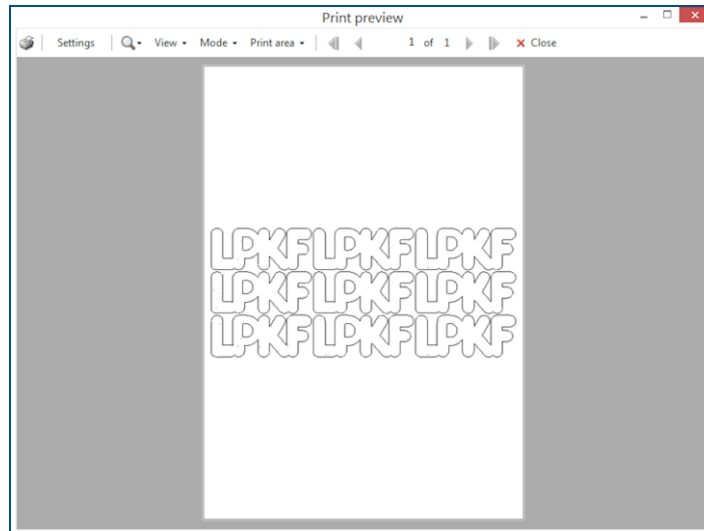
Fig. 129:   **Dialog _Print preview_**

The dialog *Print preview* contains the following icons/functions:

Icon/Button	Description
	Starts the printing operation.
Settings	Opens the dialog *Print	Settings*.
	Zooms in/out the view of the page to be printed.
View	Offers the option to select between the view for 2D objects and the view for 3D objects.
Mode	
One page	Displays one page of the document to be printed.
Two pages	Displays two pages of the document to be printed.
Three pages	Displays three pages of the document to be printed.
Four pages	Displays four pages of the document to be printed.
Six pages	Displays six pages of the document to be printed.
Print area	
All visible	Limits the print area to all visible objects.
View	Limits the print area to the current view.
Full layout	Adapts the print area to the full layout.
Selection	Limits the print area to the current selection.
	Displays the first page.
	Displays the previous page.
Page number	Displays the current page number.
	Displays the next page.
	Displays the last page.
Close	Closes the dialog *Print preview*.

Table 51: **Dialog *Print preview***

3.1.10 Info

Contains information on software and hardware.

Summary

Software...

Displays the version numbers and copyright of the program component.

Hardware...

Displays information about the PC running the application.

Operating hours...

Displays the *Operating hours of the system*, the *activated hours in CircuitPro*, as well as *Operating hours of the laser*.

3.1.11 Help...

The menu item *Help* provides information on operating the software.

3.1.12 Options

Contains application settings, such as language settings.

Context sensitive help texts that are relevant for the selected option are displayed in the lower area of the dialog:
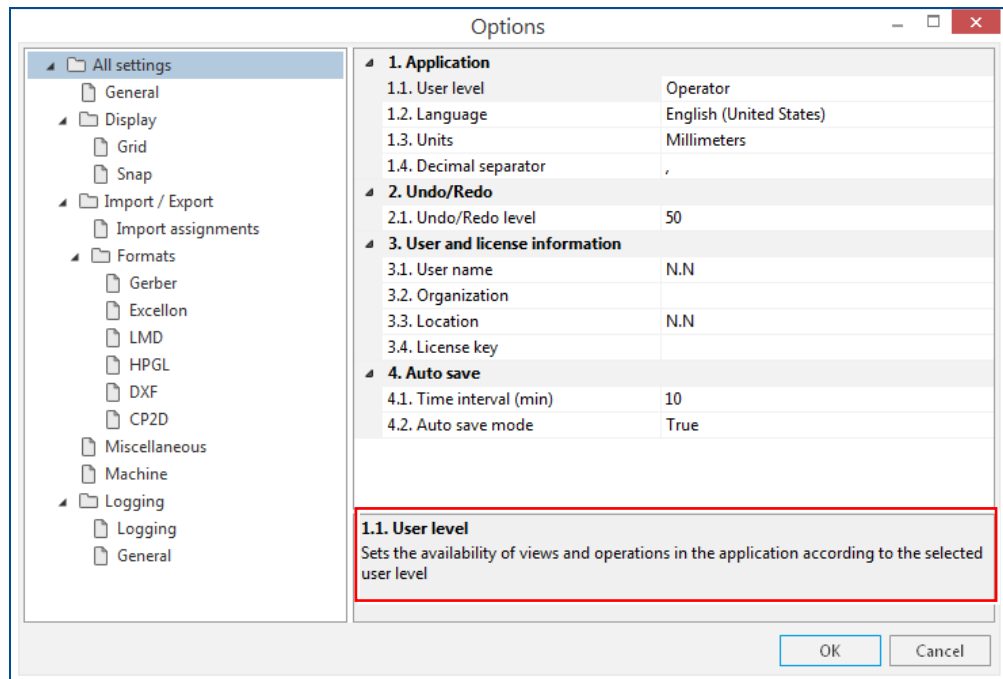
Fig. 130:   **Help texts in the dialog** *Options*

3.1.13 Exit

Exits and closes the current application.

3.2 Menu *Edit*

This menu contains functions to edit objects and their properties.
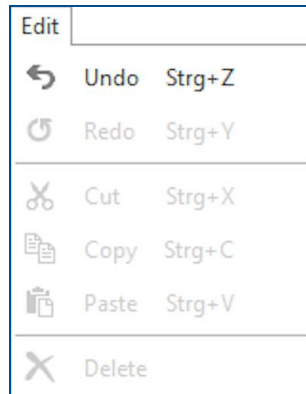
Fig. 131: **Menu *Edit***

The icons/functions of the menu *Edit* are described in the following table:

Icon	Name	Description
	Undo	Undoes the last action performed.
	Redo	Executes the last action once more that was undone by clicking on [Undo].
	Repeat	Executes the last action once more.
	Cut	Removes the selected item(s) and puts them into the clipboard.
	Copy	Copies the selected item(s) and puts them into the clipboard.
	Paste	Pastes the contents from the clipboard to the cursor position.
	Delete	Deletes the selected items.

Table 52: **Menu *Edit***

3.2.1 Undo

The last action is undone.

Summary

Click on/Tap on [Undo] to undo the last action and to restore the previous state.

The number of actions that can be undone can be set in the options.

[Undo] can also be executed with the key combination $\boxed{\text{Ctrl}}$ + $\boxed{\text{Z}}$.

3.2.2 Repeat

Executes the last action once more.

Summary

Click on/Tap on [Repeat] to execute the previously performed action again.

[Repeat] can also be executed with the key combination $\boxed{\text{Ctrl}}$ + $\boxed{\text{Y}}$.

3.2.3 Redo

Executes the last action once more that was performed by clicking on [Undo].

Summary

Click on/Tap on [Redo] to execute the previously performed action again that was performed by clicking on [Undo].

[Redo] can also be executed with the key combination `Ctrl` + `Y`.

3.2.4 Cut

The selection is removed and added to the clipboard.

Summary

Click on/Tap on [Cut] to remove the marked contents and to add them to the clipboard. These contents can be reinserted via [Paste].

[Cut] can also be executed with the key combination `Ctrl` + `X`.

3.2.5 Copy

The selection is copied to the clipboard.

Summary

Click on/Tap on [Copy] to copy the marked contents to the clipboard. Use [Paste] to insert these contents to the cursor position.

[Copy] can also be executed with the key combination `Ctrl` + `C`.

3.2.6 Paste

Pastes the contents from the clipboard to the cursor position.

Summary

Click on/Tap on [Paste] to add contents from the clipboard to the cursor position. For example, these can be added to the clipboard via [Cut] or [Copy].

[Paste] can also be executed with the key combination `Ctrl` + `V`.

3.2.7 Delete

The marked contents are removed.

Summary

Click on/Tap on [Delete] to remove the marked texts or objects (e.g. layers, toolpaths, etc.).

Accidently removed contents can be restored with [Undo].

[Delete] can also be executed with `Del`.

3.3   Menu *Insert*

This menu contains functions to create and edit objects in the user guidance step *Layout*.
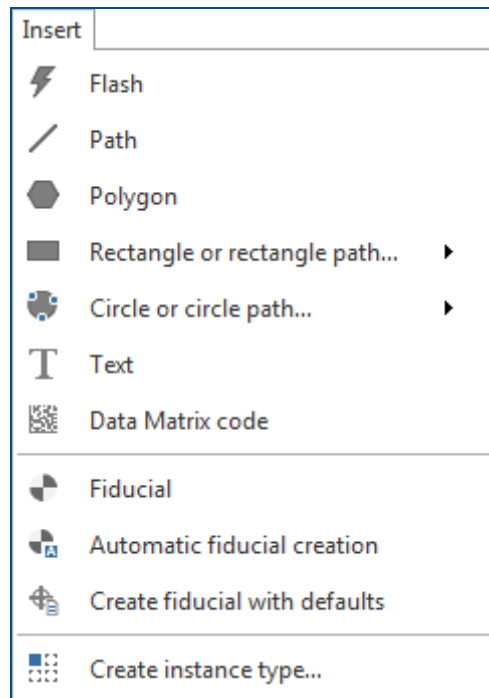
Fig. 132:   **Menu *Insert***

The icons/functions of the menu *Insert* are described in the following table:

Icon	Name	Description
	Flash	Creates a flash based on the aperture currently selected.
	Path	Creates a path in the current layer.
	Polygon	Creates a polygon in the current layer.
	Rectangle	Creates a filled rectangle in the current layer.
	Rectangle path	Creates a rectangle path in the current layer.
	Circle by diameter	Creates a filled circle by defining a diameter.
	Circle by points	Creates a filled circle by setting three points.
	Circle path by diameter	Creates a circle path by defining a diameter.
	Circle path by points	Creates a circle path by setting three points.
	Create text object	Creates a text field.
	Create Data Matrix code	Creates a Data Matrix code

Icon	Name	Description
	Fiducial	Creates a new fiducial.
	Automatic fiducial creation	Opens a dialog automatic fiducial creation.
	Create fiducial with defaults	Creates a fiducial with the default camera settings.
	Create instance type…	Creates an instance type from the selected objects where the objects are used as the primary instance.

Table 53:   **Menu *Insert***

3.3.1   Flash

Creates a flash based on the aperture currently selected.

Summary

Use the function [Flash] to create a flash on the basis of the apertures in the aperture library. If no aperture is selected the first aperture in the library is used.

The flash is assigned to the currently selected layer.

3.3.2   Path

Creates a path in the current layer.

Summary

Apply the [Path] function to create open and closed paths in the user guidance step *Layout*. These paths are automatically assigned to the currently selected layer and use the selected aperture or path. Only circular apertures can be used for paths.

To close a path, you must create the last point, then select [Close open path] in the context menu. The paths are automatically connected to close the shape.
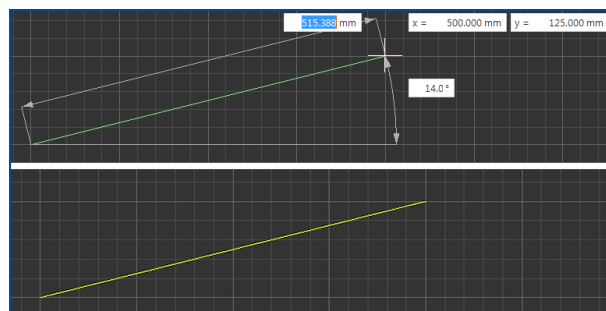
Fig. 133:   **Creating a path**

3.3.3   Polygon

Creates a polygon in the current layer.

Summary

Use the function [Polygon] to create polygons in the user guidance step *Layout*. These polygons are automatically assigned to the currently selected layer. The individual lines can be created as straight lines or as arcs. Once the element is finished, it is filled automatically.

Open the context menu and click on [Finish] or press ⌈Enter⌋ to close the polygon.
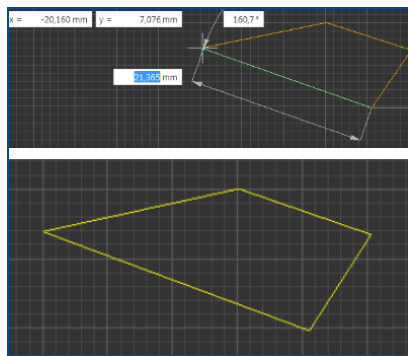
Fig. 134:   **Create polygon**

3.3.4   Rectangle

Creates a filled rectangle in the current layer.

Summary

Use the function [Rectangle] to create filled rectangles in the user guidance step *Layout*. The objects are automatically assigned to the currently selected layer.
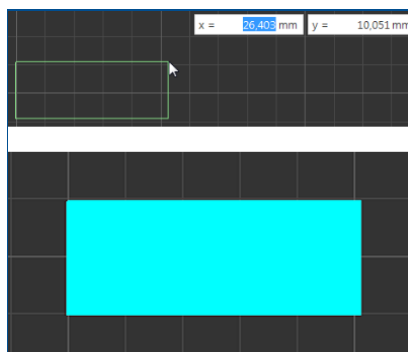
Fig. 135:   **Creating a rectangle**

3.3.5 Rectangle path

Creates a rectangle path in the current layer.

Summary

Use the function [Rectangle path] to create rectangle paths in the user guidance step *Layout*. The objects are automatically assigned to the currently selected layer.
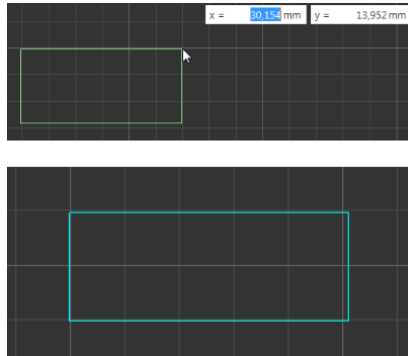
Fig. 136: **Creating a rectangle path**

3.3.6 Circle by diameter

Creates a filled circle of a defined diameter.

Summary

With [Circle by diameter] you can create circles in the user guidance step *Layout*. After creation, the circles are automatically filled and assigned to the currently selected layer.
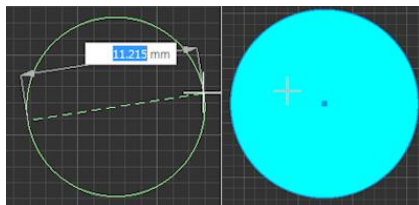
Fig. 137: **Creating circle by diameter**

3.3.7   Circle by points

Creates a filled circle by setting three points.

Summary

Use the function [Circle by points] to create circles in the user guidance step *Layout*. After the circles have been created, they are automatically filled and assigned to the currently selected layer.
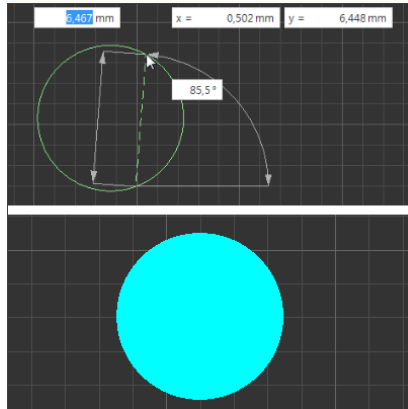
Fig. 138:   **Creating a circle by points**

3.3.8   Circle path by diameter

Creates a circle path by the defined diameter.

Summary

With [Circle path by diameter] you can create circle lines in the user guidance step *Layout*. Once created, the circle paths are automatically assigned to the active layer.
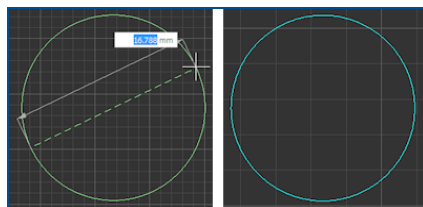
Fig. 139:   **Creating circle path by diameter**

3.3.9   Circle path by points

Creates a circle path by setting three points.

Summary

Use the function [Circle path by points] to create circle paths in the user guidance step *Layout*. After the circle paths have been created, they are automatically assigned to the active layer.
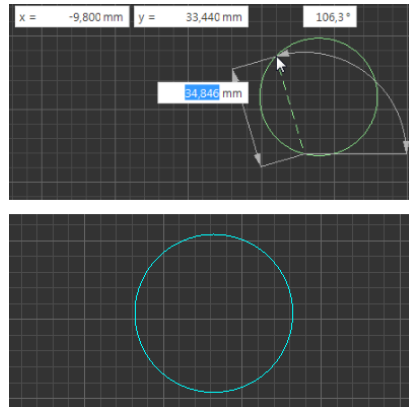
Fig. 140:   **Create circle path by points**

3.3.10 Create text object

Creates a text object in the current layer.

Summary

Use the function [Create text object] to create text objects in the user guidance step *Layout*. In addition to conventional texts and numbers, the text objects can also contain the serial number, the current date, and variables.

The texts are automatically assigned to the currently selected layer.

Fig. 141:   **Create text**

Fig. 142:   **Toolbar *Create text object***

Icon	Name	Description
	Selected layer	Displays the currently selected layer. You can change this by opening a drop-down list with a left-click and selecting a different layer from the list.
	Font	Displays the currently selected font. You can change this by opening a drop-down list with a left-click and selecting a different font from the list.
3 mm	Font size	Displays the currently selected font size. Enter the desired value for the font size into the input field.
B	Bold	Displays the currently selected text in bold letters.
I	Italic	Displays the currently selected text in italics.
T	Outline	Displays the currently selected text as an outline.
≡	Left	Aligns text objects to the left of the input field.
≡	Center	Aligns text objects to the center of the input field.
≡	Right	Aligns text objects to the right of the input field.

Table 54:   **Functions *Create text object***

With the functions in the right toolbar you can insert variable contents into the text object. Their values are not static but are adjusted at a certain point in time. Click on ✚ to add a variable. Variables of the format *Number* can be additionally assigned a type (*Serial number*, *Batch*, or *Lot*). Click on the icon to add the variable into the text field.

Fig. 143:   **Settings for text objects with dynamic contents**

Name	Description
Number	
Type	Defines the type of the variable. You can select between the following types: • Serial number At the start of each production, the serial number is incremented by one value. If there are several serial numbers and the length is changed, this value changes for all serial numbers. • Batch The value is incremented by 1 when the maximum number of serial numbers (length) has been reached. • Lot Indicates the number of fully produced batches. The value is incremented by 1 when the maximum number of batches has been reached.
Description	Indicates the description of the variable.
Length	Defines the maximum number of digits for this variable. **Example:** At a length of **3**, the maximum value is **999**.

Name	Description
Initial value	Defines the initial (starting) value of the variable.
Reset each batch	Activates/Deactivates resetting the serial number after each batch.
Batch size	Defines the maximum batch size. A batch has been produced, when the maximum serial number has been reached.
Reset each lot	Activates/Deactivates resetting the count after each lot.
Lot size	Defines the maximum lot size. A lot has been produced, when the maximum batch size has been reached.
Text	
Description	Specifies the description of the variable.
Length	Indicates the maximum character length of the variable.
Date	
Example	Displays an example of the date according to the selected format.
Date	Defines the format used for displaying the date.

Table 55: **Functions for dynamic text objects**

> When adding dynamic objects, the user guidance step *Layout* only displays example values.

3.3.11 Create Data Matrix code

Creates a Data Matrix code in the current layer

Summary

Use the function [Create Data Matrix code] to create a 2D code in a rectangular matrix in the user guidance step *Layout*. This code can be read using a camera.
The Data Matrix codes are automatically assigned to the currently selected layer.
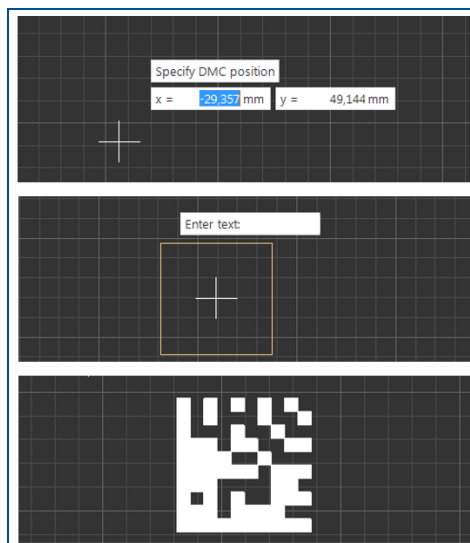
Fig. 144:   **Create Data Matrix code**

With the functions in the right toolbar, variable contents can be displayed as Data Matrix code. These values are not static but are adjusted at a certain point in time. Click on ✚ to add a variable of a specific data format (*Number*, *Text*, or *Date*). Variables of the format *Number* can be additionally assigned a type (*Serial number*, *Batch*, or *Lot*). Click on ▣ to insert the variable into the text field.
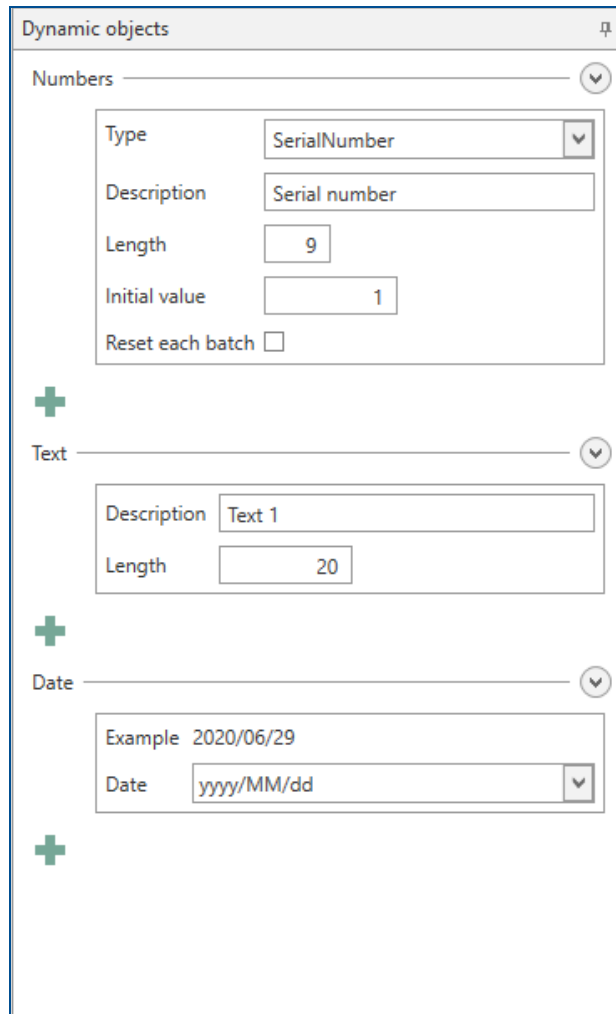
Fig. 145:   **Settings for Data Matrix code with dynamic contents**

Name	Description
Number	

Type	Defines the type of the variable. You can select one of the following types:
	• Serial number
	  At the start of each production, the serial number is incremented by one value. If there are several serial numbers and the length is changed, this value changes for all serial numbers.
	• Batch
	  The value is incremented by 1 when the maximum number of serial numbers (length) has been reached.
	• Lot
	  Indicates the number of fully produced batches. The value is incremented by 1 when the maximum

Name	Description
	number of batches has been reached.
Description	Defines the description of the variable.
Length	Defines the maximum number of digits for this variable. **Example:** At a length of **3** the maximum value is **999**.
Initial value	Defines the initial (starting) value of the variable.
Reset each batch	Activates/Deactivates resetting the count after each batch.
Batch size	Defines the maximum batch size. A batch has been produced, when the maximum serial number has been reached.
Reset each lot	Activates/Deactivates resetting the count after each batch.
Lot size	Defines the maximum lot size. A lot has been produced, when the maximum batch size has been reached.
Text	
Description	Defines the description of the variable.
Length	Defines the maximum character length of the variable.
Date	
Example	Displays an example of the date according to the selected format.
Date	Defines the format used for displaying the date.

Table 56: **Functions for dynamic Data Matrix codes**

3.3.12 Fiducial

Displays a fiducial at the cursor position. Left-click to determine the center of the fiducial and to create the fiducial.

Summary

The total size of the fiducial can be defined by the diameter in *Options > Miscellaneous> Fiducial > Diameter*.

3.3.13 Automatic fiducial creation

Opens a dialog for automatic fiducial creation.

Summary

The dialog *Automatic fiducial creation* allows you to change the settings for the automatic fiducial creation.

Fig. 146:   **Dialog *Automatic fiducial creation***

The following settings are available:

Name	Description
1, 2, 3, 4	Selects the fiducials that are to be created automatically.
Position style	Selects the criterion according to which the fiducials are to be placed. **Highest accuracy:** The fiducials are placed in a way that they can be captured with high accuracy in the camera image. **Material efficient:** The fiducials are placed so that the material is optimally used.
Distance	Indicates the (outer) distance between source layer and fiducials in x and y.
Source layer	Indicates the layer where fiducials are to be created.
Delete fiducials	Selects how to handle existing fiducials. **None**: The existing fiducials remain. **All:** All existing fiducials are deleted. **Overlapping:** Remaining fiducials that are automatically overlapping due to automatic creation are deleted.

Table 57:   **Dialog *Automatic fiducial creation***

3.3.14 Create fiducial with defaults

Creates a fiducial with standard camera settings.

Summary

To change standard values, open the user guidance step *Camera* and click [Library]. Select the entry marked as *Standard* and adopt the current camera settings by using [Apply] or [OK].

3.3.15 Create instance type…

Creates an instance type with the selected objects as a primary instance.

Summary

An instance type consists of a primary instance and at least one instance. Instances are references to the primary instance. The primary instance is produced at the position of the individual instance during processing.

Subsequent changes to the primary instance are applied only partially. Once you remove an object, this is applied immediately to the instance. If you want to add new objects, you have to dissolve the instance type and create it anew with the added objects

The fiducials contained in the primary instance are created as local fiducials and are also multiplied during processing.

Fig. 147:   **Instance type (with primary instance and three instances)**

To create tool paths for an instance type, you must use the user guidance step *Workflow* to assign it to an instance group.

Compared to multiplied data (Step and Repeat), instances have several advantages:

- You need less memory. As a result, the data is loaded faster and its calculation accelerated.

- Tool paths are only calculated for the primary instance and reused for the other instances. This greatly speeds up the calculation of the tool paths.

3.4   Menu *Layout*

This menu contains functions to create and edit geometric objects in the user guidance step *Layout.*
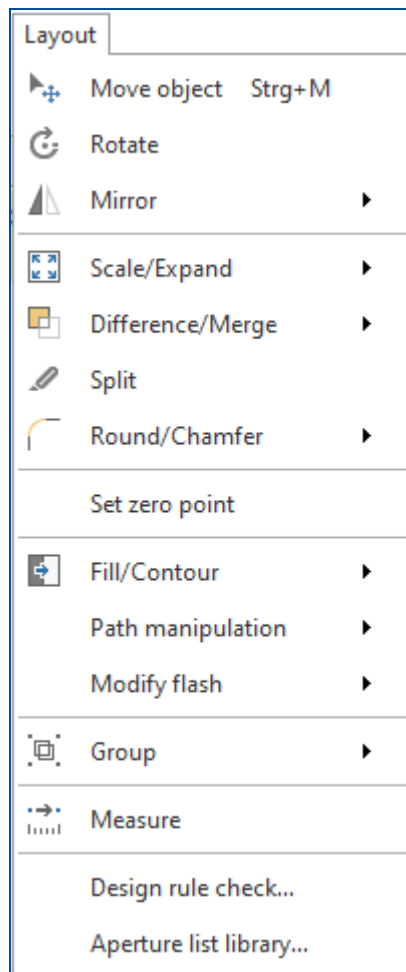
The icons/functions of the menu *Layout* are described in the following table:

Icon	Name	Description
	Move object	Moves the selected object by a defined distance and direction.
	Rotate	Rotates one or multiple objects around a definable pivot point.
	Mirror horizontally	Mirrors one or multiple objects around the horizontal coordinate axis (x axis).
	Mirror vertically	Mirrors one or multiple objects around the vertical axis of reflection (y axis).
	Scale	Scales up or scales down the marked object by the scale factor.
	Expand	Expands or shrinks the marked object by a definable length.
	Merge	Merges adjoining or overlapping objects to a single geometrical object.

Icon	Name	Description
	Difference	Removes the area of a geometrical object that is overlapped by a second selected object.
	Split	Splits a marked object using a predefined path.
	Round	Rounds the corners of the marked object.
	Chamfer	Chamfers the corners of the marked object.
	Set zero point	Sets the zero point to the selected position in the user guidance step *Layout*.
	Convert to polygon	Converts a selected closed path into a filled object.
	Convert to closed path	Converts a filled object into a closed path.
	Add point	Adds a point on a selected line.
	Add mirror point	Adds two points with the same distance from the reference point.
	Move point	Moves a selected point.
	Split path	Splits the selected line segment of a path
	Reduce number of elements	Removes redundant points in the selected object.
	Change line width	Changes the line width of the selected path.
	Change arc radius	Changes the arc radius of the selected path.
	Close open path	Connects both end points of an open path with a line.
	Convert to flash	Converts a selected object into a flash object.
	Combine to flash	Combines two or more selected objects to one flash object.
	Compare to flash	Compares the selected flash with objects on the same layer. Objects of the same shape are converted into a flash.
	Explode flash	Converts the flash into an object.
	Group	Groups selected objects.
	Ungroup	Ungroups grouped objects.
	Measure	Measures the distance between two points.
	Design rule check	Opens the dialog *Design rule check*.
	Aperture list library	Opens the dialog *Aperture list library*.

Table 58: **Menu *Layout***

3.4.1   Move object

Moves the marked object by a defined distance and direction.

Summary

Before moving, a reference point has to be specified. This point can also be located outside of the marked object/marked contour or even be created on other objects/contours. After the reference point is specified, the distance and direction can be defined.
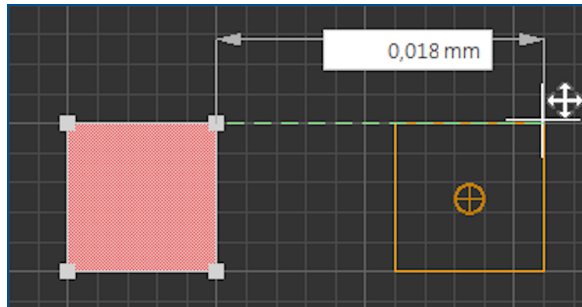
Fig. 149:   **Moving an object/a contour**

3.4.2   Rotate

Rotates one or multiple objects around a definable pivot point.

Summary

The marked objects/contours are rotated around one point. Thereby, you choose the position of the angle point and the rotation angle.
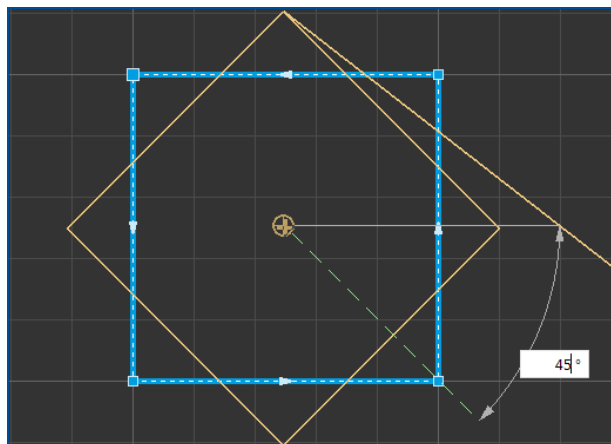
Fig. 150:   **Rotating an object/a contour**

3.4.3   Mirror horizontal

Mirrors one or multiple objects around the horizontal axis of reflection (x axis).

Summary

The axis of reflection is located at the centroid of area of the selected object. If multiple objects are selected, a common centroid of area is calculated that is used for the reflection. The centroid of area can even be located outside of the objects.
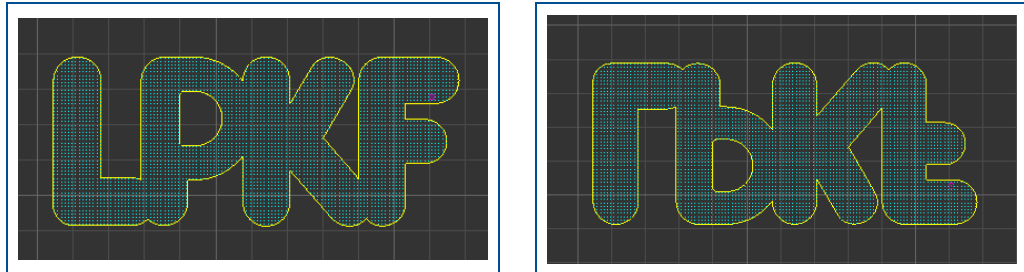
Fig. 151:   **Mirror object horizontal**

3.4.4   Mirror vertical

Mirrors one or multiple objects around the vertical axis of reflection (y axis).

Summary

The axis of reflection is located at the centroid of area of the selected object. If multiple objects are selected, a common centroid of area is calculated that is used for the reflection. The centroid of area can even be located outside of the objects.
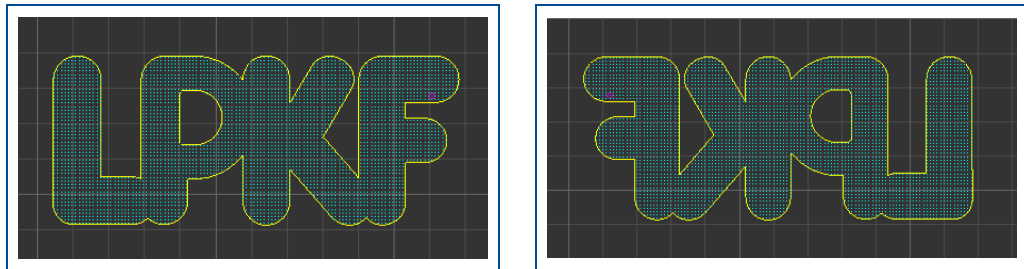
Fig. 152:   **Mirror object vertical**

3.4.5   Scale

Scales up or scales down the marked object by the scale factor.

Summary

All lines of the object are scaled uniformly so they keep their shape even after increasing/reducing the size.
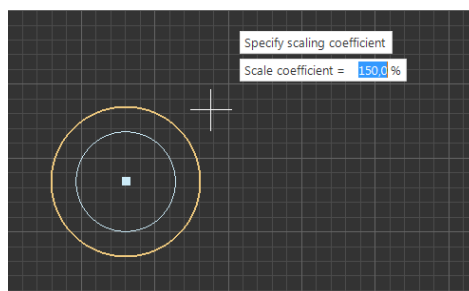
Fig. 153:   **Scaling an object**

3.4.6   Expand

Increases or decreases the marked object by a definable offset to the contour.

Summary

The marked object is increased or decreased uniformly around all sides. Increasing the object can cause a significant change of the shape.
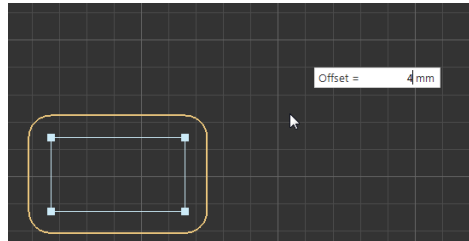
Fig. 154:   **Expanding an object**

The function is only available if a single object is marked. Multiple objects cannot be expanded at the same time.

3.4.7   Difference

Removes the area of a geometrical object that is overlapped by a second selected object.

Summary

[Difference] is only available if a filled object is selected. If the function is activated, a second object has to be selected. The area where the objects are overlapping is deleted.

After using this function, the second object is deleted by default. This setting can be changed in the options.

Objects that have been edited with [Difference] can only be restored to the previous state with [Undo].
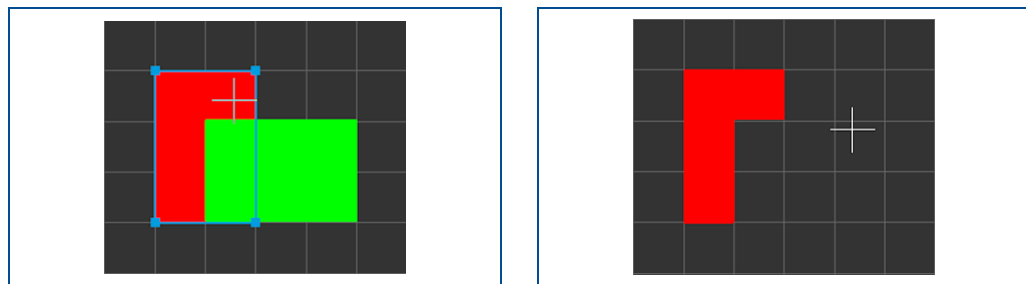
Fig. 155:   **Difference**

3.4.8   Merge

Merges adjoining or overlapping objects to a single geometrical object.

Summary

[Merge] is only available if at least two geometrical objects are marked.

Merged objects can only be restored to the previous state with [Undo].

Fig. 156:   **Merge objects**

The created object is assigned to the layer of the objects used. If the objects are located on different layers, the newly created object is assigned to the upmost layer used.

3.4.9   Split

Splits a marked object by using a predefined path.

Summary

When splitting, the line located on the object to be split is drawn first. Later, this line shall be used as a dividing line. Then select the object and enable the [Split] function. Click the line to split the object at the position of the line.
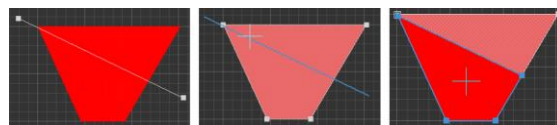
Fig. 157:   **Splitting an object**

3.4.10 Round

Rounds the corners of the marked object.

Summary

You can determine the radius of the rounding and select the corners to be rounded.

There is a differentiation between the outer and the inner corners.
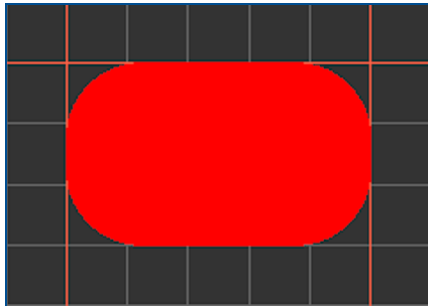
Fig. 158:   **Rounding corners**

Outer angles have an angle that is smaller than 180° within the geometrical object.
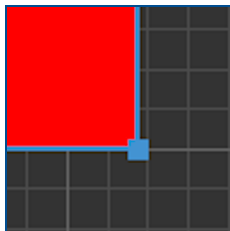
Fig. 159:   **Outer angles**

Inner angles have an angle that is greater than 180° within the geometrical object.
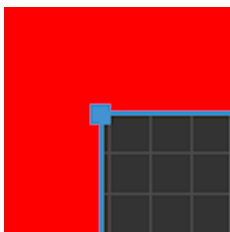
Fig. 160:   **Inner angles**

3.4.11 Chamfer

Chamfers the corners of the marked object.

Summary

You can determine the length of the sides to be chamfered and the angles to be chamfered.

There is a differentiation between the outer and the inner angles.
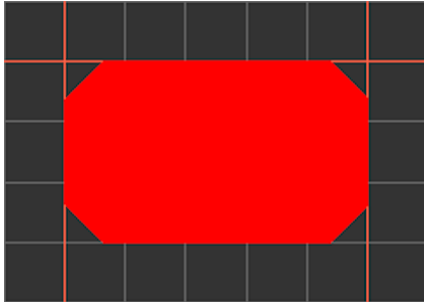
Fig. 161:   **Chamfer angles**

Outer angles have an angle that is smaller than 180° within the geometrical object.
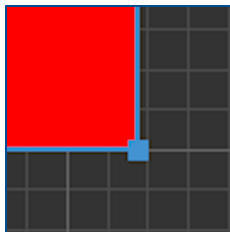
Fig. 162:   **Outer angles**

Inner angles have an angle that is greater than 180° within the geometrical object.
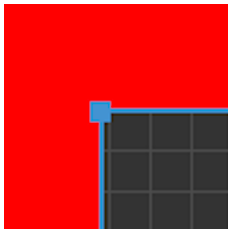
Fig. 163:   **Inner angles**

3.4.12 Set zero point

Sets the zero point to the selected position in the user guidance step *Layout*.
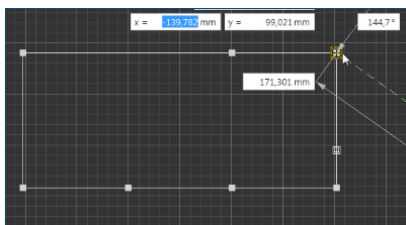
Fig. 164:   **Setting zero point**

3.4.13 Convert to polygon

Fills a marked closed path.

Summary

[Convert to polygon] is only available if a closed path is marked.
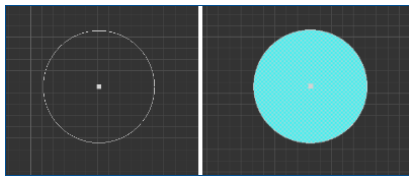
Fig. 165:   **Converting object to polygon**

3.4.14 Convert to closed path

Removes the filling of filled objects.

Summary

[Convert to closed path] is only available for marked and filled objects.
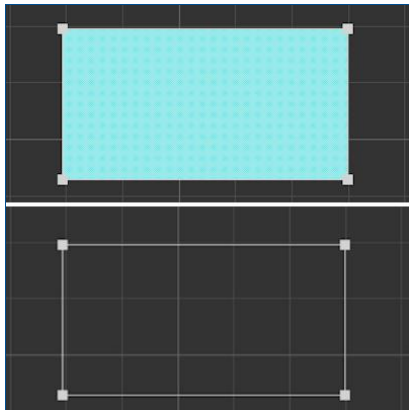
Fig. 166:   **Converting object to closed path**

3.4.15 Add point

Adds a point on a marked line segment.

Summary

[Add point] is only available if a line or a point of a segment is marked.
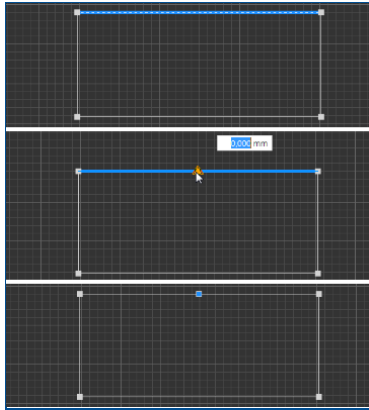
Fig. 167:   **Add point**

3.4.16 Add mirror point

Adds two points with the same distance from the reference point.

Summary

[Add mirror point] is only available if a line or a point of a segment is marked.
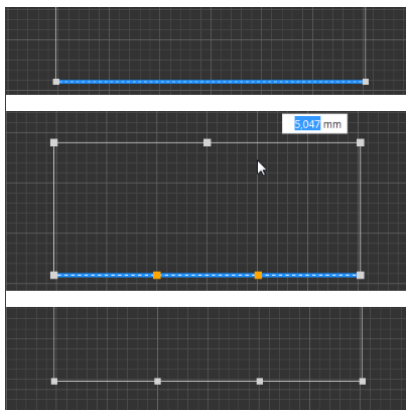
Fig. 168:   **Add mirror point**

3.4.15 Add point

3.4.17 Move point

Moves a marked point.

Summary

The marked point can be moved by using the mouse or by entering the relative coordinates. Multiple points can be marked as long as they are within the same object.
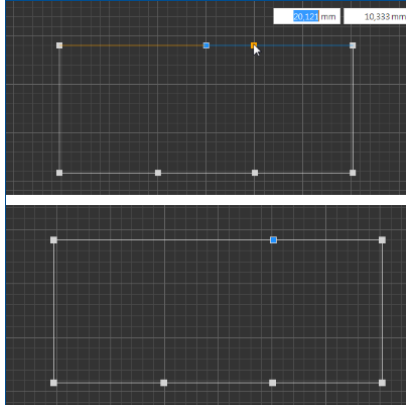
Fig. 169:   **Move point**

3.4.18 Split path

Splits the marked line segment of a path.

Summary

The line segment can be split at the mouse position or by entering relative coordinates referring to the center of the path or the selected point.
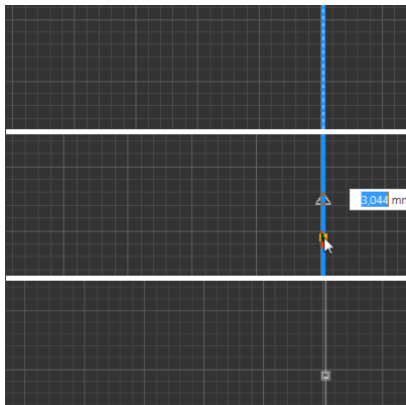
Fig. 170:   **Split path**

[Split path] cannot be used for filled objects.

3.4.19 Reduce number of elements

Removes redundant points in the marked object.

Summary

The shape of the object is not changed. Only the points that are not required for the current shape are removed.
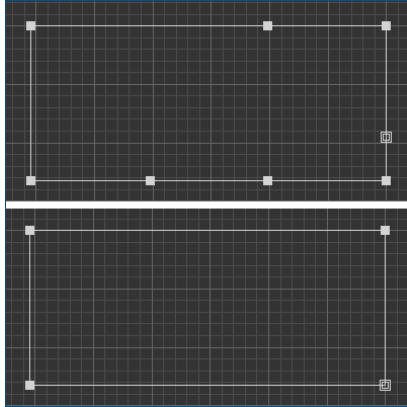
Fig. 171:   **Reduce number of elements**

3.4.20 Change line width

Changes the line width of the marked path.

Summary

[Change line width] is only available if a path is marked. When increasing the line width, the outer corners are rounded.

The line width is entered as a fixed value in mm.
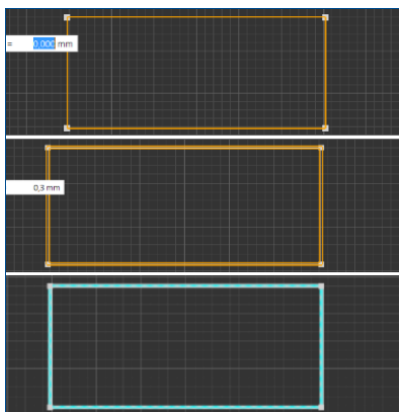
Fig. 172:   **Change line width**

3.4.21 Change arc radius

Changes the arc radius of the selected path.

Summary

[Change arc radius] is only available if a path is marked. This function can also be selected via the context menu. The arc radius is changed by defining a distance from the original path.
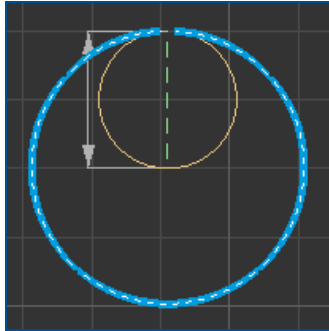
Fig. 173:   **Change arc radius**

3.4.22 Close open path

Connects both end points of an open path with a line.

Summary

[Close open path] is only available if an open path is marked. The marked object is converted to a closed path.
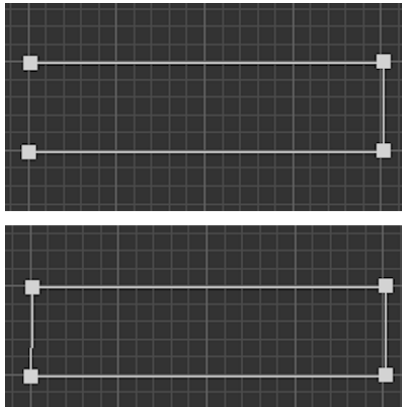
Fig. 174:   **Close open path**

3.4.23 Convert to flash

Converts a marked object into a flash.
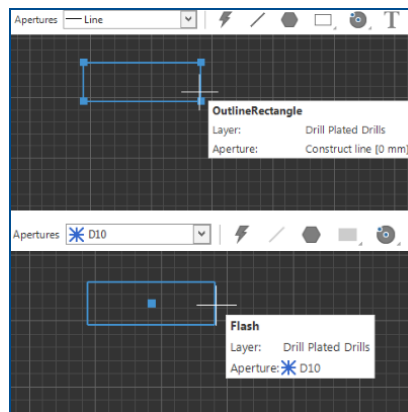
Fig. 175:   **Converting an object into a flash**

3.4.24 Combine to flash

Combines two or more marked objects to one flash.

Summary

Geometrical objects as well as flashes can be used. After combining the objects, an aperture based on the newly created flash is created.

The combined objects within the flash can only be moved together.
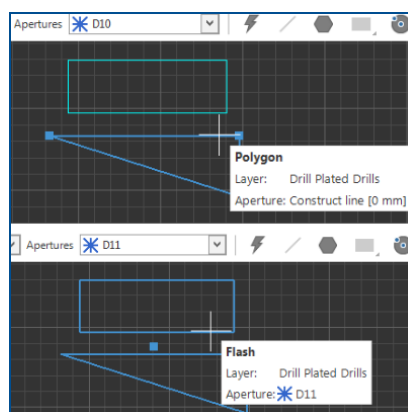
Fig. 176:   **Combining objects to flash**

3.4.25 Compare to flash

Compares the marked flash with objects on the same layer. Objects of the same shape are converted into a flash.

Summary

Smaller deviations of the object's size and angles can be adapted by entering tolerance values in the dialog.

3.4.26 Explode flash

Converts the flash into an object.

3.4.27 Group

Groups marked objects.

Summary

[Group] is only available if at least two objects are marked.
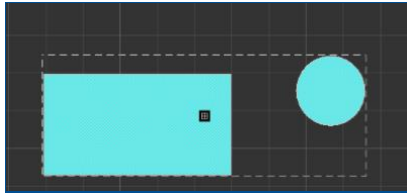
Fig. 177:   **Group objects**

3.4.28 Ungroup

Ungroups objects.

Summary

[Ungroup] is only available if grouped objects are marked exclusively.

3.4.29 Measure

Measures the distance, starting from the selected position.

Summary

The selected position is used as the initial point for measurement. As soon as you select another position, it is used as initial point for measurement.
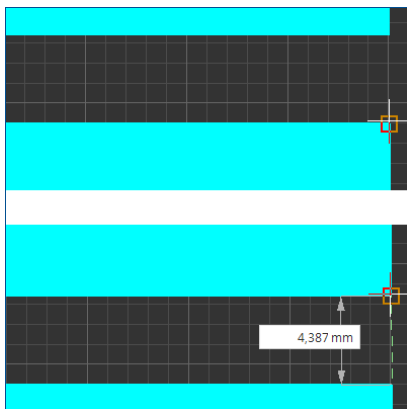
Fig. 178:   **Measure from point to point**

3.4.30 Design rule check

Opens the dialog *Design rule check*.

Summary

Use the Design rule check for checking if the PCB layout complies with the defined and recommended standards of the Design rule check.
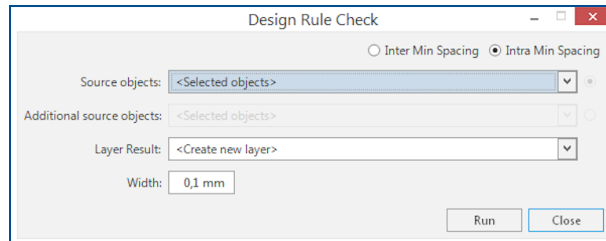
Fig. 179:   **Dialog *Design rule check***

The following can be checked with the *Design rule check*:

- Spacing of objects on different layers.
- Spacing of objects on the same layer.

3.4.31 Aperture list library…

Opens the dialog *Aperture list library*.

Summary

In the dialog *Aperture list library*, aperture lists can be copied, edited, deleted and imported.
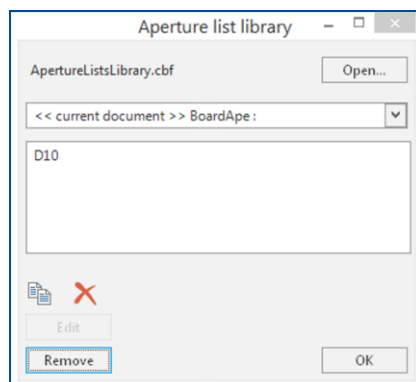
Fig. 180:   **Dialog *Aperture list library***

3.5   Menu *Toolpaths*

This menu contains settings for toolpaths.
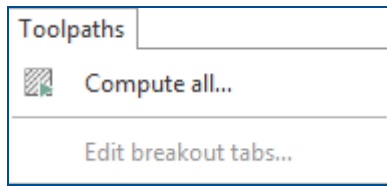
Fig. 181:   **Menu *Toolpaths***

The icons/functions of the menu *Toolpaths* are described in the following table:

Icon	Name	Description
	Compute all...	Computes the toolpaths based on the computed scan fields and work packages.
	Edit breakout tabs...	Edits the breakout tabs of the workpiece.

Table 59:   **Menu *Toolpaths***

3.5.1   Compute all…

Computes the toolpaths based on the computed scan fields and work packages.

3.5.2   Edit breakout tabs

Opens a dialog for editing the settings of the breakout tabs.

Summary

In the dialog *Edit breakout tabs position* the *Gap width* can be modified, the *Break position* can be changed by entering values for *x* and *y* , the breakout tabs can be deleted, and the breakout tabs can be created.

The dialog is structured as follows:
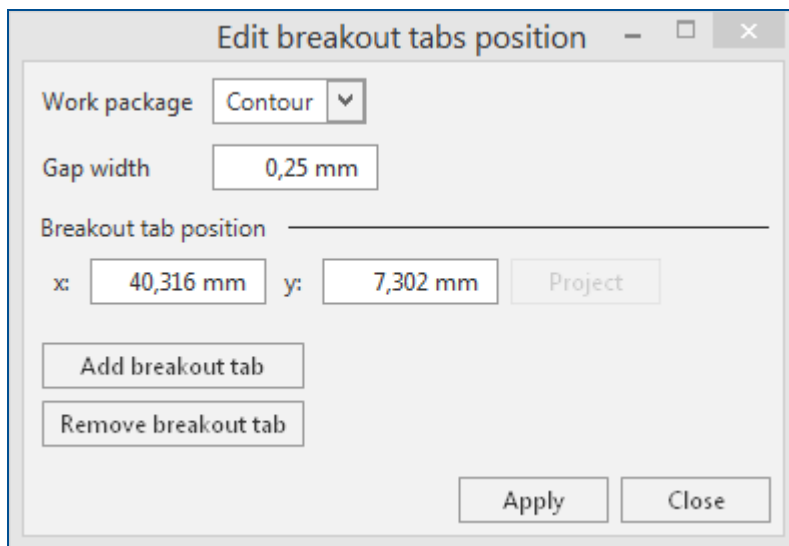
Fig. 182:   **Dialog *Edit breakout tabs position***

The following settings are available:

Function	Description
Work package	List for selecting a work package.
Gap width	Indicates the width of the breakout tabs.
Break tab position	Indicates the x and y position of the selected breakout tab.
Project	Indicates the projection of the breakout tab.
Add breakout tab	Adds a new breakout tab.
Remove breakout tab	Deletes the selected breakout tab.

Table 60: **Dialog *Edit breakout tabs position***

3.6   Menu *Processing*

This menu contains functions for processing the previously defined processing data.
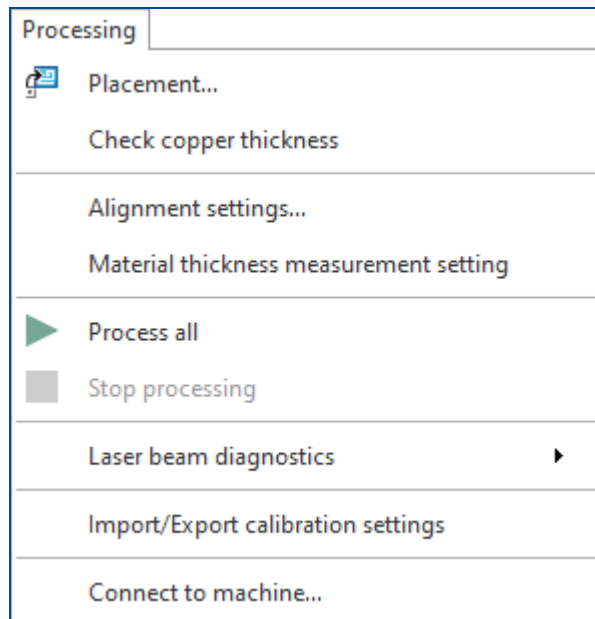
Fig. 183:   **Menu *Processing***

The entries of the menu *Processing* are described in the following table:

Icon	Name	Description
	Placement...	Opens a dialog for shifting the processing data.
	Check copper thickness	Opens a dialog for checking the copper thickness.
	Alignment settings…	Opens a dialog for configuring the fiducial search. While processing, these settings are used for the fiducial search.
	Material thickness measurement setting	Opens the dialog *Material thickness measurement settings* This dialog is only available if the connected machine allows a material thickness measurement.
	Process all	Starts the production of all processing data.
	Stop processing	Stops the production of the processing data.
	Power measurement	Opens the dialog *Power measurement*.
	Laser beam diagnostics	Opens the dialog *Laser diagnostics*.
	Import/Export calibration settings	Opens a dialog for importing and exporting calibration settings.
	Connect to machine…	Opens a dialog for connecting the system software to a real or simulated machine.

Table 61:   **Menu *Processing***

■ **Referencing the processing area**

After replacing or cleaning the sinter plate and after transporting the system, it is recommended to re-reference the processing area. This function is only available if the required sensor is present in the system.

1. In the menu *Processing*, click on *Material thickness measurement setting*.
2. Click on [Perform referencing] to start the procedure.
☐ The message *Thickness measurement running* is displayed.
3. Wait until the measurement is finished.

3.6.1 Placement...

Opens the dialog *Placement* for rotating and moving the processing data.

The dialog *Placement* allows correct placement of the material. Once the toolpaths and scan fields have been generated, the tab *Processing data* is also displayed.

Fig. 184: **Dialog** *Placement*

The button [Measure material thickness] starts the automatic measurement of the material thickness. This function is used for unconventional material thicknesses and is only available if the required sensor is present in the system.

The following functions are available in the tab *Material*:

Name	Description
Material	
Width	Specifies the width of the material.
Length	Specifies the length of the material.
Set default size	Resets the width and length to the initial value.
Material thickness	Specifies the material thickness.
Measure material thickness	Measures the thickness of the material. You can find more settings for the thickness measurement in the menu *Processing* under *Material thickness measurement setting*.

Table 62:   **Dialog *Placement* | Tab *Material***

Fig. 185:   **Dialog *Placement* | Tab *Processing data***

The following functions are available in the tab *Processing data*:

Name	Description
Center of processing data	Specifies the center of the processing data in x and y direction.
Angle	Rotates the processing data by a definable angle.
Use information layers	Takes the information layers into account when placing the processing data.
Center on material	Positions the processing data on the center of the material.
Processing head	
Center on data	Positions the processing head at the center over the machining data.
Show bounding box	Shows the bounding box of the processing data.

Table 63: **Dialog *Placement* | Tab *Processing data***

3.6.2   Check copper thickness

Opens a dialog for checking the copper thickness.

Summary

In the dialog *Copper thickness* the copper thickness required for the process can be checked and changed if necessary.
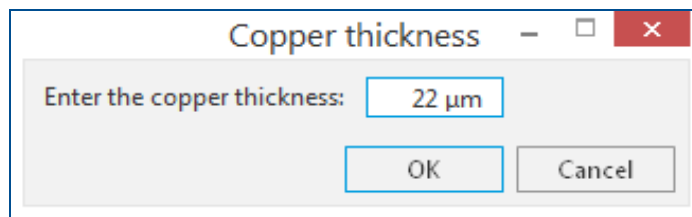
Fig. 186:   **Copper thickness**

You can create a work package of the type *Instruction* in the user guidance step *Workflow* containing the instruction *Check copper thickness* to open this dialog automatically during production.

3.6.3   Alignment settings

Opens a dialog for configuring the fiducial search.

Summary

In the dialog *Alignment settings* you can configure the fiducial search settings. While processing, these settings are used for the fiducial search.

You can adjust the search area, the fiducial criteria, and the alignment settings.
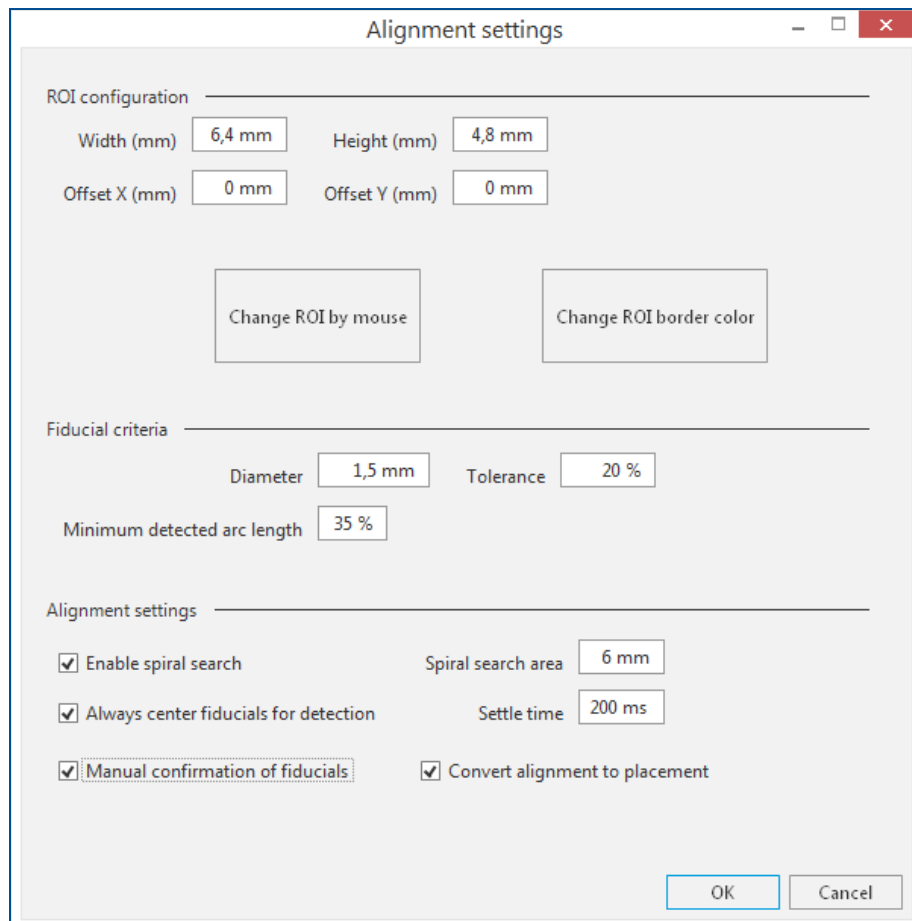
Fig. 187:   **Dialog *Alignment settings***

Name	Description
ROI configuration	
Width (mm)	The specified width is used for the search in the camera pane. If this value is decreased, measuring works faster. Large fiducials (larger than 1 mm) incur the risk of not being recognized.
Height (mm)	The specified height is used for the search in the camera pane. If this value is decreased, measuring works faster. Large fiducials (larger than 1 mm) incur the risk of not being recognized.
Offset X (mm)	Defines an offset in x direction.
Offset Y (mm)	Defines an offset in y direction.
Fiducial criteria	
Diameter	Displays the allowed diameter of the fiducial.

Name	Description
Tolerance	Indicates the allowed tolerance for the fiducial search.
Minimum detected arc length	Indicates the minimum allowed arc length for the fiducial search.
Alignment settings	
Enable spiral search	Activates the spiral search within the alignment settings.
Always center fiducials for detection	If this function is activated, the camera is positioned above the center of the fiducial.
Manual confirmation of fiducials	If this function is activated, the position has to be manually confirmed, after a fiducial is found.
Spiral search area	Determines the searching area for the spiral search.
Settle time	Determines how long the system should wait after a movement.
Convert alignment to placement	If this function is active, the alignment settings are also applied in the dialog *Placement*.

Table 64: **Dialog *Alignment settings***

3.6.4   Material thickness measurement settings

The dialog *Material thickness measurement settings* contains functions for measuring the material thickness and for defining the processing area.

Fig. 188:   **Dialog Material thickness measurement settings**

Button/Element	Description
Perform thickness measurement during process	Activates the material thickness measurement during production. The material thickness measurement is started by a work package of the type *Instruction*. The option **Material placement** must be selected here as instruction.
Material thickness tolerance	Specifies the permissible measurement deviation from the specified material thickness. The lower the tolerance, the longer the process time.
Min hole distance	Specifies the minimum hole spacing of the printed circuit board. This ensures that the material thickness measurement does not take place in a hole or other depression of the material.
Measurement strategy	Sets the measurement strategy. **Measure three points:** A total of three points are measured **Measure five points:** A total of five points are measured

Button/Element	Description
	Measure one point per scan field: Each scan field is measured separately with one point at a time.
Referencing	
Left rear	x, y, and z coordinates of the material at the left rear corner.
Right rear	x, y, and z coordinates of the material at the rear right corner.
Center	x, y, and z coordinates of the material at the center.
Front left	x, y, and z coordinates of the material at the front left corner.
Front right	x, y, and z coordinates of the material at the front right corner.
Material thickness	Specifies the material thickness. If a material template is used in the user guide step *Material*, the value of the material thickness is automatically entered.
Perform referencing	Starts the referencing of the processing area taking into account the selected measuring strategy. Referencing should always be carried out after cleaning or replacing the sinter plate and after transport to ensure the highest possible precision of the system.

Table 65: **Functions in the dialog *Material thickness measurement settings***

3.6.5   Process all

Starts the production of all processing data.

3.6.6   Stop processing

Stops the current production.

3.6.7   Power measurement

Opens the dialog *Power measurement*.

Summary

The laser power of the system can be measured here.
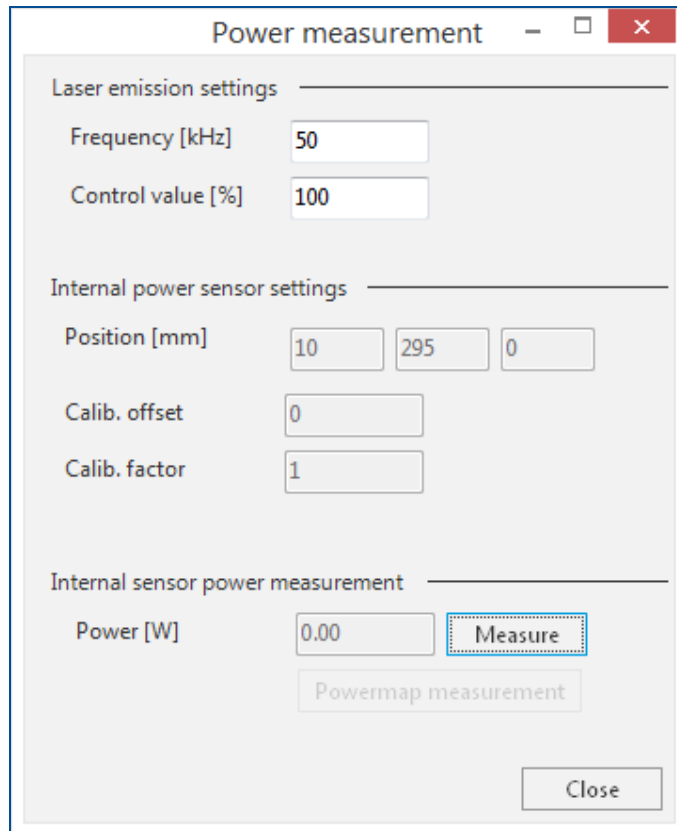
Fig. 189:   **Dialog *Power measurement***

Name	Description
Laser emission settings	
Frequency [kHz]	Defines the frequency for operating the laser.
Control value [%]	Defines the control value for operating the laser.
Internal power sensor settings	
Position [mm]	Displays the position of the laser power sensor.
Calib. offset	Displays the calibration offset of the laser power measurement.
Calib. factor	Displays the calibration factor of the laser power measurement.
Internal sensor power measurement	
Power [W]	Click on [Measure] to display the laser power measured by the laser power sensor.
Powermap measurement	Starts the power measurement for creating a powermap.

Table 66:   **Dialog *Power measurement***

3.6.8 Laser beam diagnostics

Opens the dialog *Laser diagnostics*.

Summary

You can diagnose the laser beam here which includes a focus measurement and determining the optimum cutting speed.
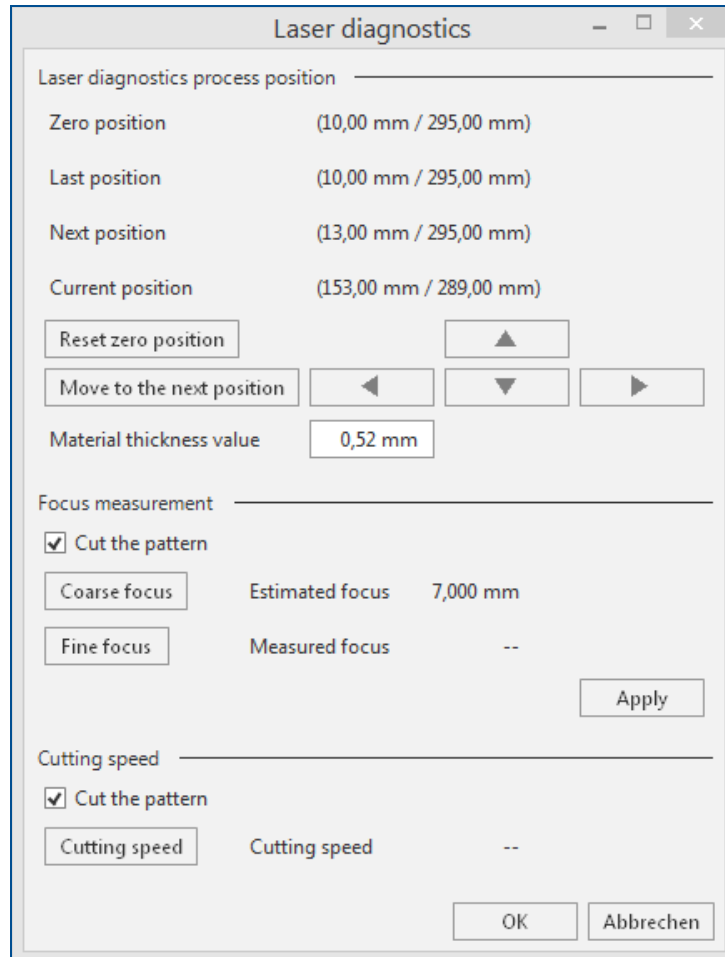
Fig. 190:   **Dialog *Laser diagnostics***

The following settings are available:

Button	Description
Laser diagnostics process position	
Reset zero position	Defines the current position as the zero position.
Move to the next position	Moves to the next position.
▲ ◄ ▼ ►	Moves the processing head to the next/previous position.
Material thickness value	Specifies the offset between the laser sensor and the processing table. This value has been set correctly already on delivery of the system.
Focus measurement	
Cut the pattern	Activated: A test pattern is cut during focus measurement. This is necessary for the first focus measurement.

Button	Description
	Deactivated: The focus is measured with a test pattern that was cut previously.
Coarse focus	Starts the coarse focus measurement. This requires that a test pattern is cut first that is evaluated with the vision system. The measured value is displayed in *Measured focus*.
Fine focus	Starts the fine focus measurement. This requires that a test pattern is cut first that is evaluated with the vision system. The measured value is displayed in *Measured focus*.
Astigmatism	Indicates the ratio between the x focus level and y focus level of the laser beam. An astigmatism of ≥ 0.2 mm indicates a technical problem with the system.
Apply	Applies the focus values determined with [Coarse focus] and [Fine focus].
Cutting speed	
Cut the pattern	Activated: A test pattern is cut when determining the cutting speed. This is necessary when determining the cutting speed for the first time. Deactivated: The cutting speed is determined with a test pattern that was cut previously.
Cutting speed	Determines the optimum cutting speed.

Table 67:   **Buttons and functions in the dialog *Laser diagnostics***

3.6.9   Import/Export calibration settings

Opens a dialog for importing and exporting calibration settings.

Summary

Click on/Tap on [Import] to select a file from the file system to import calibration settings.

Click on/Tap on [Export] to save the active calibration settings in the file system.
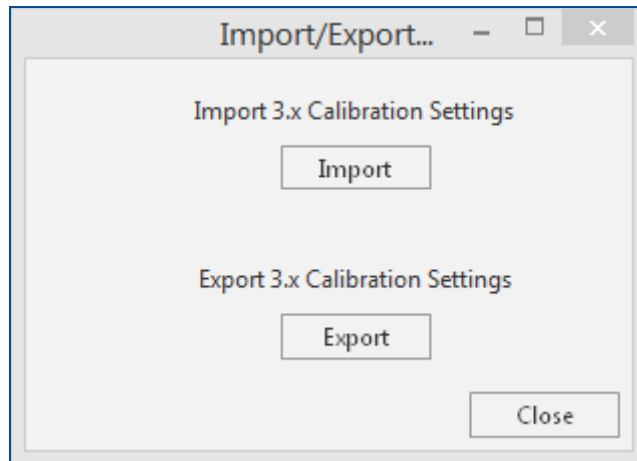
Fig. 191:   **Dialog *Import/Export calibration settings***

3.6.10 Connect to machine…

Opens a dialog where you can connect the system software to a real or simulated machine.

Summary

Select an appropriate machine from the list for connecting.

You can also simulate a virtual machine without having a real machine connected.

The dialog *Connect* is displayed when the connection between the software and the system is established. The COM interfaces of the individual system components are automatically scanned and connected when the connection is established. Select a component from the list to display further information. You can start a new scan of the COM interfaces by clicking on [Search components]. Clicking on [Create report] creates a folder at
`C:\ProgramData\LPKF Laser & Electronics\LPKF CircuitPro PL 3.5 \Config\Reports` containing error details.
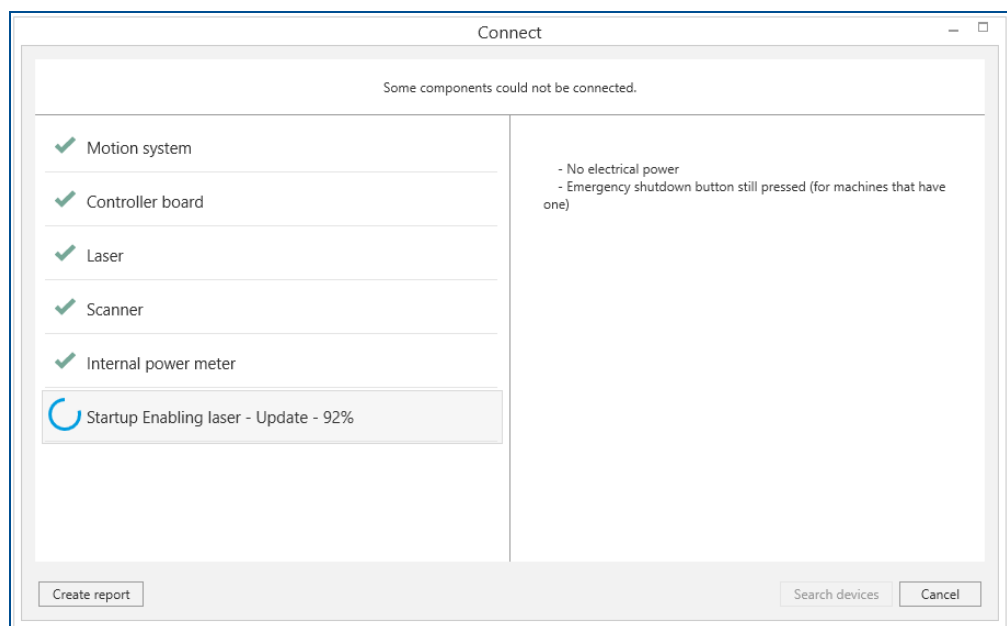
Fig. 192:   **Automatic connection of the COM interfaces**

3.7 Menu *Service*

This menu contains password-protected menu items that are only available for the LPKF Service.

Use the menu item *Send support information* to send an email with support information to the LPKF Service.
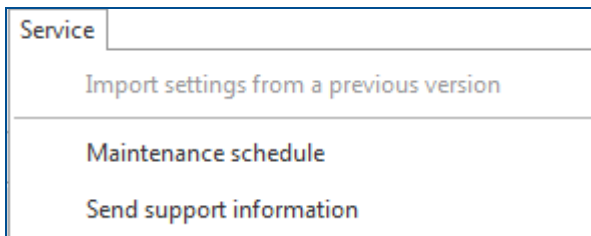
Fig. 193: **Menu *Service***

The entries of the menu *Service* are described in the following table:

Name	Description
Import settings from a previous version	Opens as dialog for importing settings from an old CircuitPro installation.
Maintenance schedule	Opens a PDF file with maintenance steps to be performed on a regular basis.
Send support information	Sends an email with support information to the LPKF Service.

Table 68: **Menu *Service***

3.7.1 Import settings from a previous version

The menu item *Import settings from a previous version* allows you to import settings from previous CircuitPro versions and CircuitMaster versions. You can import settings from older CircuitPro PL versions automatically or select a folder of the file system manually. This function can only be used if no machine is connected. So disconnect the machine beforehand, if necessary (see Connect to machine…).

Importing powermaps from *CircuitMaster 1.10* can cause errors if the Microsoft ACE drivers (Access Database Engine) are not installed on the system.

In case of errors, proceed as follows:

■ **Troubleshooting powermap import errors**

1. Navigate to the program folder of CircuitPro PL (`C:\Program Files\LPKF Laser Electronics AG\LPKF CircuitPro PL [version number]\Support Files\Runtime\AccessEngine`).

2. Right-click on the application `AccessDatabaseEngine_X64.exe` and create a link.

3. Right-click on the newly created link and click on *Properties*.

4. In the tab *Link*, add the parameter **/quiet** in the line *Target*.

5. Start the link.

6. Once the installation has finished, retry importing the powermap.

☑ Troubleshooting of powermap import errors is finished.

3.7.2   Maintenance schedule

Displays the maintenance schedule of the system.

3.7.3   Send support information

Sends support information to the LPKF Service

4   How to work with the software

The following pages provide information on the typical production process of the system and the software.

4.1   Typical production process

This chapter describes a typical production process.

The following tasks are executed:

- Starting the system software
- Selecting a template
- Selecting a material
- Connecting the system software
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- Closing the system software

■ **Starting the system software**

1. Double-click on the desktop icon of *CircuitPro PL*.
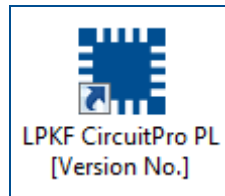
Fig. 194:   **Desktop icon** *CircuitPro PL*

2. Wait while the system connection is established.
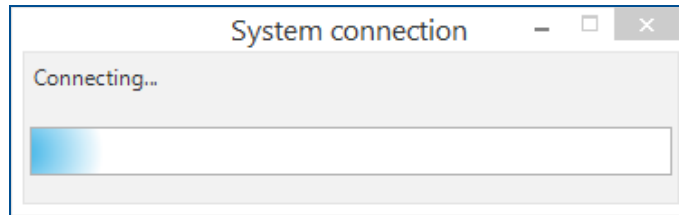
Fig. 195:   **Message** *System connection*

3. The system software automatically detects the connected system and establishes a connection. The following dialog is displayed:
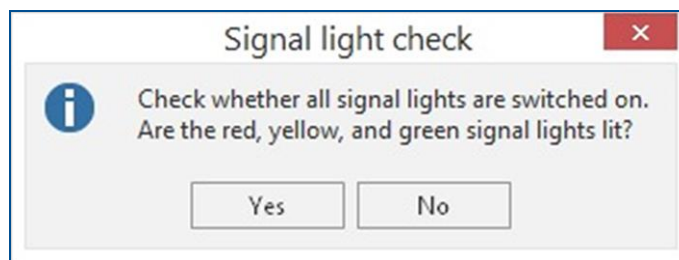
Fig. 196:   **Dialog** *Signal light check*

4. If all specified lamps of the stack light are lit, click on [Yes].

☐   The user interface of the system software is displayed:
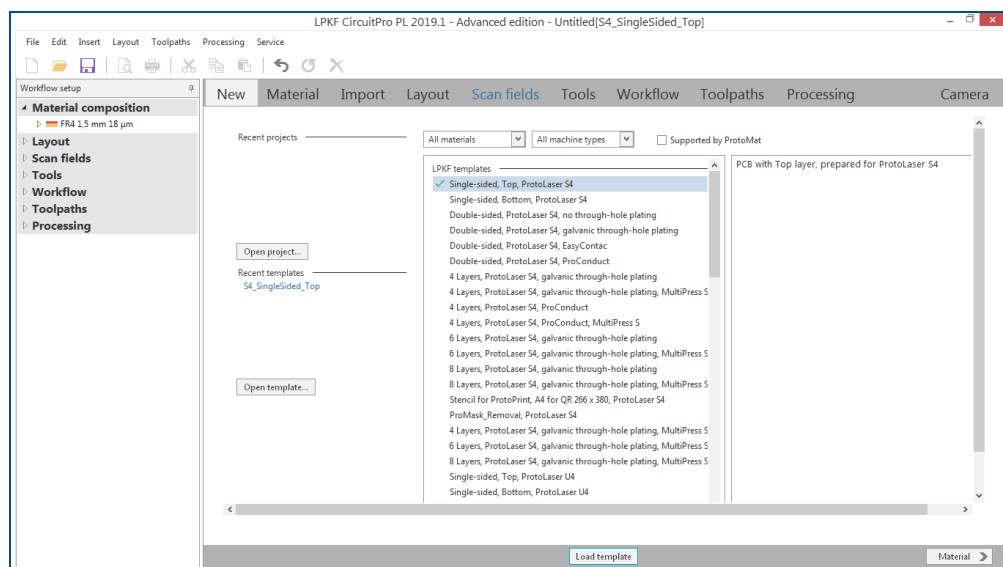
Fig. 197:   **User interface** *CircuitPro PL*

☑ The system software has been started.

Connecting the system manually

If the connection to the system fails, you can manually connect the system to the system software.

1. Click on *Processing > Connect to machine…*
2. Select your system from the drop-down list.
3. Click on [Connect].

The system requires a warm-up time of approx. **20** minutes for the laser source to attain a constant diode temperature. The warm-up phase starts automatically with the processing of the first job.
Alternatively, you can start the warm-up phase manually. In the *Processing* view,

click on ✳ .

◼ Selecting a template

1. Select the suitable template for your project.

   You can filter the templates by machine type and PCB type (single-sided, double-sided and multi layer) to determine a suitable template.

2. Click on [Load template].
☐ The system software navigates to the user guidance step *Material*.
☑ The template has been selected.

■ **Selecting a material**

1. In the user guidance step *Material* click on a material template or define a new material.
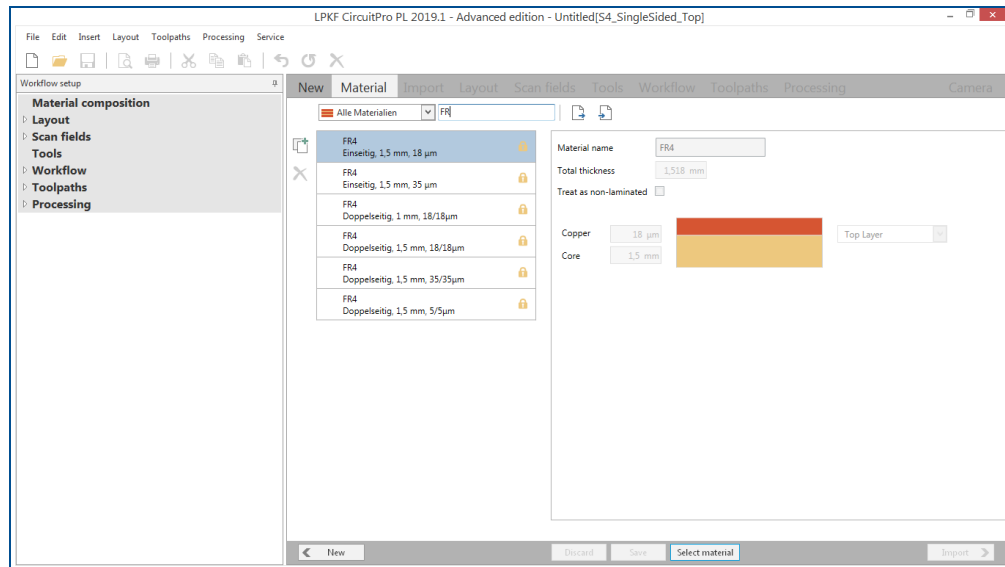
Fig. 198:   **User guidance step *Material***

2. If necessary, make changes to the material settings.

3. Click on [Select material] to confirm the selected material.

☑ The material has been selected.

💡 **Selecting a material type**

When selecting the *Material*, you also select the tool library with the laser parameters specific to the material.

■ **Connecting the system software**

1. Click on/Tap on *Processing > Connect to machine…*

☐ The following dialog is displayed:
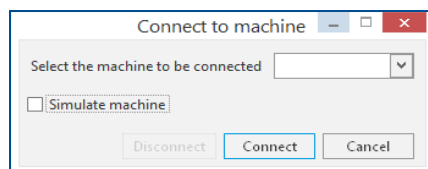
Fig. 199:   **Dialog *Connect to machine***

2. Select your system in the drop-down list.

3. Click on/Tap on [Connect].

4. Wait until the process is completed.

☑ The system software has been connected.

> Once connected, you can set the options in *Machine* that the software shall connect automatically. Activate the check box *Simulate machine* to simulate the complete workflow. You can use this mode to create projects or to practice using the software without connection to a machine.

▪ Importing data

1. Open the user guidance step *Import*.
2. Click on ⬚.
3. Select the files to be imported.
4. Click on [Open].
   ☐ The following contents are displayed, according to your imported file.
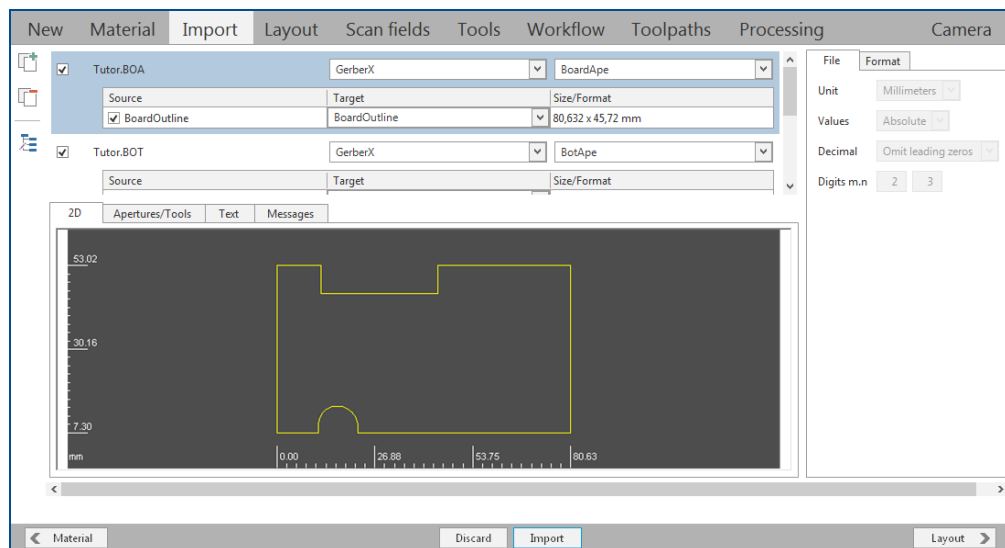
Fig. 200:   **User guidance step *Import***

   ☐ The tab *2D* displays the preview of the imported data.
      You can assign an existing project layer to the layers of the file in *Target*.
5. Click on [Import].
   ☑ The data have been imported.

■ **Assigning a technology to a layer**

1. Right-click on a layer in the pane *Workflow setup*.
☐ The following context menu is displayed:

Color...	
✓ Visible	
✓ Selectable	
PCB layer ▶	
▦ Display mode ▶	
Technology ▶	✓ Mechanical
Inverse	Fiducials
Rename	Drilling
✕ Delete	Cutting
	Wiring
	Rubout
	Solder mask
	Solder paste
	Silk screen
	Topography
	Information
	Unknown
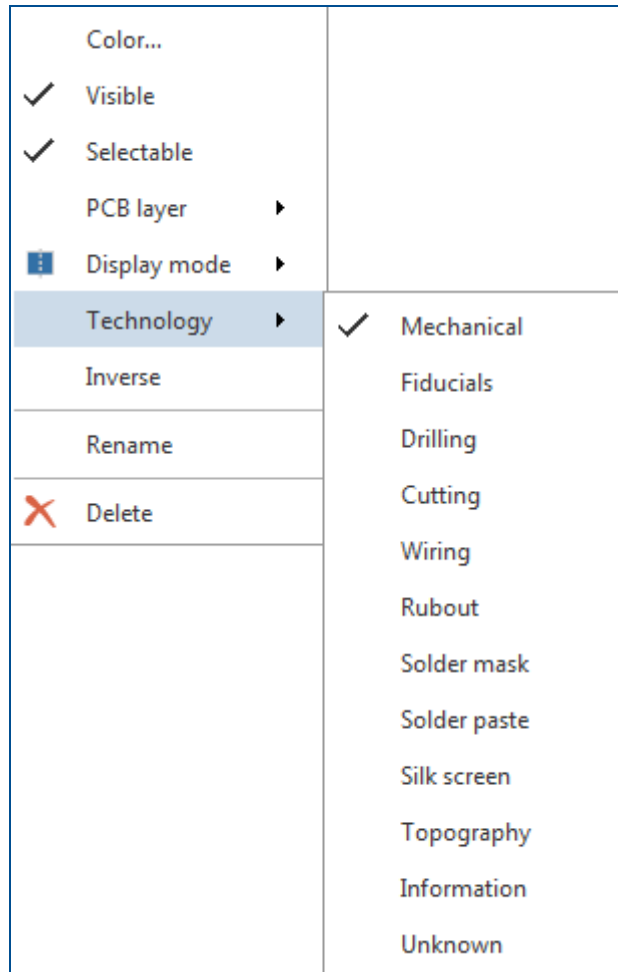
Fig. 201: **Context menu *Layer***

2. In the menu item *Technology*, click on an entry.
☑ The technology has been assigned to the layer.

ℹ The assigned technology determines to which work package a layer can be assigned to and also which scan fields and tools are used.

■ **Multiplying the layout with *Step and Repeat***

1. Select the object to be multiplied.
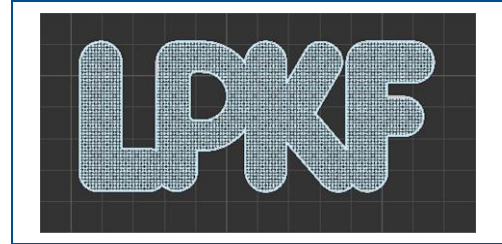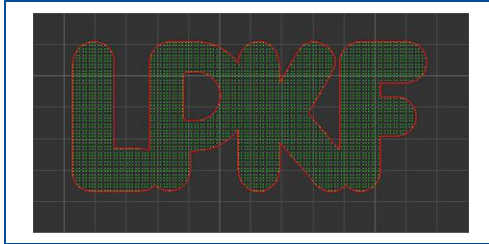
Fig. 202:   **Selecting the object**

2. Right-click on any position inside the user guidance step *Layout*.
☐   The context menu is displayed.
3. Click on/Tap on *Step and Repeat*.
☐   The following dialog is displayed:
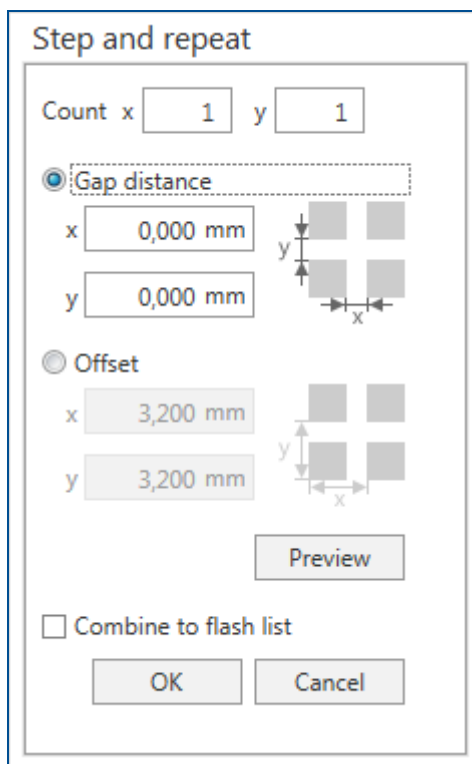
Fig. 203:   **Dialog *Step and Repeat***

4. In the fields *x* and *y* in *Count* enter the count for the multiplications of the selected object.

5. In the fields *x* and *y* in *Distance* enter the distance between the center points of the objects to be created.

ℹ The preset distance is defined by the height and width of the selected object. Using unchanged settings, the new objects are created side by side without a gap. Increase the value in the fields *x* and *y* to generate a gap between the created objects.

6. Click on/Tap on [OK].

☐ The selected object is multiplied.
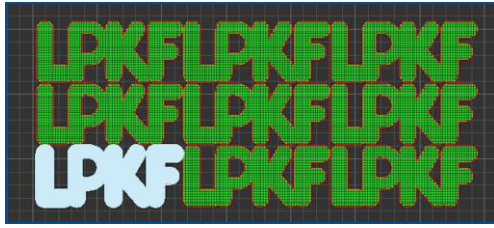
Fig. 204: **Multiplied object**

☑ The layout has been multiplied with *Step and Repeat*.

■ **Creating the fiducial manually**

1. Navigate to the user guidance step *Layout*.

2. Click on *Insert > Fiducial*.

☐ The mouse cursor is displayed as crosshairs.

3. Click on the position in the layout where the fiducial is to be inserted.

4. Enter an x and y value for positioning the fiducial.

5. Right-click in the layout to open the context menu.

6. In the context menu click on *Cancel* after all fiducials have been set in the layout.

☐ In the pane *Workflow setup* in the area *Layout > Fiducials* the fiducial is displayed and assigned to the layer *Fiducial*.

☑ The fiducial has been created manually.

💡 **Scan field sets**

Scan field sets define which positions of the material are processed in which order. They can be defined for one or more layers and are combined in work packages with the corresponding tools.
The individual scan fields are combined to scan field sets, the numbering indicates the direction of the processing head's movement. This order can be adapted automatically or manually in order to configure the production as efficient as possible.

■ **Creating a scan field set**

1. Open the user guidance step *Scan fields*.

2. Click on/Tap on 🔳.

3. Enter the name for the scan field set.

4. Activate the check boxes of the desired layers.
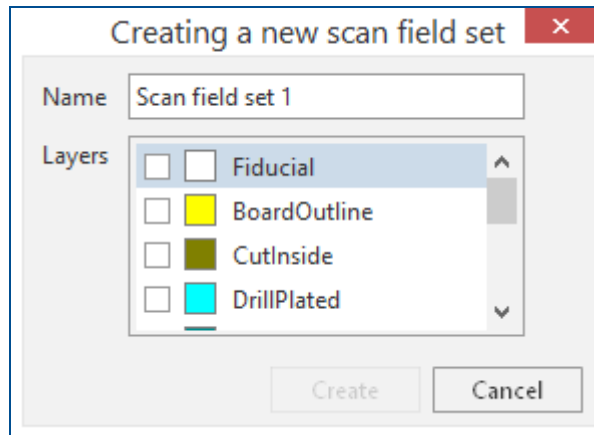
Fig. 205:   **Dialog *Creating a new scan field set***

5. Click on/Tap on [Create].

☑ The scan field set has been created.

■ **Computing scan fields automatically**

1. Open in the pane *Workflow setup* the context menu with a right-click on *Scan fields*.

2. Select a scan field set in the drop-down list *Scan field set*, if necessary.

3. Click on ▪ *Compute*.

☐ The following dialog is displayed:
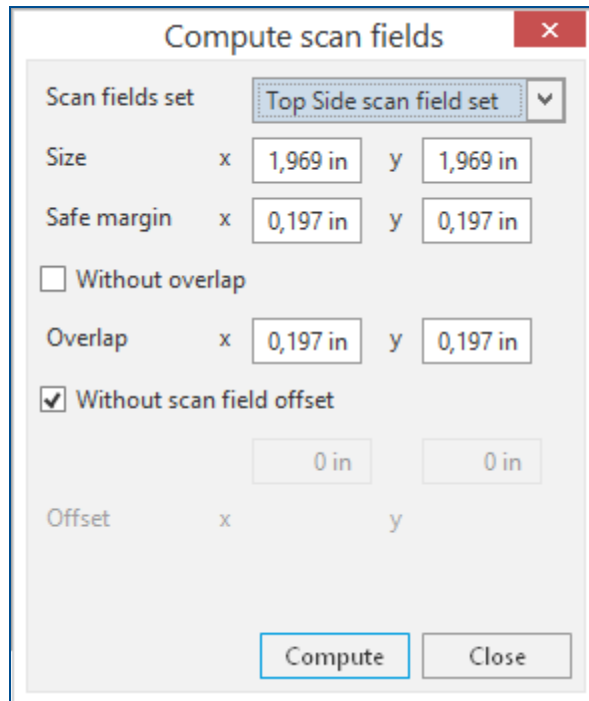
Fig. 206:   **Dialog *Compute scan fields***

4. Enter the parameters:

Name	Description
Scan field set	Specifies the name of the scan field to be computed.
Size	Defines the size of the computed scan fields.
Safe margin	Defines a margin between the data inside the scan field and the edge of the scan field. If the value is *0* the data can be placed right to the edge of the scan field.
Without overlap	Deactivates the overlap of scan fields in x and/or y direction.
Overlap	Defines how far the scan fields overlap each other.
Without scan field offset	Specifies the isolation distance between the scan fields.
Offset	Specifies the offset between the scan fields.

Table 69:   **Dialog *Compute scan fields***

5. Click on [Compute].

☑ The scan fields have been computed automatically.

ℹ After creating the scan fields, you can sort the order automatically or manually which changes the processing order.

The preset tools are suited for processing sample files. You should use new tools with optimized parameters for your own data.

In the user guidance step *Tools*, you can create new tools or tasks and edit existing tools or tasks. The tasks and their parameters define the laser settings that are used for processing the material.

■ Editing tools and tasks

1. Open the user guidance step *Tools*.
2. Select a task or create a new task.
3. Set the parameters of the task.

   Click on ⊞ to create more tasks.

   Click on ⧉ to copy a task.
4. Once the parameters are correctly set, click on [Apply].

☑ The tools and tasks have been edited.

Work packages

The work packages combine various information such as layers, tools, scan fields, and technology and enable computing the toolpaths.
There are predefined work packages that already use the existing layers, tools and scan fields. If you are using customized data for your own layout, you should edit the work packages or create new ones.

■ Editing a work package

1. Open the user guidance step *Workflow*.
2. Click on a work package.

Fig. 207:   **Area *Work package options***

3. Select the type.

The selected type defines which layers can be processed in this work package and which tools may be used. A package of the type *Drilling* can only process layers of the technology *Drilling*.

4. Select the layers to be processed.

   Some types do not require assigned layers.

5. Select a tool.

   Some types do not require assigned tools.

   Only tools that are suited for the selected type are displayed.

6. Select a scan field set.

   Some types do not require an assigned scan field set.

7. Click on [Apply].

☑ The work package has been edited.

ℹ️ You can create new work packages by clicking on ⬜. After that, you can change the options of the new work packages.

ℹ️ LPKF recommends to use at least two fiducials to be able to determine exactly the position and rotation of the PCB.

■ **Setting the dynamic alignment**

1. Click on/Tap on the user guidance step *Workflow*.

2. Click on/Tap on a work package of the type *Read fiducials*.

☐ The following dialog is displayed:

Fig. 208:   **Function *Dynamic alignment***

3. In the fields of the area *Dynamic alignment* select your fiducials.

4. Depending on the number of fiducials, different adjustment options are available.

ℹ️ LPKF recommends to use at least two fiducials to be able to determine exactly the position and rotation of the PCB.

5. Click on/Tap on [Save].

☑ The function *Dynamic alignment* has been set.

■ **Computing toolpaths**

1. Click on *Toolpaths > Compute all…* or in the user guidance step *Toolpaths* on ⬚.

Toolpaths
▨ Compute all…
   Edit breakout tabs…
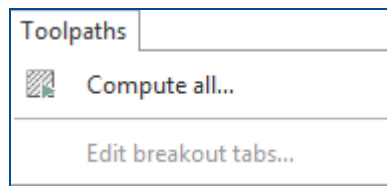
Fig. 209:   **Menu** *Toolpaths*

☐   The toolpaths are computed.

2. Wait until computing is finished.

Toolpaths calculation   – ▢ ×

Calculation of toolpaths is in progress. Please wait…
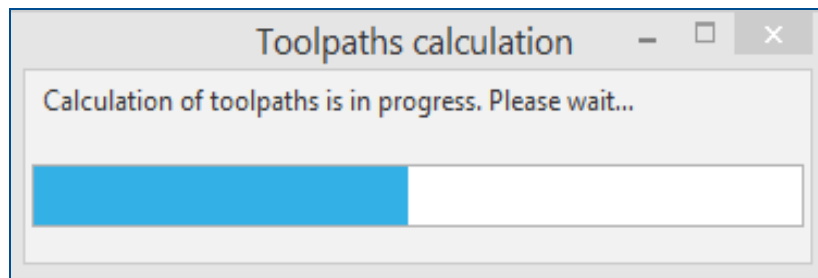
Fig. 210:   **Message** *Computing toolpaths*

☐   A message displays the computation results.

3. Click on [Close].

☑ The toolpaths have been computed.

ⓘ   You can have the toolpaths displayed by clicking in the user guidance step *Toolpaths* on ⁘ .

■ **Saving the project**

1. Click on *File > Save as...*
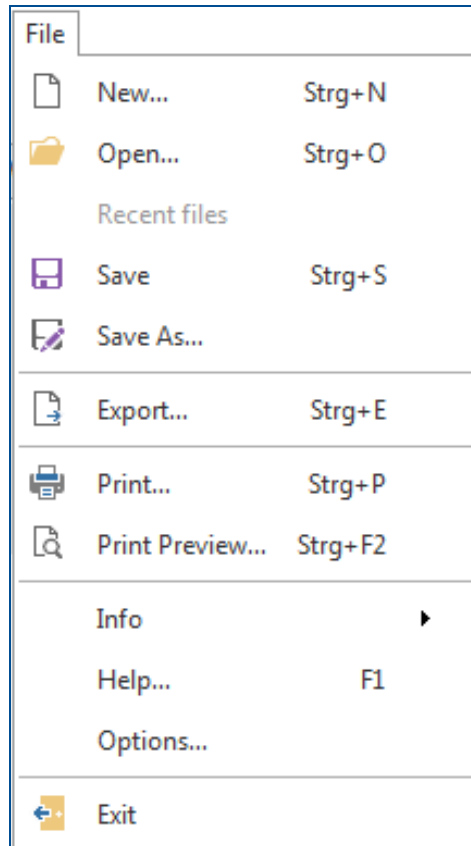
Fig. 211: **Menu *File***

2. Select the location and the file name for the project.
3. Click on [Save].

☑ The project has been saved.

> ℹ The system requires a warm-up time of approx. 20 minutes for the laser source to attain a constant diode temperature. The warm-up phase starts automatically with the processing of the first job. As an alternative, the warm-up phase can be previously activated via a function in the menu *Processing*.

■ **Starting the production**

1. Click on *Processing > Process all* or in the user guidance step *Processing* on ▶.
2. Follow the instructions on your screen.

☑ The production has been started.

■ **Stopping processing (optional)**

▶ Click on/Tap on *Production > Stopping processing* or click in the user guidance step *Processing* on ■ .

☑ Processing has been stopped.

■ **Closing the system software**

1. In the menu *File* click/tap on *Close*.

2. The following message is displayed:
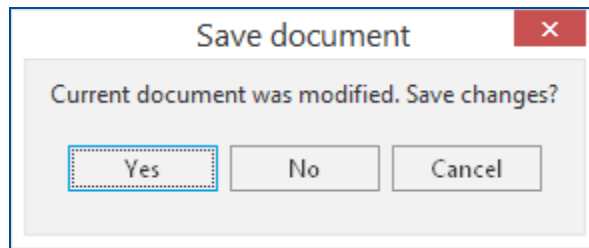
Fig. 212: **Dialog *Save document***

3. Select one of the following options:

   [Yes] to save all changes in the document.

   [No] to discard all changes since the last save.

   [Cancel] to continue using the system software.

☑ The system software has been closed.

■ **Closing the system software**

1. In the menu *File* click/tap on *Close*.

5   Appendix

This chapter contains navigation elements of the document.

5.1   List of figures

5.2   List of tables