

5 BeamConstruct

5.1 Security

This application is designed to control laser equipment which may effect a person's health or may otherwise cause damage. Prior to installation and operation compliance with all relevant safety regulations including additional hardware-controlled safety measures has to be secured.

Beside of that some laser equipment can be damaged in case it is controlled with wrong signals. Thus it is highly recommended to check the output generated by this plug in using e.g. an oscilloscope to avoid problems caused by wrong configurations. This should be done prior to putting a system into operation for the first time and whenever a software update was installed or whenever some of the relevant parameters have been modified.

Here "software update" not only means updates of the HAL package or BeamConstruct software but also modifications with dependent software, like components or drivers for scanner controller cards.

5.2 Overview

BeamConstruct is a CAD application specialised for creation and processing of laser marking data. These data can be used together with a laser scanner system to perform the material processing.

5.3 Quick Start into BeamConstruct

This section describes how to use BeamConstruct in direct operation mode where laser marking is done directly out of the application. It gives a short overview about basic set-up and usage of BeamConstruct and describes with some short steps how to get first results easily. So this section is a shortcut to start into this software very fast but it ignores most of the useful features. These features are described in detail in following sections of the users manual, so it is recommended to use this quick start only to understand the very basic working principles of the software while going deeper into it afterwards.

The very first and most important rule, when starting to work with BeamConstruct is: **DON'T TOUCH!** BeamConstruct comes with default settings that all make sense for a common, non-complex setup and therefore can be used quite well for the beginning. So unless you exactly know what you are doing and why you are changing some values, don't modify any parameters. At the beginning, when you do your first steps with BeamConstruct, try to work with these default parameters until you stumble upon a problem, where you explicitly have to change some specific parameters to solve this problem.

1. **SECURITY CHECK:** The following steps describe how to set up BeamConstruct and how to control laser equipment out of it. Thus all laser safety rules and regulations need to be respected, all required technical security mechanisms need to be available and active prior to starting with this software.
2. **Main configuration:** First the scanner controller card that has to be used needs to be selected and configured. To do that, select Menu "Project" menu item "Project settings..." and go to panel "Hardware" of the now opening settings dialogue. Within the selection-list named with "Scanner Card" choose the scanner controller card you want to use. After selecting it, press the button "Configure" and set up the scanner controller card according to its specific needs (choose things like firmware file, correction table, working area size, number of controlled axes or what ever your card requires for proper operation) and according to your local hardware configuration.
3. **Save Configuration:** Leave all these settings dialogues by pressing "OK" once all parameters have been entered correctly and select menu "Project" menu item "Save as default configuration". Now

whenever you start BeamConstruct and as long as you do not load a project file with a different hardware set-up, these settings are used by the application.

4. **Create basic geometry:** Select the blue triangle-symbol within the tool bar and draw that triangle within the drawing area right below the tool bar. There you have to left-click your mouse three times at different positions to create the triangle, every of these mouse-clicks specifies an other corner of the triangle.
5. **Modify existing geometry interactively:** Once you have finished creation of the triangle this new element is selected and highlighted by a double-lined blue box surrounding it. This box can be used to modify the geometry. While picking and dragging one of the coloured squares that are contained in this surrounding, the triangles size can be changed (the grey squares) as well as its rotation (via the red square). The cyan-coloured squares can be used to slant the geometry. When the triangle is dragged by clicking the selection frame between these coloured squares, its position can be changed.
PLEASE NOTE: When modification of the geometry has finished it still has to be located completely within the working area that is symbolised by the grey rectangle. This working area is the maximum range your scanner can work within, so all geometry that is located outside of that range will be cropped.
6. **Modifying existing geometry manually:** The method described previously is a very quick way to change the geometry but it is also a very inaccurate one. Thus there exists an other possibility: As long as an element is selected, there is a configuration panel usable at the windows left hand side. The first configuration panel is always an element-specific one, in this example it contains several parameters and values that influence the creation of the triangles base geometry. On the same side of the main window there also exists an other tab-pane "Geometry" where the generic geometric data of an element can be changed by entering the desired numeric values. Using this way things like size, position and rotation can be modified in a very exact way. The related values are taken over and applied to the geometry as soon as the data input is confirmed by pressing "Return" or by leaving the input field.
Several of these data depend on each other and will change automatically whenever one of them is modified. So in case you change the scale factor of your geometry, the position and size values of it will be changed too as soon as you hit your "Return"-key within the scale value input field.
7. **Apply laser parameters:** Required laser parameters can be applied to existing geometry via a number of predefined and freely definable pens. Such an (existing) pen can be set via the tab-pane "Element" and the selection list named "Pen". Whenever a new pen is selected for an existing geometry it is applied to it automatically, which means the visual representation of that geometry within the drawing area changes its colour and the next laser marking cycle would use the parameters of this pen when this specific geometry is processed.
The different laser and scanner parameters that are assigned to such a pen can be modified by selecting menu "Project" menu item "Pen settings...". There a dialogue opens where you can select the pen that has to be modified (by using the selection list on the upper side of the dialogue). The tab-panes below this list give access to all relevant parameters that influence mark and jump speed, laser power and frequency, scanner delays and others more. When you change some of these parameters and leave the dialogue by pressing "OK" all the geometries that are assigned to this (now changed) pen will use the modified parameters during next laser marking process.
8. **Adding a hatch pattern:** Currently only the outline of the triangle is shown and only this outline would be processed during laser marking. To process the inner side of the triangle too, a fill pattern has to be added by using the Additional Geometry element "Hatch". It is symbolised by a purple-coloured tool bar icon that consists of several horizontal lines. When this icon is clicked as long as a Primary Geometry element (like the triangle) is selected, it is added to this element automatically. Now the appearance of the geometry and the appearance of the application changes:
 - the first panel on the main windows left hand side switches to show all the "Hatch" parameters
 - the Element Tree on the main windows right hand side now shows the new hierarchical structure of the element with the "Hatch" as sub-element of the primary "Triangle" geometry
 - the triangle within the drawing area is filled with some hatch linesThis hatch pattern now can be changed by modifying the values within the property-panel "Hatch" on the main windows left hand side.
PLEASE NOTE: after clicking the Hatch-button within the tool bar, the new geometry of the now added hatch/fill pattern is selected instead of the triangle! That means all modifications to the selected geometry (as described previously) now would apply to the hatch geometry only but NOT to

its parents triangle! So in order to manipulate the whole element the parent of the hatch has to be selected – which is the base element generated in previous step.

9. **Save data:** To avoid the currently generated geometry gets lost, the project has to be saved now. To do that, select menu “Project” menu item “Save as...” and save these data at a suitable position using the .BEAMP format.
PLEASE NOTE: this project contains all the hardware definitions that have been done during configuration of the software in first steps. Whenever you change this configuration and then load this project again, the hardware set-up of the project is used instead of the changed one of the application. To avoid that after loading such a project, the menu “Project” menu item “Load default configuration” can be chosen to replace the projects hardware set-up by the local, desired one.
10. **SECURITY CHECK:** Next the scanner controller card together with a possibly connected laser will be accessed for the first time. That means it is opened and initialised and all connected equipment may start working now. Thus it is very important to ensure all security regulations are met and nobody can be injured and no damage can be caused also in case laser output or other motion starts spontaneously and unexpectedly!
11. **Prepare for laser marking:** Now the created geometry has to be sent to the connected laser and scanner system for processing it on some material. To do that the menu “Process” menu item “Mark” has to be selected. It opens the marking dialogue and tries to access the connected hardware. In case it is not possible to access the scanner controller card, an error message is shown and none of the buttons of the mark dialogue are usable (except the “Cancel” button to leave the dialogue). In this case you have to go back to the project settings as described in step 2 and to correct the set-up of your scanner controller card.
12. **SECURITY CHECK:** Next the laser and scanner will be accessed. Since there are some (laser) controllers available that are VERY sensitive to wrong laser signals, it is recommended first to check the output your scanner controller card produces. This can be done e.g. by using an oscilloscope instead of the real hardware. The target equipment should be connected only in case all signals are checked, correct and acceptable by the hardware. More than this it is recommended to repeat this step whenever the something within the complete set-up changed; changes may be caused e.g. by modified parameters, by software or driver updates.
13. **Start marking:** Now marking can be started by pressing the big yellow button (the one with the laser warning sign) in the middle of the marking dialogue. This starts sending of all laser and scanner data to the scanner controller card so that it is able to output motion and laser control data synchronously. Such a marking operation can be stopped by pressing the big red button (with the STOP-symbol) at the dialogues right hand side.
PLEASE NOTE: this stop-button is not a replacement for a real emergency stop, it will try to stop the currently running laser process only via software which – in worst case – may fail for an example due to an abnormal problem or in case of a hardware failure. Thus there must be independent and working emergency stop equipment available in every case!