

# **Step And Repeat and Single Step**

## **User manual**

04 - 2004



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# 1 General

A layout bigger than the physical galvo field is to be marked by moving the workpiece. The movement of the workpiece will be done by a positioning system supplied by the customer. The number and positions of galvo fields / Steps together with the handshake of a handler moving the workpiece effectively, increases the size of the marking area to a multiple of the size of the physical galvo head.

As the VLM software itself distributes the marking objects to the galvo fields according to its positions, the only thing being important is the location of the marking objects in the layout in respect to the galvo fields.

## 1.1 What is a Step?

A step is a position in a VisuallaserMarker drawing. The position of a Step is represented and limited by a galvo shadow in the VisuallaserMarker drawing (Marking View). The size of a Step is the size of the galvo shadow, which is depending on the size of the physical galvo head. Defining steps implies to define the positions of galvo fields. All the marking objects lying in the same galvo shadow will be lasered when that Step is executed. The position of a step is defined in the machine configuration or in the flexible mode in the drawing itself.

## 1.2 What is Step & Repeat?

The Step and Repeat mode is a standard VLM feature supporting M-function handshake during a marking sequence. It consists of setting up the number of steps and the M-functions (parallel I/O by the PCLD or Ali board) in the machine configuration. The Steps are fixed in the drawing. When the Step And Repeat mode is used in the flexible mode the number of steps and the positions can be set in the drawing and in the machine configuration.

## 1.3 What is Single Step?

The Single Step mode is the other standard VLM feature supporting the selection of VLM drawing parts by selecting galvo shadows representing a step. Single Step consists of setting up the number of steps in the machine configuration. The selection of the steps can only be done by calling LmosActX Function `SelectSingleStep(StepIndex As Long)` in the source code of an application. To use Single Step with a standard tool the VMC2 can be used. The Steps are fixed in the drawing. When the Single Step mode is used in the flexible mode the number of steps and the positions can be set in the drawing and in the machine configuration.

An example for single Step could be:

Two parts of a layout/drawing are to be marked on two different locations of a workpiece. E.g. mark the top and the bottom side of a workpiece by rotating the workpiece upside down.

## 1.4 What is the Flexible Mode?

Since VisuallaserMarker 3.3 the Step & Repeat and the Single Step Mode are extended to a flexible mode. The flexible mode enables the definition of the Step positions in the machine configuration and in VisuallaserMarker. The positions of the steps in the flexible mode can be defined in the VisuallaserMarker marking view by adding and positioning galvo shadows. In the normal Step & Repeat and the Single Step Mode the positions and numbers of the galvo shadows are fixed and can't be changed in the VisuallaserMarker marking view.

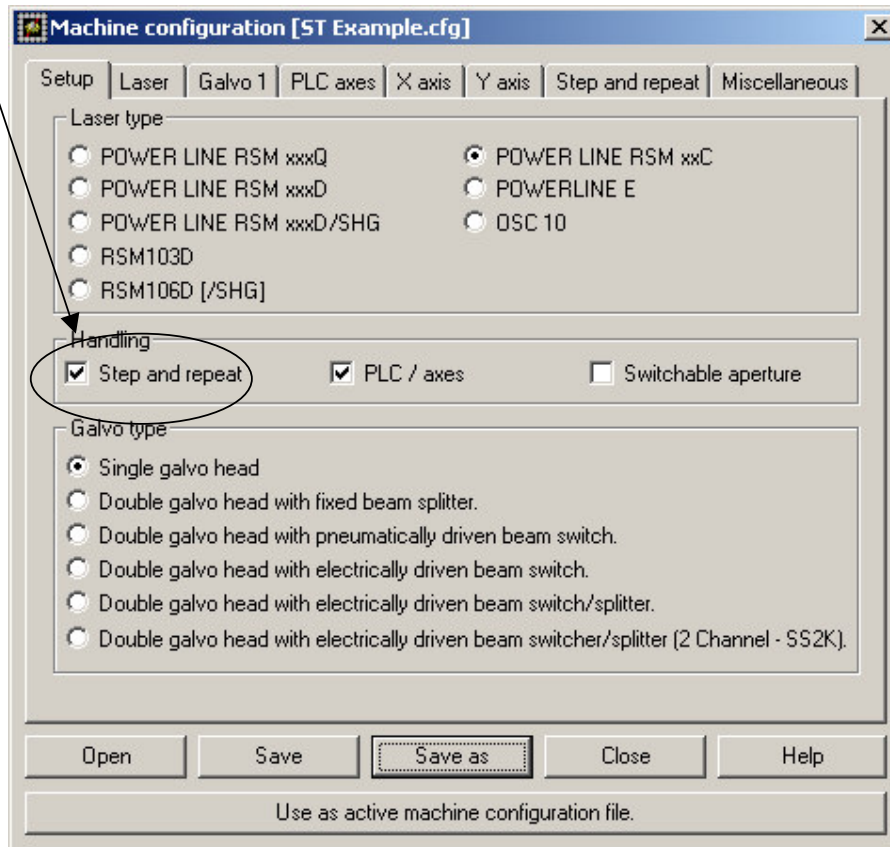
## 2 How to setup Step & Repeat or Single Step

### 2.1 Setup in Machine Configuration

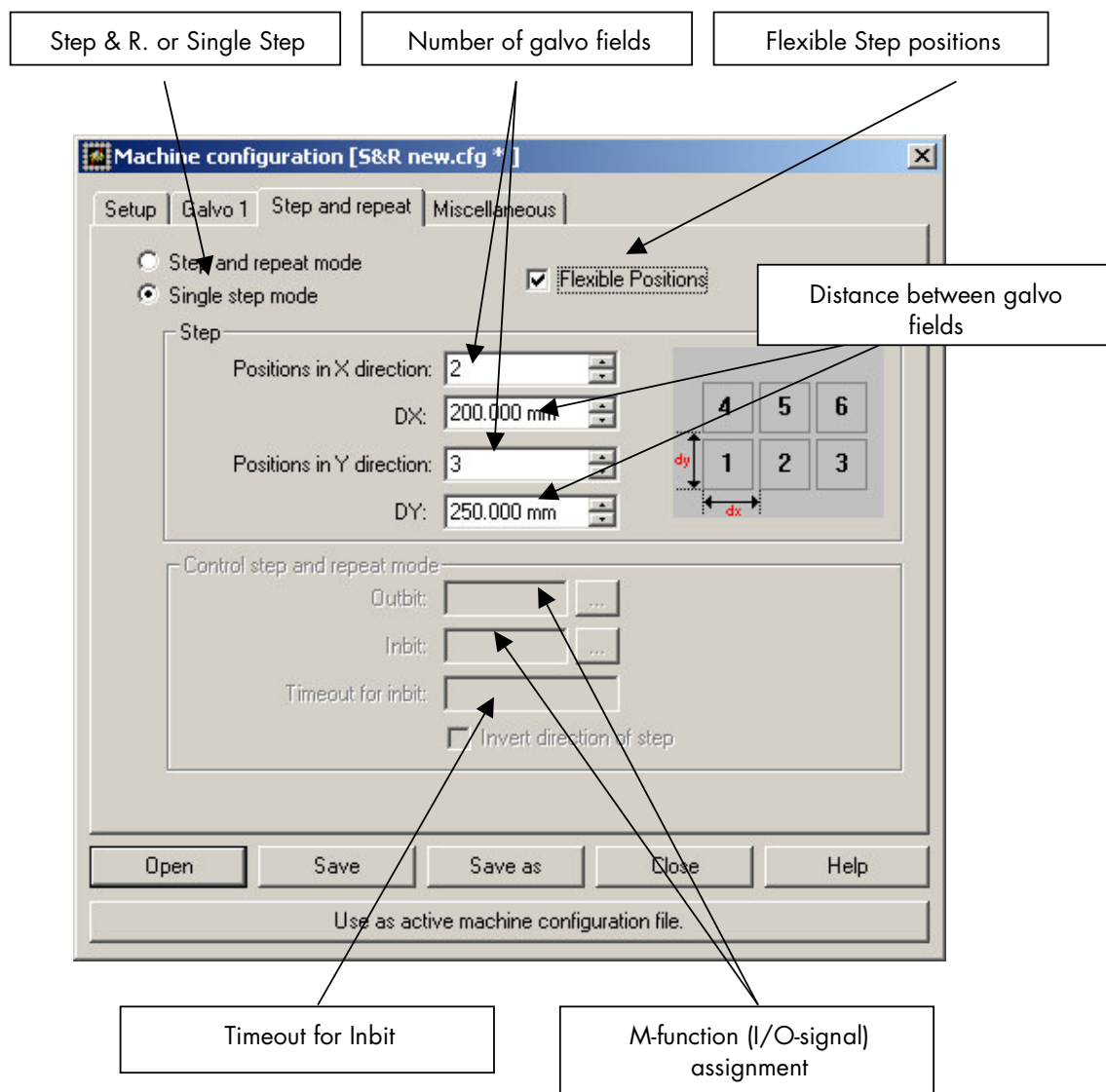
Before starting the VLM, you must apply the settings for the Step & Repeat mode in the Machine Configuration File:

Start the program :

-> Start -> Visual Laser Marker -> Configuration -> **Machine Configuration**



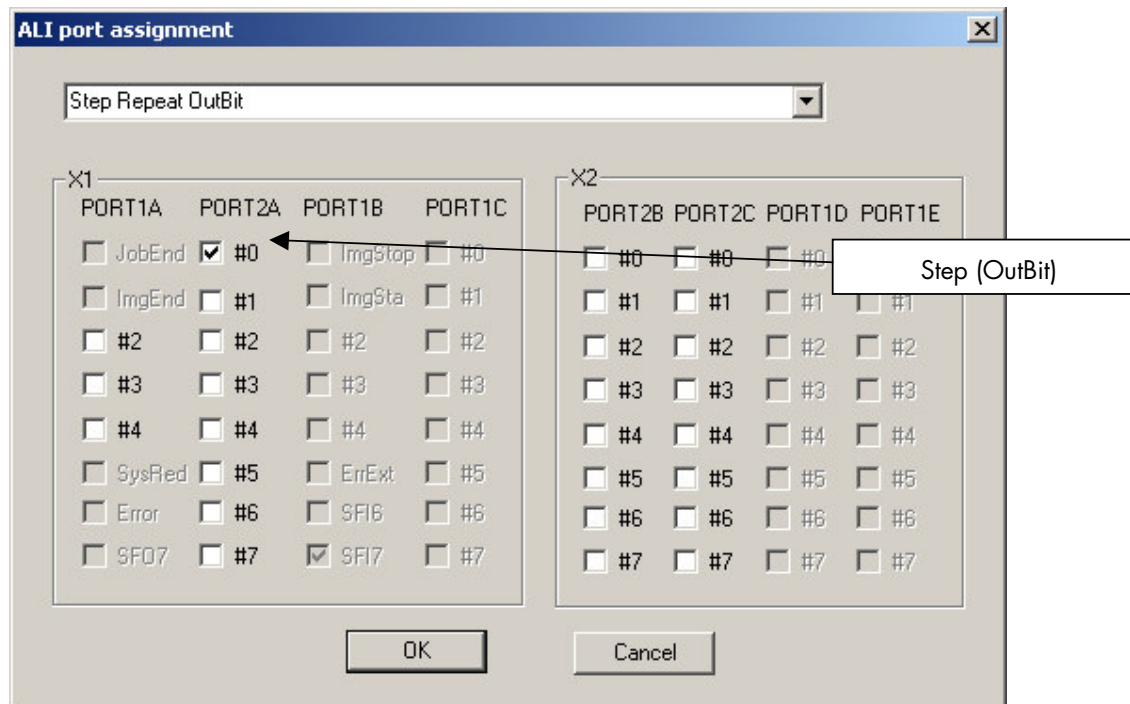
When selecting the checkbox Step and Repeat a new tab appears: Step and Repeat  
The checkbox Step & Repeat must be activated for Single Step mode too.



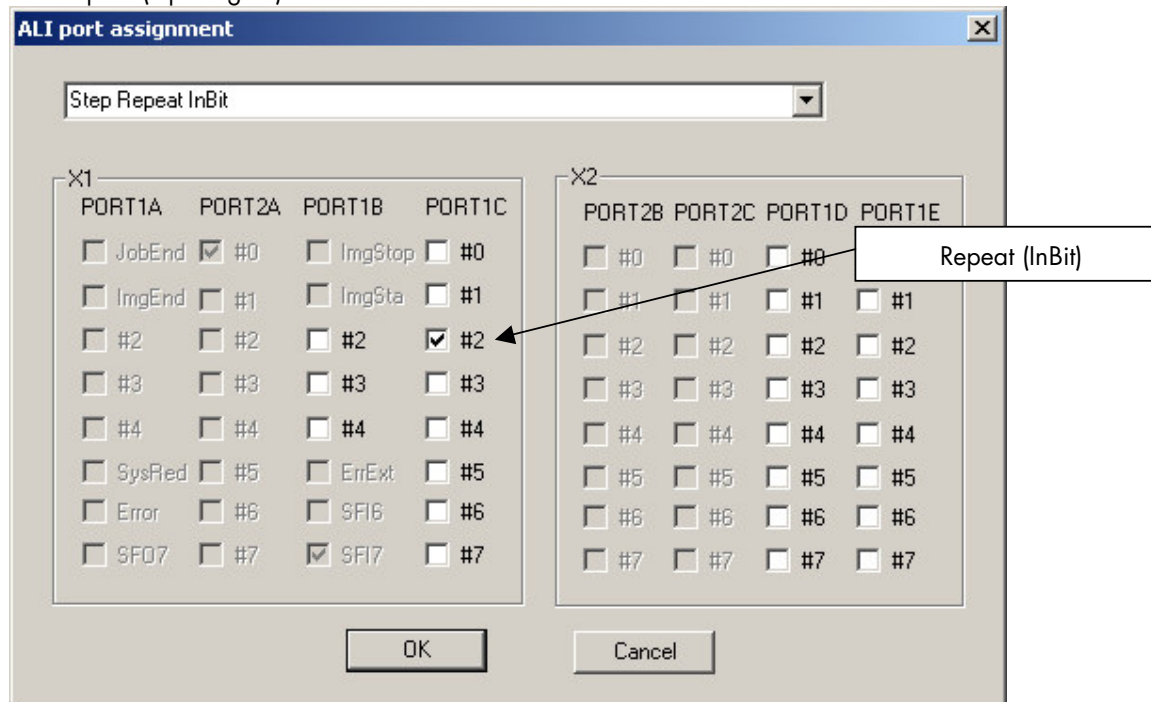
The positions of the galvo fields, setup in the machine configuration in the fields DX and DY do not need to overlap, they can have any distance besides overlapping. The timeout for the InBit is needed to have a timeout for the positioning. After this time an error will be generated and shown. If Flexible positions are activated the axes are added automatically!

## 2.2 M-Funktion assignment (Step & Repeat only):

Select the bits for Step (Output-Signal)

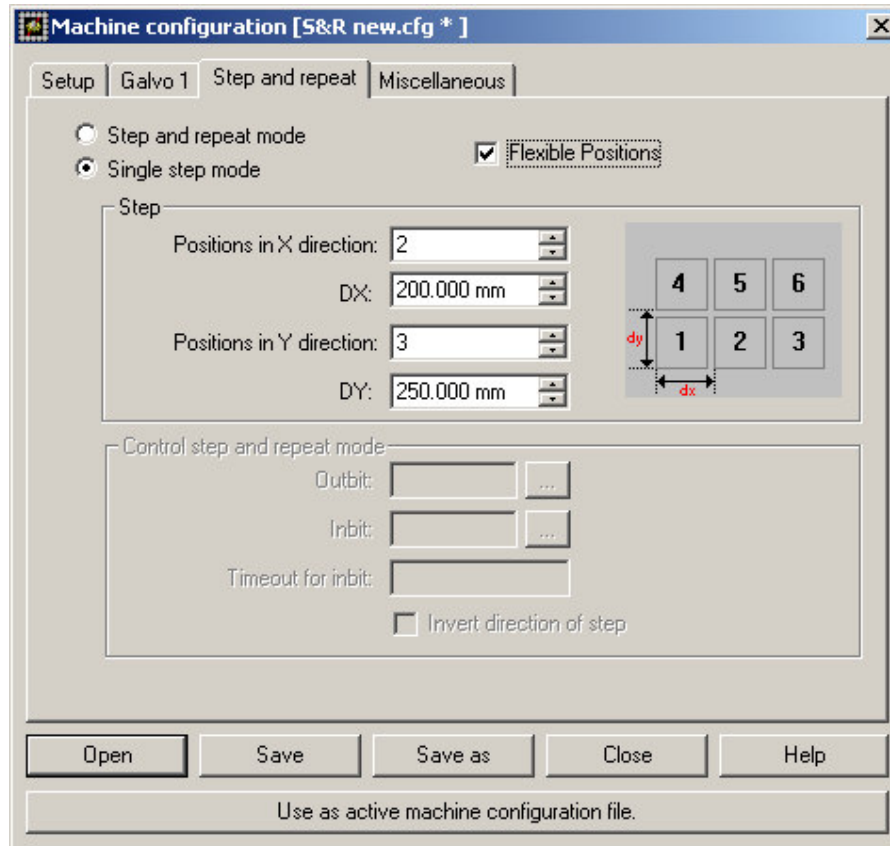


and Repeat (Input-Signal)



## 2.3 Setting up Flexible Positions

When you set "Flexible Positions" in Step and repeat page you can define a row and column structure of step positions. This is the same for non-Flexible and for Flexible mode. The difference of the Flexible mode is, that step positions can be changed in VisuallaserMarker. In Flexible mode the galvo positions can be changed in the VisuallaserMarker max marking area view, in non-Flexible mode the galvo positions can't be changed in the VisuallaserMarker max marking area view.



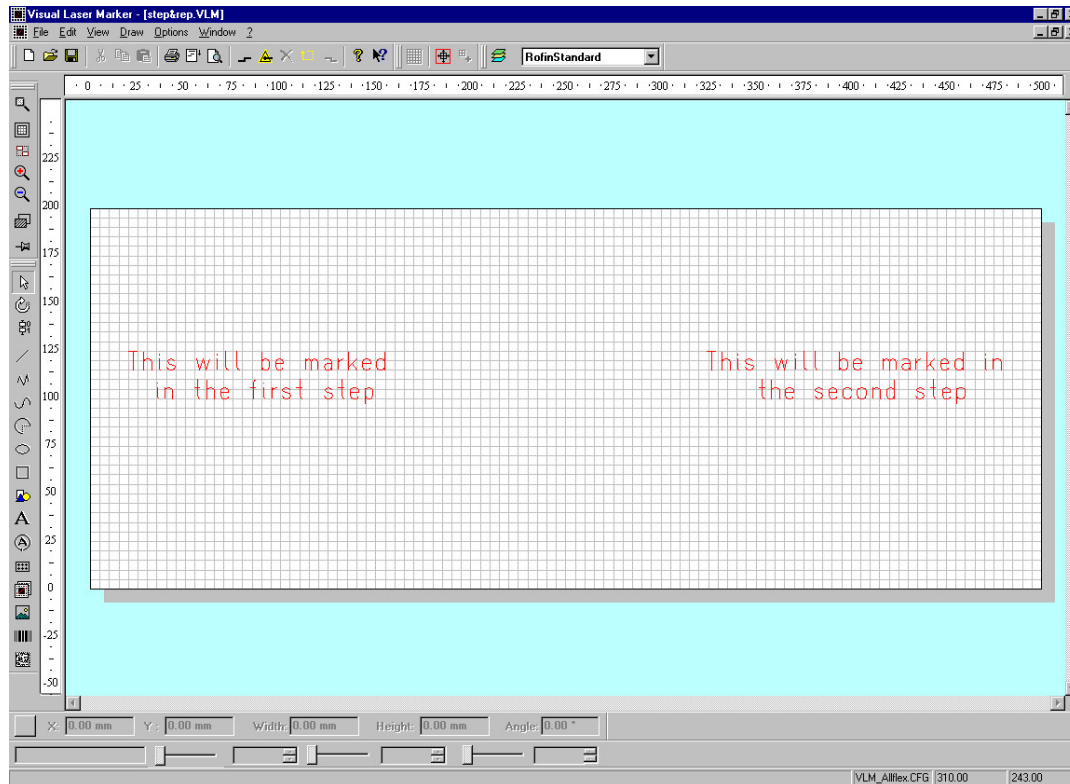
Save the configuration and click "Use as active machine configuration file"

After defining/changing the machine configuration, the VLM must be restarted to get the new machine configuration.

## 2.4 How to setup a drawing in VLM

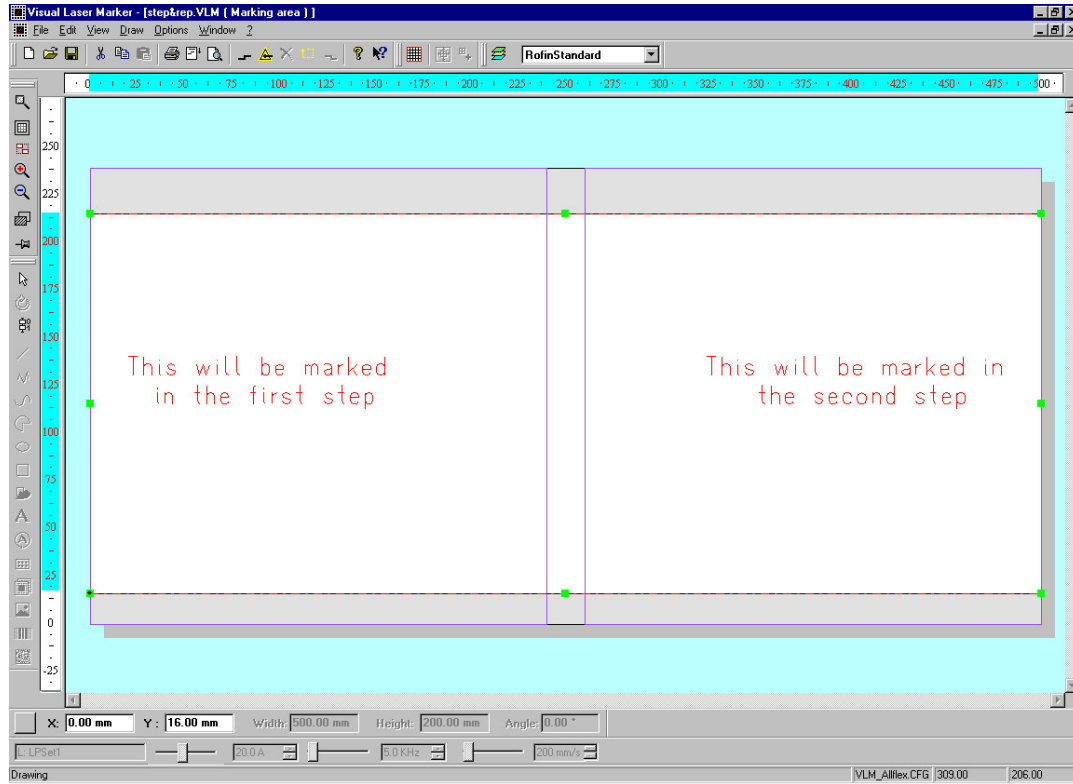
### 2.4.1 Setup a drawing in Normal Mode (not Flexible Mode)

Sample drawing in the drawing view:



Sample drawing in the marking area view:





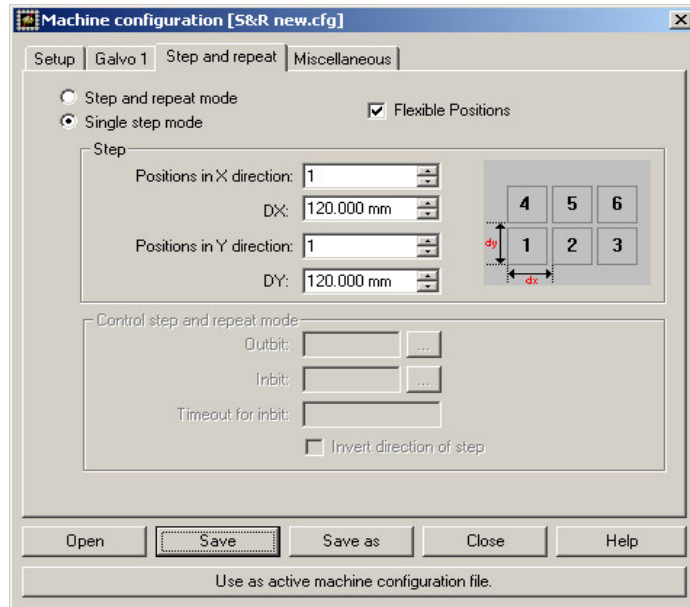
The marking area view shows the two galvo fields (gray area covered by the two blue rectangles) and the drawing (white area covered by the red rectangle). The text **"This will be marked with the first step"** (and all other marking objects being completely in the left galvo field) is marked in the first step, the text **"This will be marked with the second step"** (and all other marking objects being completely in the right galvo field) is marked in the second step.

Between the steps there is a Step and Repeat handshake (Step & Repeat Mode) or the call of the `LmosActx.SelectSingleStep` method in the custom software (Single Step Mode). This example is for a machine configuration with two steps in X direction and one step in Y direction.

## 2.4.2 Setup a drawing in Flexible Mode

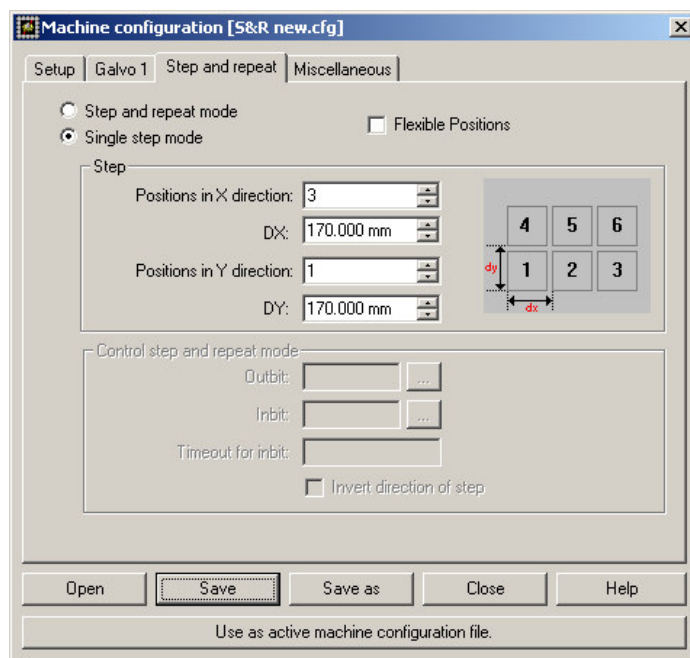
The machine configuration must be set to Single Step or Step and Repeat with flexible positions. → 2.3 Setting up Flexible Positions.

### 2.4.2.1 Example for a configuration with one step



With this configuration you would only have one galvo shadow in your VisuallaserMarker "Marking area" view. The position of the galvo shadow could be changed in the "Marking area" view.

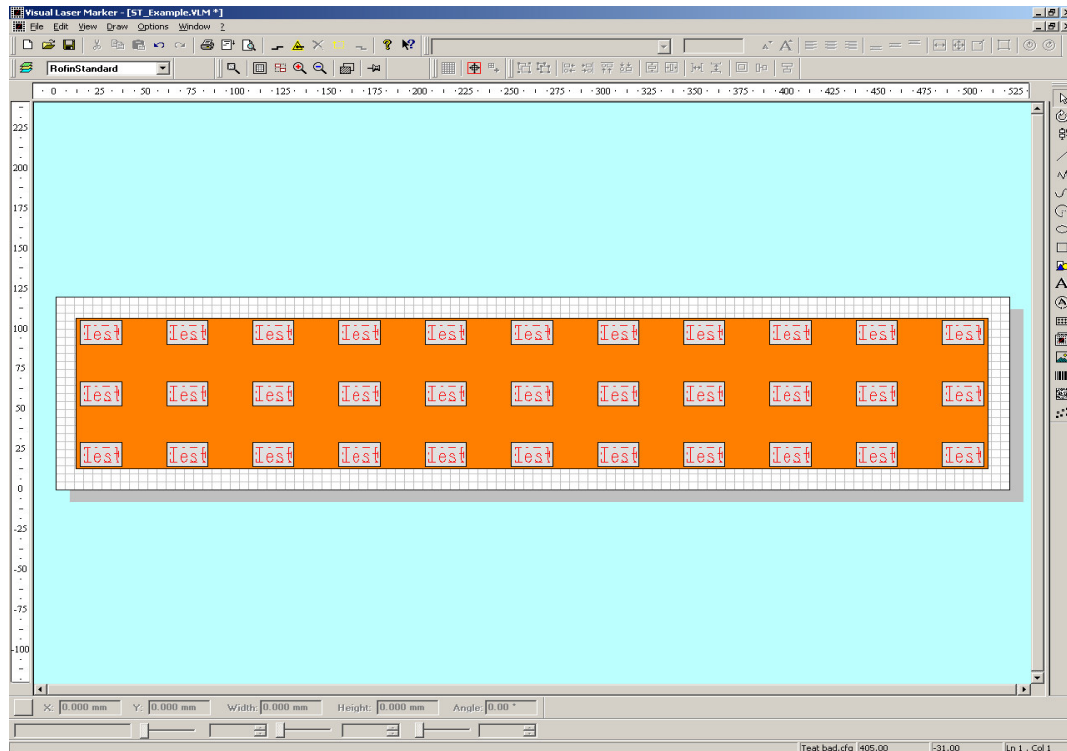
### 2.4.2.2 Example for a configuration with three steps



With this configuration you would have three galvo shadows in your VisuallaserMarker "Marking area" view. All of them could be changed in its positions.

### 2.4.2.3 Sample drawing in the drawing view:

After defining/changing the machine configuration, the VLM must be restarted to get the new machine configuration.



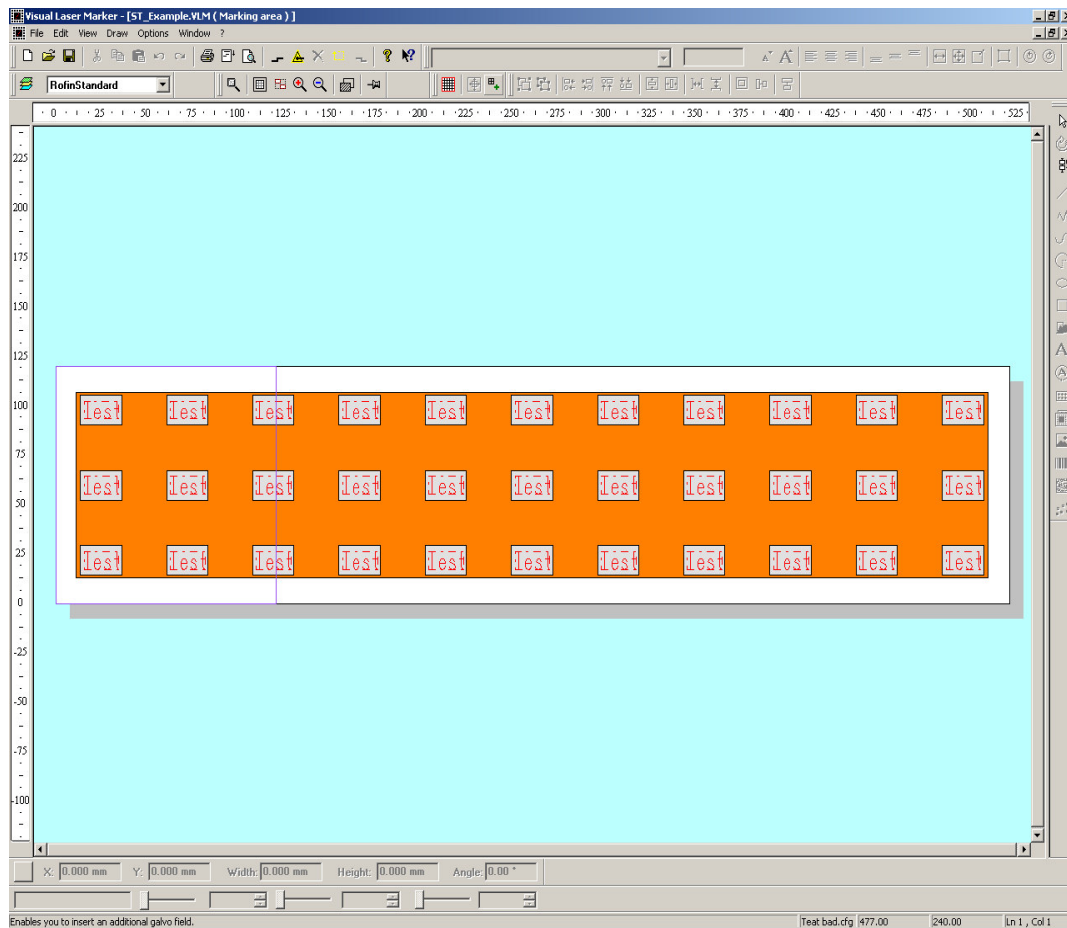
#### 2.4.2.4 VisualLaserMarker view with configuration with on step

After defining/changing the machine configuration 2.4.2.1, the VLM must be restarted to get the new machine configuration.

Switch to the "Marking area" view. The first position of your handler is the position of the blue galvo shadow.

This position can be changed in Flexible mode.

Sample drawing in the "Marking area" view:



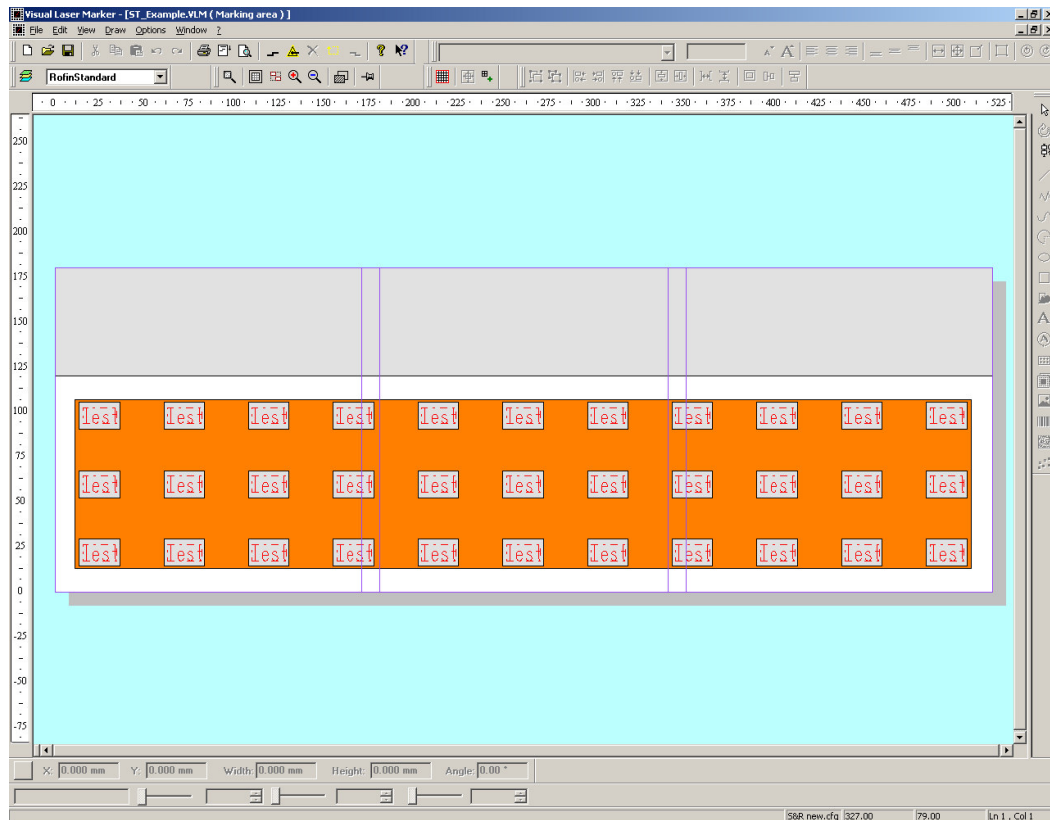
### 2.4.2.5 VisualLaserMarker view with configuration with three steps

After defining/changing the machine configuration 2.4.2.2, the VLM must be restarted to get the new machine configuration.

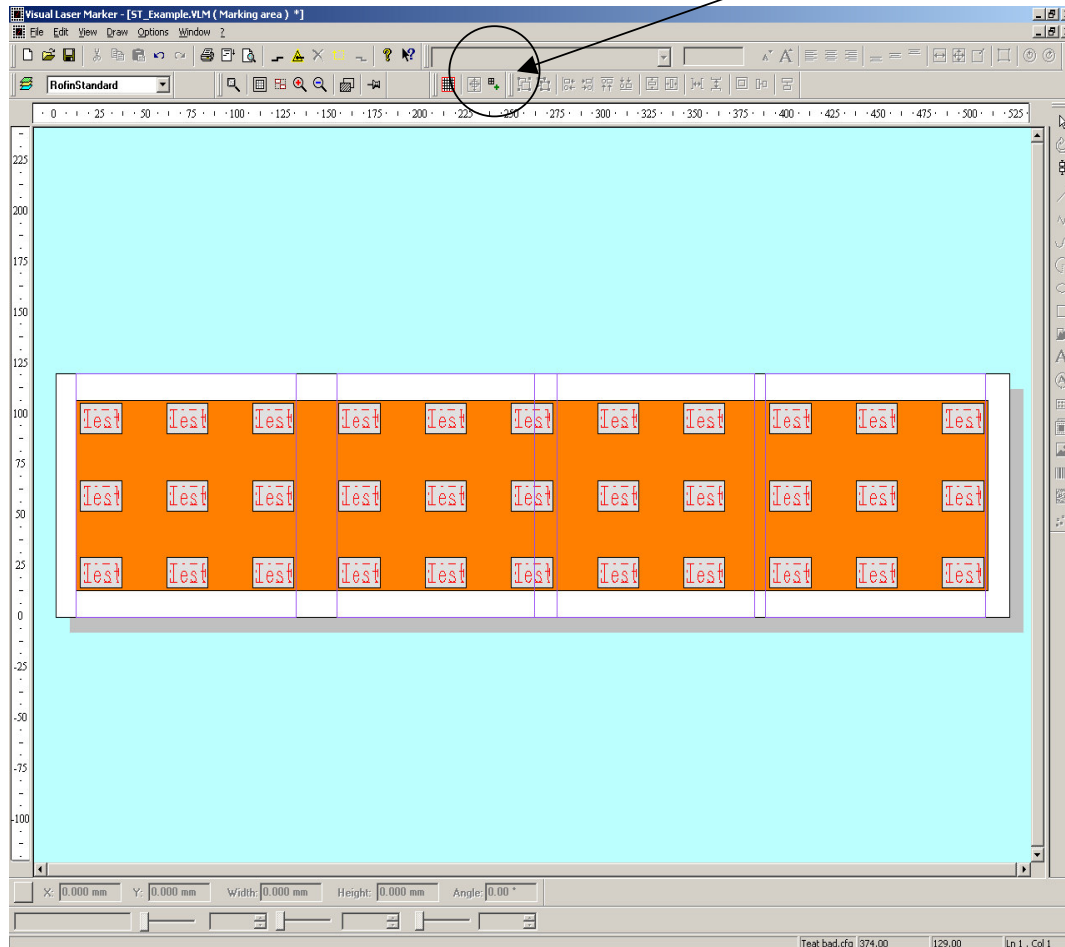
Switch to the "Marking area" view. The three positions of your handler are the positions of the blue galvo shadows.

These positions can be changed in Flexible mode.

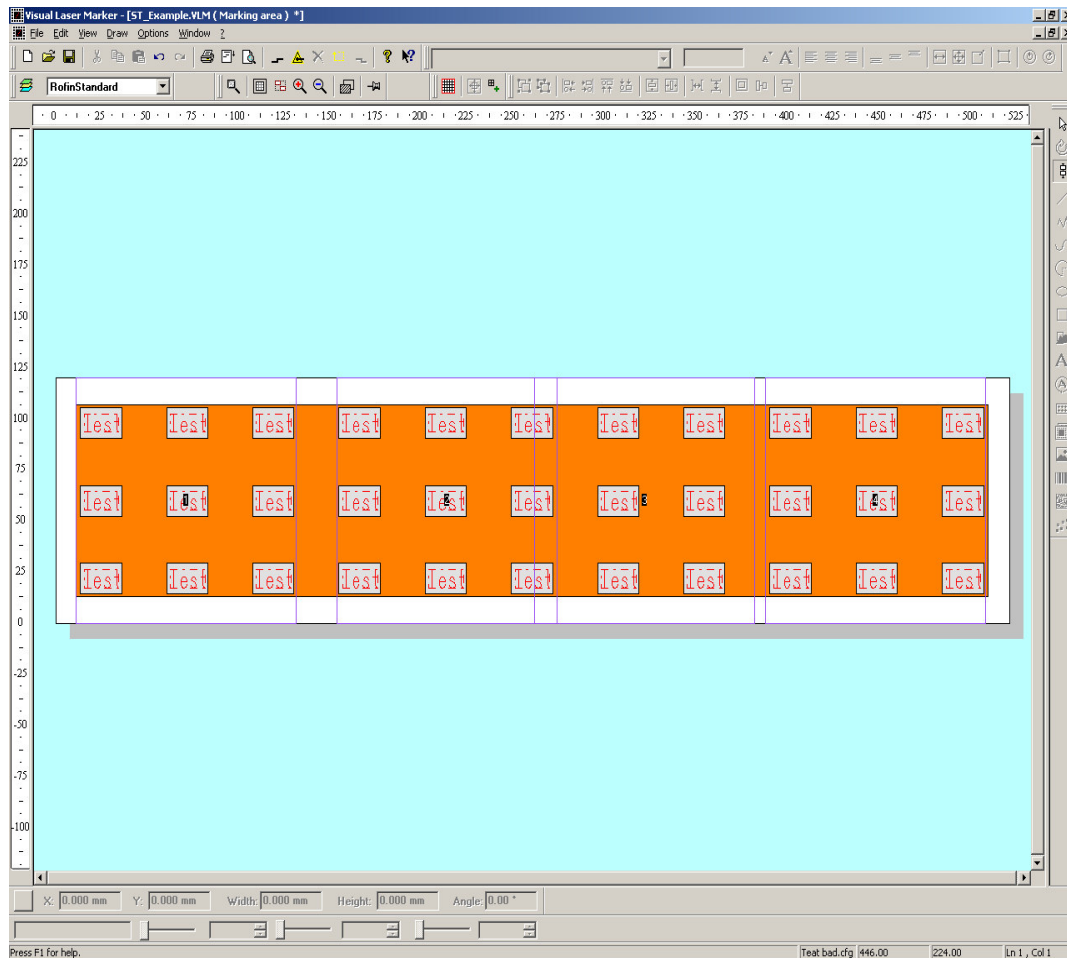
Sample drawing in the "Marking area" view



A step (galvo shadow) can be added by pressing the icon "add a galvo field". This second galvo field will be on position 0,0. Move it to the position of your handler for this layout.

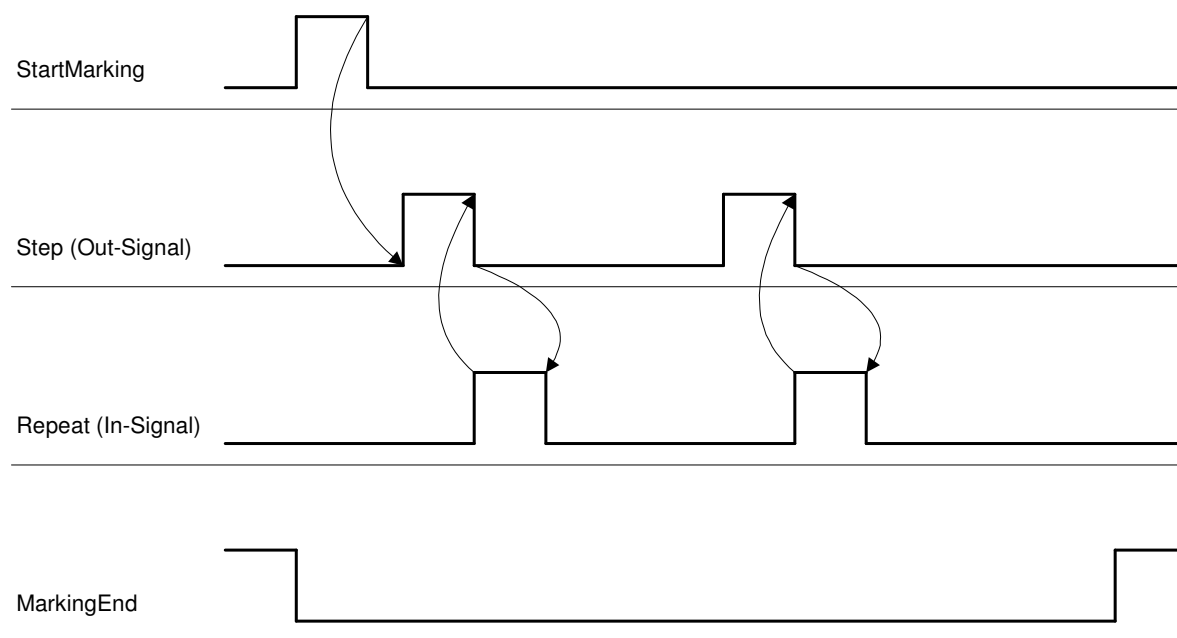


Add more galvo fields to the drawing, as many as your steps for the actual layout are. Maybe you have to adjust the positions of the galvos after the adding. Set the execution order of the galvo shadows. This will be the number for the Single Step selection or the order of execution in Step & Repeat mode.



### 3 I/O Signaling in Step & Repeat Mode

Timetable Process Control in Step&Repeat-Mode





## 4 Tips & Tricks

- The time the repeat signal is high must not exceed the marking time of the objects being within one galvo field. Otherwise the repeat signal will acknowledge **two** step signals!
- The galvo fields are normally marked beginning from the left side. The Step and Repeat setting "Invert direction of step" reverts this.
- Step and repeat handshake is left out for galvo fields on the right side when all marking objects are already marked. E.g.: If you setup three fields being marked from left two right, and the third field does not contain any marking objects, the handshake for the third galvo field is left out. So a handler program has to react either to the step- or to the marking end signal.
- Even it is not really necessary there is a step and repeat handshake for the first galvo field immediately after start marking.
- Don't mix up the "virtual" galvo fields of step and repeat with the physical galvo head. Step and repeat always works with one physical galvo head. Double galvo head configurations are not supported.
- Several fields are used to mark a big layout: Make the overlap of the fields bigger than the biggest object. This ensures that in all cases all objects can be marked.
- Several fields are used to mark on different locations of a workpiece (e.g.: top and bottom side marking): The fields setup in the step and repeat galvo configuration must not overlap.
- As marking objects can only be manipulated in the drawing view where the galvo head rectangles are invisible, it can be useful to add two rectangles onto a layer, which is not laserable. This enables to see the borders of the galvo fields during the design of a drawing. A drawing with this additional layer and the rectangles on it can also be stored as a template and so effectively facilitate the design of new drawings.
- Another issue is the origin of the coordinate system for the second (and all other) galvo fields. In order to have a coordinate system with an origin matching the lower left corner of the galvo field, you can add a group to the drawing. The group should contain a rectangle of the size of the galvo field on a non-laserable layer together with your marking objects. The lower left corner of the group gets placed to the lower left corner of the second galvo field. As group editing gives you a local coordinate system with a local zero point this facilitates your design task.
- For special purposes there is a setting called "Single step mode" on the Step and Repeat page. This setting allows selecting one single step, which is to be marked within a marking cycle. The selection of the step is done by the LMOsActX function **"SelectSingleStep"**. See **"Description of the ActiveX component LMOsActX"** for further details