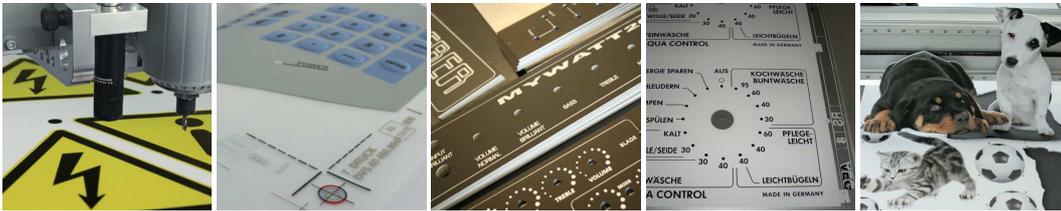


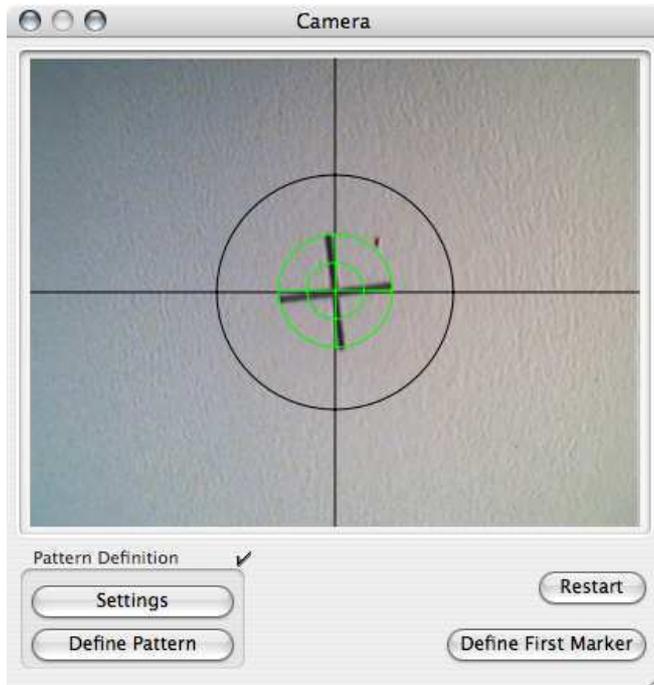
2.5 Camera-Gauging



This feature allows the recognition of position, orientation, and distortion of a working piece by using a camera mounted on the machine.

The parts to be processed are placed approximately on the machine table. Now the camera-image can be analyzed to obtain the exact position, rotation, and deformation, relative to the constructed (original) graphics. During output, the graphics will be transformed, so that it fits the working piece.

Possible applications are, cutting of Large Scale Prints in the Sign Making industry, or the processing of Screen-Printed front panels or keyboards. Whenever multiple working-steps need to be combined (ex: Printing -> Cutting, Laminating -> Milling, Drilling, etc.), the camera function can be applied.



The bridging elements between Graphics and Working-Piece are Reference-Markers printed on the graphics (or corners of the material). In Cenon, the Reference Markers are placed as Markings on a dedicated layer.

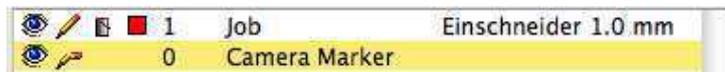
The application is very easy using three buttons only:

1. Define Pattern (of markers)
2. Move first marker into camera-view
3. Start Output

To activate the camera function in Cenon, you have to enter the appropriate Key into the Licensing-Panel of Cenon (see section 1.6). Additionally, a camera has to be connected. Both is available from vhf.

2.5.1 Preparing the Project - building the bridge

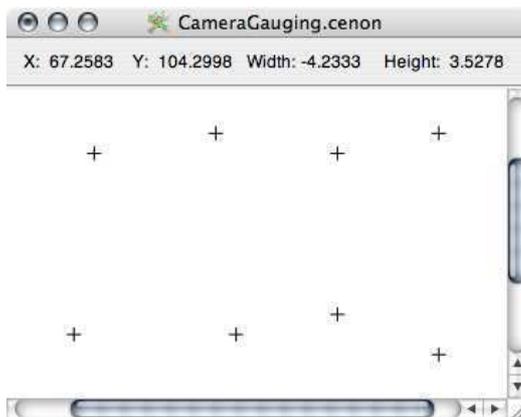
The primary step to prepare a Camera-Project is to add a layer with the Reference Markers. This layer will be the bridge connecting the target graphics and the working piece on the machine. So first, create a new layer (see section 3.4.1).



Then go to the Layer-Details (Kapitel 3.4.2) of the CAM-Panel, and change the Type of the layer to "Camera Layer".



On the Camera Layer, you have to place Markers at the target positions (fitting the original Graphics on the other layer). These Reference Markers have to be present in some way (Crosses, Circles, ...) on the working pieces, also. Usually they are just printed or screen-printed with the first step of manufacturing. At least 3 markers are needed.



In Cenon, you will either place a Mark (see Cenon User's Guide, Markings) for each

of the Reference Markers, or another element like a cross (two crossed lines), a circle, a path, etc. The center of each marking object will be used as Target-Position. These marking objects can easily be extracted from an imported graphics, for example using the "Move to Layer" functionality.

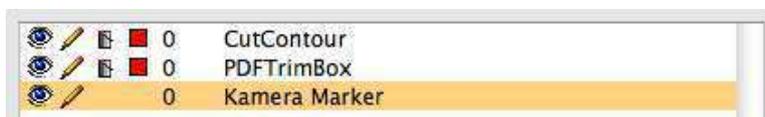
You don't have to place the markings as wild as in our example, which is demonstrating the flexibility. Generally the best advice is to keep things simple and arranged.

For Batch Production it is sufficient to set the markings for the first piece of the batch. All other pieces can be processed automatically.

2.5.2 Import of Cut-Files

Cenon is able to import cut data from RIP processors in various formats, for example SVG or i-Cut.

The i-Cut format can contain all needed layers. If it does, Cenon will create all needed layers.



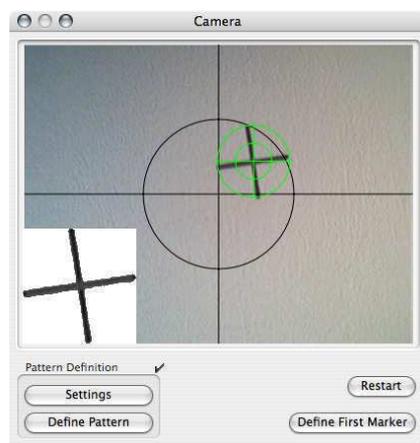
2.5.3 Action

The entire Output, is based on three buttons only: "Define Pattern", "Define First Point", "Start".

After opening a Camera-Project or creating the Camera-Layer, the Camera-Panel will open and displays the view of the connected camera.

1. Define Pattern

Now, you have to move one (usually the first) marker of the working piece into the camera view. To do this, use the Arrow-Buttons for X and Y in the Control-Panel (see section 3.4.5).



To avoid unnecessary distortion by the camera optics, the Reference Marker should be moved into the circle of the crosshairs.

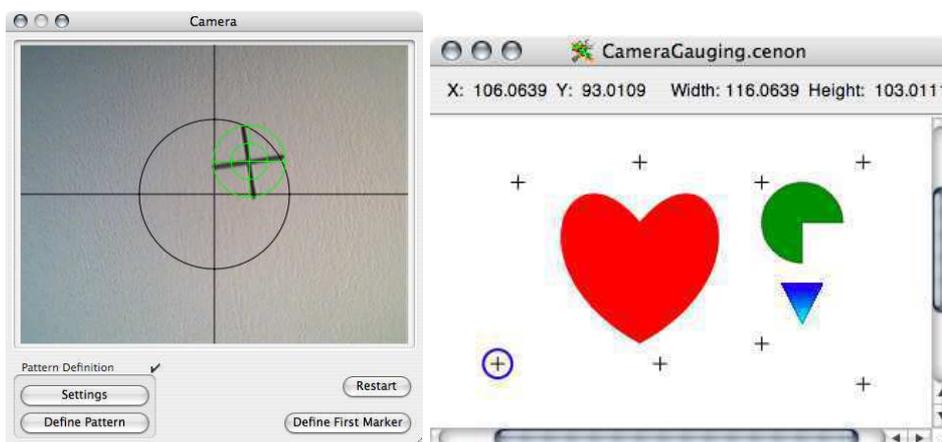
After the Reference-Marker is recognized and its position and size is marked correctly and stable by a green circle, you can press the "Define Pattern". The pattern of the Reference-Markers is now defined and will later be used to recognize the other Reference-Markers.

The small image in the lower left corner of the camera view displays the pattern recognized, and is a help to decide for the correct recognition of the pattern. The small image will disappear after this step. Before pressing the "Define Pattern" button, make sure that the small image appears massive and stable.

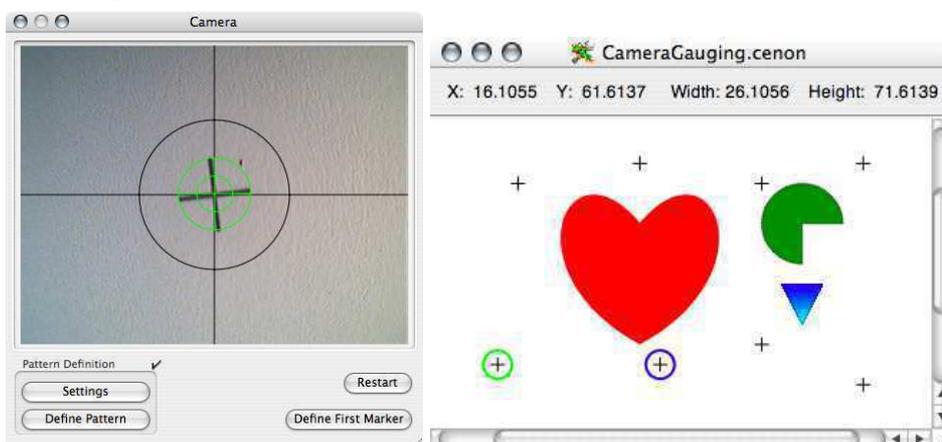
This step of the pattern definition may be omitted, once the pattern is defined. The defined pattern will be saved with the document and stays defined for later use. It may still be necessary to redefine the pattern, if the light has changed.

2. Move first marker into view (Reference-Point) / Start Camera-Drive

If not already done in step one, move the first marker into the circle of the camera view. The first marker is emphasized by a blue circle in the Graphics Window - it is the one closest to the Document-Crosshairs.



When the first marker is completely inside the view and marked by the green crosshairs, you can press "Define First Marker"



By pressing the button, the first marker is defined and is automatically moved into the center of the camera view. Immediately after centering the first marker, the Camera-

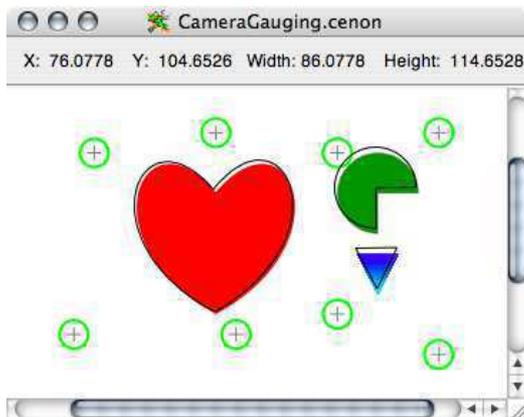
Drive starts to collect all the other markers.

While moving the marker being approached next, is emphasized by a blue circle. If recognized the circle changes to green, and in case it is not found, it will be marked red.

Blue Circle The Reference-Marker is being approached

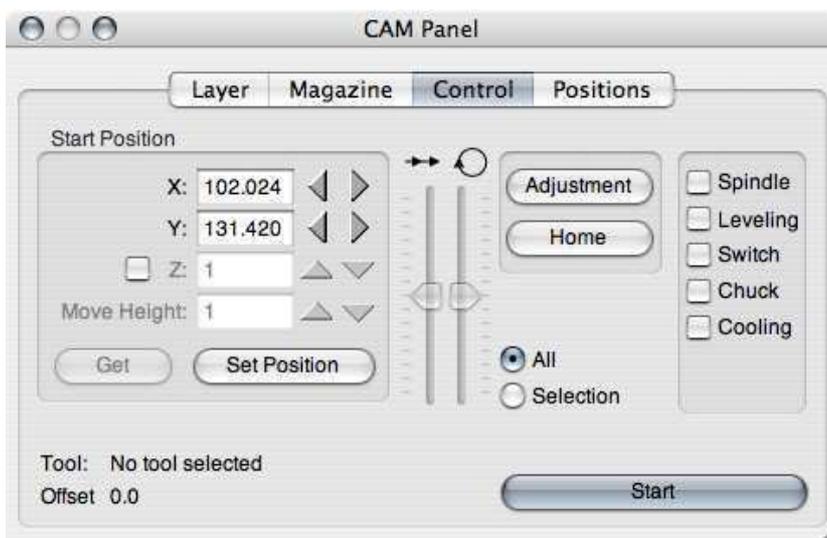
Green Circle The Reference-Marker has been successfully recognized

Red Circle The Reference-Marker has not been found and will be omitted



All reference markers have been recognized successfully. The output paths (enable the switch in the Layer-Panel) are transformed to fit the working piece placed on the machine. In the next step you will start the output.

3. Start Output



In the Control-Panel, you can start the output as usual by pressing the Start button. The start position has been set automatically to the First Marker (when centering the first marker). The crosshairs in the document window have no meaning for output with the camera.

A click with the mouse on "Set Position", will bring the camera (machine) back to the position of the Reference-Marker.

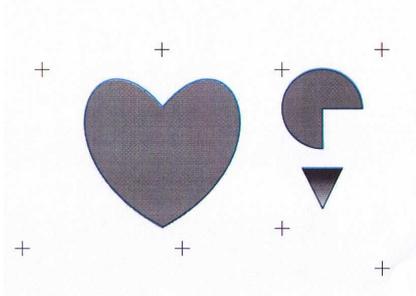


Image: our simple example was printed on a Laser-Printer, then the contour has been drawn by a pen-plotter

2.5.4 Other Applications

Corner-Recognition

This mode can be used for fast cutting of rectangular parts, recognizing corner marks (crop marks) to obtain the shape.

To apply the Corner recognition, follow these steps:

1. In your Cenon-Project, place a Marker for each Corner Point on the Camera-Layer. For a batch of Objects, you only have to place the markers for the first object of your batch. The first object is the one at the lower/left position.
2. For batch production generate the other markings using the batch-function (see the Cenon User's Guide "Batch Production") of Cenon. Use the button "Set" to define your batch.
3. Position the machine to the lower/left Corner of your Material and define the pattern of this corner.

The recognized markers will be turned into a Path in Cenon, located on a dedicated output-layer. Cenon will create this layer if needed.

- If the corner markings on the material are true "Corners" that are not tolerant to rotation, then exactly 4 corners have to exist. Here, the lower/left mark must be used to define the pattern. Cenon starts with the Camera-Recognition on the lower/left corner and proceeds counterclockwise. To allow the recognition of the corners, the defined pattern will be rotated by 90° after each step.



The marking of a corner in Cenon has to be at the exact position at the corner marking. The red cross in the picture shows the correct position relative to the printed Crop-Mark on the material for two different kinds of Crop-Marks.

- Using Circles or other shapes that are tolerant to rotation, any number of markings can be used to define the shape.

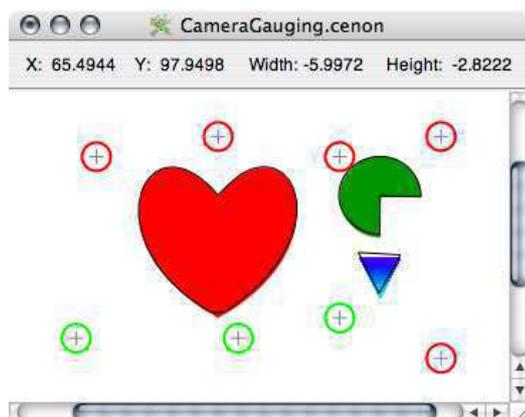
Prototype Placement

The Prototype Placement allows to output graphics or apply manufacturing steps at positions recognized by the Camera. For example to place drills or threads at the position of markers printed on a working piece.

To be able to use this function, you have to define a graphic prototype (Drill, Thread, ...), that will be applied to the positions recognized by the Camera. To define the Prototype, you have to create a Template-Layer (see Section 3.4.2), and place on it the Prototype element. During the Camera-Recognition, the graphic element on the Template-Layer, will be duplicated on a dedicated output-Layer for each recognized marking. When the camera is done, the Output-Layer is ready for output without further preparation.

All settings of the camera, can be modified in the Project-Settings (section 3.2.2).

2.5.5 Problems and Solutions



If some reference markers were not found, light could be a reason. If the light is not sufficient, then a ring-illumination mounted at the camera may help.

Also, too much light might be the cause of problems. In this case less light helps, especially with reflecting material.

A wrong selection of a pattern may also be the cause of a failed recognition. For example, if the Pattern-Preview shows holes, that actually are not in the pattern. When defining the pattern, make sure the pattern is recognized stable.

If the objective of the camera is strongly rotated (camera image not angular to the axis of the machine), then the direction is not translated correctly and the markers are likely missed.

Also, if the second marker has been missed, then probably no other markers can be found as well.

The reaction of the camera gauging to errors are generally good-natured. Not recognized markers can be omitted and not used in the transformation, or they can be defined manually by the user.

Precision

The precision of the camera-measurement is dependant on the resolution of the camera image, and limited to about 1 pixel of the camera image.

If the section of the working piece in the camera-view is too small, then only a small rotation of the working piece is allowed and recognizable. Therefore, we have to accept a compromise between high precision and a large area of recognition.

Angularity

Move the camera over a marker and take a look at the camera image. If the position of the marker in the camera-image is gradually moving while zooming the camera, then your camera / Z-axis is not mounted angular to the machine table and the gauging results may suffer.

If the position of the marker on the camera image is jumping instead of gradually changing then the mechanic of the zoom is not good enough for this test.

Focus

The focus is only good within a tolerance of about 1cm of distance change. The focus should be adjusted for the average distance from the working piece. A camera with automatic adjustment of the focus is not recommended, as the ever-changing scale increases the problem of a correct recognition of patterns.

Corner-Recognition

To achieve good results when using the corner recognition of material, keep the following Tips in mind:

- the camera has to be focussed on the material surface, not the background (which might be considerably lower)
- a sharper image goes hand in hand with better results
- too much, especially dark shadow, can influence the results and may even shift the recognized position towards the shadow!
- On the other hand, reflections from the material may influence the reliability of the recognition.

2.5.6 Summary of the Steps

1. Place Reference-Markers on a separate Camera-Layer. The positions of the markers define then target net for the translation. If the camera layer exists, the Camera Panel will open.
2. Place Working Piece on the machine. The direction should be approximately correct.
3. Using the Control-Panel, move the First Marker into the Camera-Image.
4. Click on "Define Pattern", to define the pattern, highlighted by green Crosshairs.
5. Click "Define First Marker", to tell Cenon that the first marker is in the camera view. The Camera-Drive will start to collect all the other markers, providing the actual points for the Markers defined on the Camera-Layer.
6. After all deviations are collected, the transformation net is complete. You can check the transformed output paths on your screen by enabling the output paths in the Layer-Panel.
7. Start the output by pressing "Start" in the Control-Panel.

Note: the crosshairs in the graphics window are ignored for the camera. Origin of the output is the first Reference-Marker.

2.5.7 Tips

- Turning off the camera layer (closing the eye in the layer panel), stops the delivery of images from the camera. This can come in handy on slow computers to regain full power, if needed.