LasershowGen
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Introduction

LasershowGen (formerly ildaGen) is an affordable laser show file creator and editor. It primarily deals with the open ILDA file format. It has both a Windows and web (HTML5) version. A free version without exporting options is available.

The official site for downloading and purchasing LasershowGen can be found on BitLasers.com here.

If you have any questions, bug reports or feature suggestions, please don't hesitate to contact me at gitlem@gmail.com .

LasershowGen currently consists of two **modes**. When you start the program, what you see is the **editor mode**. Here you can edit or create laser frames by using various drawing, coloring and blanking tools. The other mode is the **timeline mode**. To switch between the two modes, press [Tab] or use the "View" menu on the top of the screen. In the timeline mode, you can create longer and more complex laser shows by placing multiple laser frame files, either imported or made in the editor mode, on a timeline with layers. You can also import music to sync the lasershow to.

At this point the timeline mode is unfortunately only available in the Windows version of LasershowGen, not the web version.

In both modes, when hovering the mouse over a button etc., a **tooltip** will appear in the top-left corner, explaining the function. You can also get a list of **keyboard shortcuts** by hovering the mouse over the "HELP" button.

*It is recommended to read through this manual to get the most out of LasershowGen, or at least the **brief usage guides** for each mode.*

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The Editor Mode

Brief usage guide

What you see when you open LasershowGen is the editor mode. In this mode you can create and edit laser frames. The frames you create can either be exported to ILDA files, or sent to the timeline mode as part of a larger project. You can read more about the timeline mode in the next chapter.

To start drawing to your laser frames, select a drawing tool in the top right corner of the screen, and adjust various settings such as color and blanking with the sliders and buttons that appear. Now click and drag the cursor somewhere in the large black area to the left. Depending on the drawing tool selected, you should now see what you drew created as an object.

You can **select** any objects you have previously created by holding down [Ctrl] and clicking on them. Selected objects are marked by a blue square. By clicking and dragging the arrow icons in the corner of the blue square you can **rotate and scale** the object. You can also edit the object by selecting new settings and then pressing the button **REAPPLY,** or the keyboard key Enter. Not only can you rewrite the settings like color and blanking, but you can also layer edits on top of each other to create complex patterns that would not be possible in a single edit. More on the REAPPLY button in another chapter.

If you have selected an object, you can also **copy it** [Ctrl+C] or **cut it** [Ctrl+X], then **paste it** somewhere else [Ctrl+V]. You can also **delete** elements using the Delete key. You can right click on the selected object or click the "Edit" button in the top menu for more options.

You can change the total **number of frames** in the editor by clicking "Properties"->"Change number of frames" in the menu at the top of the screen. Use the left/right arrow keys to navigate between frames. Use the space key to **play/pause**.

LasershowGen can create automatic **animations** by gradually changing settings over the course of several frames. You can do this by first enabling animation by using the checkbox marked "Enabled" in the Animation area (bottom right) of the interface, then editing the final values using the new cyan colored sliders that appear next to the main sliders.

You can edit the **scope**, that is the active frames that animations or reapplying spans over, by using the SCOPE button. If you only wish to edit a single frame, there is a checkbox in the Animation area for that too.

When you are done with creating the frames in the editor, you can either:

- Click the **EXPORT ILDA** button to export them to an ILDA file. You must remember to end the name of the file in ".ild", or the program creates a file with no extension and you need to rename it for other programs to be able to recognize it as an ILDA file.
By right-clicking on the export button, you can choose between **optimized and minimized exporting.** If you have not yet entered a **license code**, you will be asked to do so when you export.

- **Send the frames to the timeline mode** as part of a larger project. To do this, first enter the timeline mode by pressing [Tab]. Then select a position on one of the layers in the timeline by clicking on it. This marks where your frames from the editor will be inserted. When you have marked a position, you can click the "Send to timeline"-button or press [I] to copy the frames from the editor mode to the timeline. You can read more about the timeline mode in the next chapter.

You can save and load the LasershowGen frames by using the **SAVE- and LOAD FRAMES** buttons so you can continue your work later. Remember, this is different from exporting the ILDA file, the saved frames can only be opened by LasershowGen itself.

Keyboard Controls in the editor mode

Left Mouse)	Select drawing tool and draws
Right Mouse)	Open context menu, or edits value of sliders manually
Enter)	Remake (Reapply) object, finalizes curve, or presses OK
Space)	Play/Pause
Tab)	Enter timeline mode
I)	Send frames from the editor mode to the selected position in timeline mode.
Right/Left Arrow)	Move one frame back or ahead
Ctrl+Mouse)	Select object
P)	Change previewing mode between 2D and 3D (simulated scanner)
Shift)	Force straight lines/angles when drawing
Q)	Snap cursor to nearest ending or starting position of any object.
Alt)	Snap cursor to ending position of last placed object for chaining.
Ctrl+Alt)	Snap cursor to *starting* position of last placed object for chaining.
S)	Show/snap to square grid. Double press to toggle.
S+Up/Down Keys)	Resize the square grid
R)	Show radial grid. Double press to toggle.
Z)	Zoom in around the cursor for extra precision.
A)	Show symmetry/alignment guidelines of objects. Double press to toggle.
E+Mouse)	Clone the color that the cursor is pointing at, for example from a background image or a previously placed object.
Delete)	Delete selected objects
Backspace)	Cancel object placing (used with curve tool)
Ctrl+Z)	Undo
Ctrl+C)	Copy selected objects
Ctrl+X)	Cut selected objects
Ctrl+V)	Paste selection
0)	Jump to first frame
Ctrl)	Move all color sliders, or centers symmetrical sliders
Mouse wheel)	Adjust amplitude in wave drawing tool
Ctrl+Mouse wheel)	Adjust frequency in wave drawing tool
N)	Reset window aspect ratio
M)	Reset window size
F11)	Toggle fullscreen
F1)	Open this document

Buttons and user interface

In the editor mode, you will see with this interface:
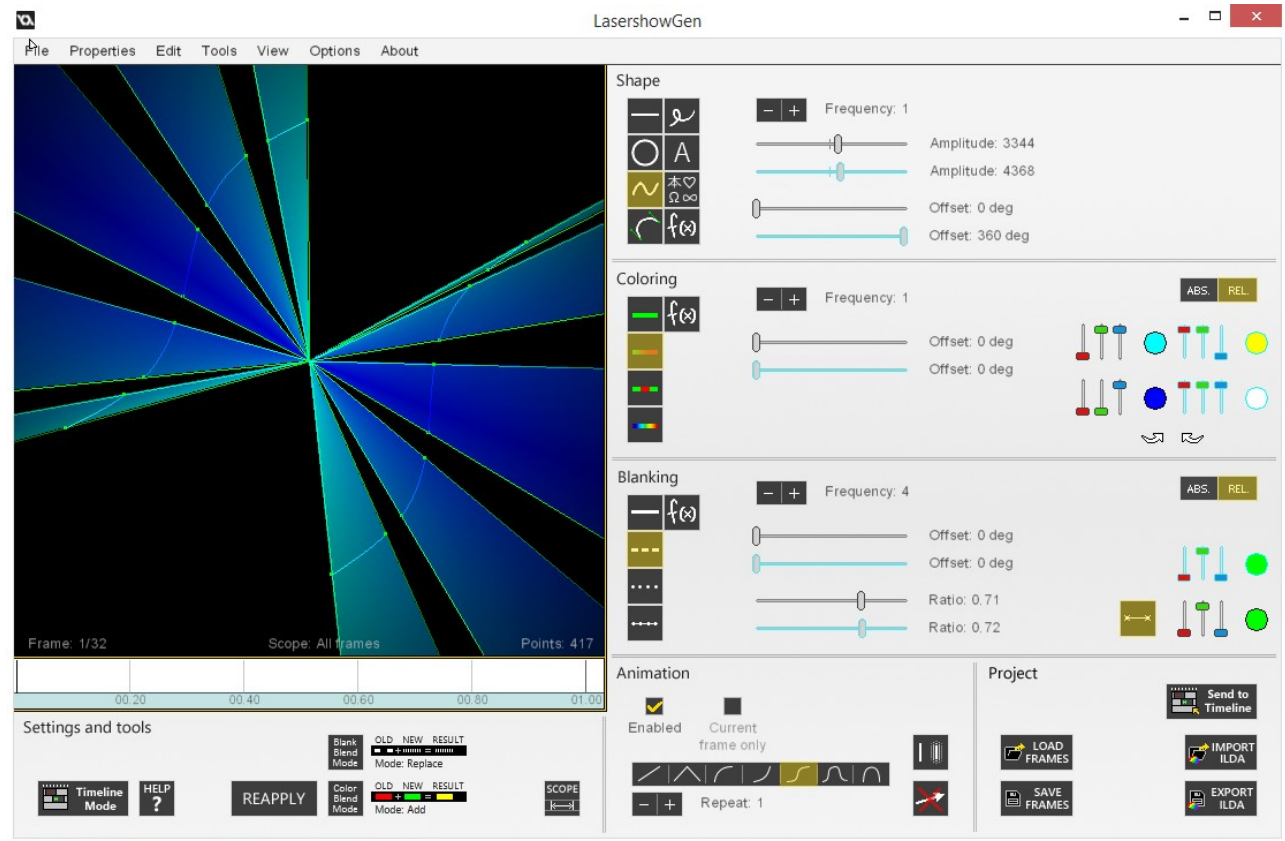
The window is divided into 7 main sections. The drawing and previewing window which is the large black area to the left, and the six gray sections marked with their names written in their respective upper-left corners. There is a chapter for each of these sections below, where the buttons and tools are explained.

Button tips and tricks

Some of the sliders and selectors in the screen-shot above may not appear to you, this is because they are only visible when the relevant settings are activated. For example, the settings related to making waves such as the amplitude and frequency sliders, are only visible if the wave drawing tool is selected.

Some buttons have *drop-down menus* with additional settings that can be accessed by right-clicking on them. Pay attention to the tool-tip in the corner which will inform you if this is the case.

By holding down CTRL and using sliders, you can control them in alternative ways. Colors sliders will move both the red, green and blue channel at the same time, and sliders with a neutral center point will snap back there.

On most sliders you can right-click to enter a specific value.

Toggle-able buttons will be marked with a yellow tinge when they are enabled.

The drawing and preview area

The large black square is the drawing and preview area. Your frames as they currently look, are shown here. To make additions to the file, select a drawing tool (see below), and click or drag your mouse anywhere in this area.

In the bottom of this area, you will find some information:

Frame: This is the current and maximum frame in the ILDA file you are viewing. You can move between frames by using the left and right arrow keys.
Scope: These are the frames that are selected as the editing scope, all modifications you do to the project will only happen within these frames.
Points: This is the approximate number of data points in the frame you are viewing. NB: Might not be accurate after exporting, especially if optimization is enabled.

Below these three numbers there is a simple time-line, showing the editing scope marked in yellow, and the current frame marked with a black line. If you have loaded music in the timeline mode, a visualization is shown here, synced to the selected position in the timeline.

You can select objects by holding [Ctrl] and clicking on them with the mouse. The selected objects will be marked with a blue square. When an object is selected, some extra editing tools become visible. There is a small blue anchor symbol, which marks the anchor point of rotations and resizing. You can move this point around by dragging it with the mouse, or you can right-click on it to automatically move it to the center of the selected object for symmetrical and uniform rotation/resizing.

To *rotate* a selected object, click and drag the curved arrow symbol in the bottom-left corner of the blue square. To *resize* it, click and drag the straight arrow symbol in the bottom-right corner.
If animation is enabled, the change will happen gradually over the frames in the editing scope, so the result may not be immediately apparent depending on what frame you are currently viewing.

You can press P to toggle *3D preview*, showing how the current frame would look like when projected from a scanner.

The shape area

This area contains the drawing tools selectors, and various settings related to the shape of the drawing.

Furthest to the left you will find the drawing tools selector. As of v1.0.0 you can choose between line, circle, wave, curve, free drawing, text, symbol and arbitrary function tools. Click the buttons to select them.

The line, circle, wave, symbol and free drawing tool will be created as they are previewed at the time you release the mouse button.

However, when the ***curve tool*** is selected and you release the button, you will enter adjustment mode. Two green bars will appear next to the curve. By dragging the tips of those bars with your mouse, you can manipulate how the curve looks. When you are done, click the enter button to finalize and create the object. If you wish to cancel while in adjustment mode, press backspace.

With the ***text tool***, you must first load a font to use. You can do this by right-clicking on the text button and pressing Load. LasershowGen comes with Arial, which you can find in the folder that you installed LasershowGen to. You can find many other fonts by installing LaserBoy. Read more about this in the dedicated chapter. To place text, click on the desired point of origin (bottom left of the text) and enter the text. NB: The text tool can not be used in the web version, instead you can use the symbol tool (see below).

The **symbol tool** lets you draw various symbols and text glyphs. Select a symbol from the table, then click in the drawing area to place it. There are over 2000 symbols to select from, including English, Japanese (hiragana, katakana and some kanji), Greek and Cyrillic letters in various fonts, math, music and weather notation, and other miscellaneous symbols.

The *arbitrary function drawing tool* lets you enter a mathematical function for the X and Y value, rather than drawing the shape yourself. It is a quite powerful tool but also the most complicated. To learn more about it, read the dedicated chapter on arbitrary function tools.

Depending on the drawing mode selected, one or more settings in the form of sliders or more buttons will become visible. For explanations on what each setting does, check their tooltips by hovering the mouse cursor over them.

The color area

This area contains settings related to the coloring of objects.

To the left you will find the color mode buttons. As of v1.0.0 there are five *coloring modes:*

- Single-colored
- Dashed coloring that alternates sharply between the primary and secondary color,
- Gradient coloring that alternates gradually between the primary and secondary color,
- Rainbow coloring that gradually alternates the hue,
- Arbitrary function coloring, which lets you enter mathematical functions that describe the color.

There are also up to four *color selectors* visible to the right, depending on what coloring mode is selected. The primary color selector is on top, and below it is the secondary color selector. For each selector, you have three sliders, one for the red, green and blue channel respectively. They are blended additively, like laser light, so for example red at max, green at max and blue at zero creates the color yellow. The selected color is previewed in the circle next to the three sliders. You can hold CTRL to move all channel sliders simultaneously, or right-click on a slider to manually enter the value for the channel.

When animation is enabled, the amount of selectors are doubled, and two *arrow symbol buttons* are revealed below the selectors. You can click these arrows to copy the color to or from the main color selectors to the animation color selectors, marked with a cyan tint.

Between the color mode buttons and the color selectors, there may be some extra settings depending on what color mode is selected. These modify how the coloring is applied in various

ways. For explanations on what each setting does, check its tooltip by hovering the mouse cursor over it. There is a button in the upper right corner that modifies some of these settings by switching from a relative (for example 5 cycles per object) to an absolute (for example 10 000 length units between cycles) metric.

The blanking area

This area contains settings related to the blanking (on/off modulation) of objects.

To the left you will find the blanking mode buttons. As of v1.0.0 there are five **blanking modes:**

- No blanking.
- Dashed blanking that alternates between on and off.
- Dotted blanking that places a single point that creates a straight laser beam periodically along the object path.
- Connected dotted blanking, similar to dotted blanking except the laser is on/unblanked between the points.
- Arbitrary function blanking, which lets you enter a mathematical function that describes the blanking pattern.

Next to the blanking mode buttons, there may be some extra settings depending on what blanking mode is selected. These modify the blanking in various ways. For explanations on what each setting does, check its tooltip by hovering the mouse cursor over it . There is a button in the upper right corner that modifies some of these settings by switching from a relative (for example 5 cycles per object) to an absolute (for example 10 000 length units between cycles) metric.

In the bottom right corner, there is a button that lets you enable **dotted ends**, that means that whenever the blanking switches from on to off and vice versa, a dot is placed. These dots can have their own separate color, which can be chosen using the color selector next to the button.

Settings and tools

In the bottom left area of the window you will find buttons for various settings and useful tools.

HELP: This button opens this *manual*, or shows the *keyboard controls* when hovering over it with the cursor.

SETT.: This button opens the settings view, see separate chapter.

SCOPE: This is the *editing scope* button. It lets you edit the starting and ending frame of the editing scope, in other words what frames your edits will affect. For example, if your scope is 5-10 and you create an animated object, the object will be placed and animated from frame 5 to 10, no other frames before or after will change. This affects both creating new elements and reapplying.

ONION: This toggles *onion skinning*. It superimposes the previous frames over the current one, to let you manually draw animated frames easier. By right-clicking, you can edit various settings, such as the number of earlier frames to preview, or the transparency level of the previewed frames.

GRID: This button changes the grid displayed over the drawing area, you can choose between a square and radial grid and alignment guidelines. There are also keyboard shortcuts for these that lets you change settings and display several grids at the same time, see the section for keyboard controls.

There is also a button that opens the **timeline mode** (Shortcut key: **[Tab]**). See the chapter on the timeline mode for more information.

Above the timeline button, there are controls for playback (Play, pause and stop) and buttons to increase or slow down playback speed.

REAPPLY: These buttons remakes the selected object (you can select objects by using the up/down arrow keys). In other words it *reapplies* new properties such as blanking and coloring to the object, depending on whether you press the Coloring or Blanking reapply button. The shape of the object stays the same, however. Other properties, such as displacement and removing overlapping points can be done using either button. A shortcut for both buttons is the **[Enter]** key, this triggers both recoloring and reblanking. Next to the reapply buttons there are buttons for related settings, such as **color and blanking blend modes**. See the dedicated chapter later in this document for more information on reapplying.

Settings/tools in top menu

You will also find some more tools and settings in the menu at the top of the screen. If you have used an earlier version of LasershowGen, some of these tools used to be buttons in the "Settings and tools" area rather than being part of the top menu. A more detailed explanation of a few of these can be found here:

Tools → Load/toggle background image: This buttons lets you load an image from your computer to get *superimposed* on the screen, allowing you to *trace* the outlines when drawing the frame. Clicking it a second time will disable the image. Only JPEG and PNG file types supported right now. The image will stretch to fill the entire drawing area, so if the aspect ratio is not square, or if the image is supposed to be small, it is recommended to open the image in an image editor first, and using the Resize->Canvas.. tool to add some blank space around the image to force a certain size and shape when stretched.

Tools → Toggle alignment guidelines: This toggles guidelines on the screen that helps you create symmetrical and aligned frames. Green lines mark the center of the screen. Gray lines mark the ending and starting points of objects, red lines are symmetrical to gray lines. Keyboard shortcut: [A]

Tools → Toggle onion skinning: This toggles *onion skinning*. It superimposes the previous frames over the current one, to let you manually draw animated frames easier. By clicking Options → "Onion skinning settings", you can edit various settings, such as the number of earlier frames to preview, or the transparency level of the previewed frames.

Properties → Change number of frames: This sets the number of frames in the current animation.

Properties → Change FPS: This sets the nominal playback speed in frames per second. Default is 30. FPS and scan rate (see chapter on settings) determines the amount of points in an outputted frame when optimization is enabled.

File area

This area contains buttons related to the input and output of files from the program. As of v0.9.7 there are only two buttons here:

Export ILDA
This button exports your work into an ILDA file. If you have not yet entered a ***license code***, it will ask you for one. You must remember to end the name of the file in ".ild", or the program will create a file with no extension and you will probably need to rename it to be able to open it with other programs.

By right clicking on this button, you can choose between optimized and raw output, and ILDA format 5 and 0 output. More information about this in the "Settings and tools" chapter (previous page).

Import ILDA
This button imports an existing file into the project. ILDA formats 0 and 1 (with default 63 color palette) and 4 and 5 are supported.

Save Frames
This button saves all the frames in the LasershowGen project into a file of format IGF (LasershowGen Frames), so that you can save the progress and resume work later. This is different from exporting the ILDA file, the saved file can only be opened by LasershowGen itself.

Load Frames
This button loads an IGF file (see SAVE for more information).

Send to timeline
This button sends the frames to the timeline mode. Before clicking this, you must have selected a position on the timeline. To do this, enter the timeline mode by pressing [Tab]. Then select a position on one of the layers in the timeline by clicking on it. This marks where your frames from the editor will be inserted. When you have marked a position, you can click the "Send to timeline"-button or press [I] to copy the frames from the editor mode to the timeline. You can read more about the timeline mode in the next chapter.

The animation area

This area contains tools to automatically animate your objects. By default animation is disabled, but if you click the **check-box marked "Enabled"**, many new buttons and tools with a cyan tinge, should appear. These are the animation-end equivalents of their neighboring tools. The objects you now draw will transition from the main settings, to the animation-end settings (marked with a cyan tinge), over the course of the frames within the animation scope.

Other than the enable checkbox, there are four tools inside the animation interface area:

The check-box marked **"Current frame only"** toggles filling all the frames with the objects that you draw. If this is unchecked, an object, even if animation is disabled, will be copied to all the frames rather than just the active one when placed. Also, this check-box decides whether or not the last frame will be copied to the rest when using MAX button to extend the number of frames in the project.
When loading external ILDA files, this check-box decides whether or not the ILDA file will loop after reaching the end if the number of frames is lower than that of the LasershowGen project. For example, when this button is checked and you load a 10 frame long file into a project that currently have 30 frames, the loaded file will loop three times, filling all the frames available.

The row of buttons in the bottom of the area, is the **animation mode selector**. It lets you choose the animation function, in other words how the transition over time looks, and whether or not the animation loops seamlessly. Experiment with different modes to find what looks best for your desired effect.

This button above, with one clear and one blurry line, toggles **shaking**. It will shift the object slightly in a random direction for every frame, making it shake when the animation is played back. When shaking is enabled, a slider that lets you adjust the intensity becomes visible.

The button to the right with the **red X** resets all the displacement/movement animation of an object, including shaking. It copies the X and Y origin coordinates of the object in its first frame, to all its other frames.

More on key features

Reapplying

The REAPPLY buttons are very useful tools. To use them you must first select an object you have placed by holding down [Ctrl] and clicking on the object, or using the Edit → Select All tool in the top menu. Once selected, if you click either reapply button, the object is remade with all the properties like color, blanking and displacement that is currently set. As the name implies, the REAPPLY COLORING button recolors the object and the REAPPLY BLANKING button reblanks it. To reapply other properties like displacement and removing overlapping points, either button can be used. There is also a keyboard shortcut, [Enter], that triggers both coloring and blanking reapplying. Only the shape of the object stays the same. For example, if you have a plain solid line, and reapply it while the blanking mode in the sidebar is set to dashed, and the color set to rainbow, the plain line changed into a dashed line with rainbow coloring.

By right clicking on either button, you can edit various settings, including:

- ***Affect displacement***, which will toggle whether or not to reapply the displacement (movement) of the object, for example using the shaking effect.

- ***Remove overlapping points***, which will cause all overlapping points in the object, like dots, to be removed and transformed into a single point and smooth segment.

- ***Interpolate points***, which will adjust the number of points in the object to suit the selected resolution. Sometimes this is required to get for example a smooth color gradient when the object consists of too few points.

Blend modes

Next to the reapplying buttons there are two selectors for the **blend modes**, one for **color** and one for **blanking**. The blend mode controls how the original and the new settings are blended together when using the reapply buttons. The default blend modes simply replace the old settings with the new, but by changing this, you can layer settings on top of each other in many different ways to create complex patterns and effects.

The **blanking blend mode** uses binary logic, in other words **AND, OR and XOR**.

For example, if you combine these two blanking settings using the AND blend mode..

‾‾‾‾‾ ‾‾‾‾‾   ‾‾‾‾‾   ‾‾‾‾‾
. . . .

You get this, because the AND blend mode only turns on the laser when both the original *AND* the new blanking settings would turn the laser on:

. . . .

The **color blend mode** chooses how the individual RGB components of the color should combine. You can either replace (default), add or subtract the new RGB values from the original values. For example, the color red combined with the color green in the Additive blend mode gives you the result red+green which is yellow. Then, if you have yellow and subtract green, you get the original red, because yellow, which is red+green – green = red.

The reapplying tool abides the scope settings. This means you can choose to only change the object for certain frames. See the explanation for the scope button in the "Settings and tools" chapter earlier in this document.

Arbitrary function modes

For the shape, blanking and coloring, you have arbitrary function modes available. These modes let you create your own mathematical functions to describe the data of new objects. Functions are equations that use variables and mathematical expressions to get a resulting value depending on what value the variables have. For example, the function "2*a+1" has one variable: a. If for example a=1, the result is 2*1+1 = 3.

For the **shape function mode**, you must create two functions, one for the X value (horizontal) and one for the Y value (vertical). Both of these range from 0 to 65535 (FFFF in hexadecimal), where 0 is the far left for X, and the far top for Y. The number of points to calculate and place can be edited by using the slider above the function input buttons.

For the **color function mode**, you must create three functions, one for each color channel. However, you can choose between using the channels red, green and blue as usual, or you can use a different set of channels: hue, saturation and value/brightness. Use the "RGB|HSV" button to toggle this. All channels range from 0 to 255, where 255 is the maximum.

For the **blanking function mode**, you must create one function to control the blanking, on or off. The laser is on (unblanked) if the result of the function is 1 or higher, off otherwise.

In all functions, you have a set of variables and constants that you must use to make the functions non-constant. The most important ones are:

"**point**" - This variable changes form 0 to 1 over the course of the object (path of points), symbolizing the how the ratio between the current point and total number of points in the object.
"**frame**" - This variable changes from 0 to 1 over the course of the animation, symbolizing the ratio of the current frame to the total number of frames.
"**max**" - This is a shortcut to the max value of the function result, 65535 for shapes and 255 for colors.

You can also use built-in helper functions inside your functions, such as sine and cosine, logarithms, exponential, lerp, etc.

Here are two **example** functions for X and Y respectively:

point*max

max/2+sin(2*pi*point)*10000

These functions will create a simple sine wave in the middle of the screen. The X function increases gradually, pushing the points further to the right than the previous. The Y function is one period of a sine wave with an amplitude of 10000 and a mean of max/2 = 32767.5, which is the center of the screen. As you can see, all functions like sine use radians instead of degrees when describing angles.

Here is a full list of **built-in variables and functions**:

Variables

Items marked * are not available for the shape X and Y functions.

Variable name	Description
point	The current point, ranging from 0 to 1
frame	The current frame, ranging from 0 to 1
startx	The X coordinate of the starting point of the object.
starty	The Y coordinate of the starting point of the object.
endx	The X coordinate of the ending point of the object.
endy	The Y coordinate of the ending point of the object.
*anchorx	The X coordinate of the anchor point when editing objects
*anchory	The Y coordinate of the anchor point when editing objects
*pri_red	The value of red in the current primary color (from 0 to 255)
*pri_green	The value of green in the current primary color (from 0 to 255)
*pri_blue	The value of blue in the current primary color (from 0 to 255)
*sec_red	The value of red in the current secondary color (from 0 to 255)
*sec_green	The value of green in the current secondary color (from 0 to 255)
*sec_blue	The value of blue in the current secondary color (from 0 to 255)
*x	The X coordinate of the current point
*y	The Y coordinate of the current point
max	The max value of the current function, 65535 for X/Y and 255 for color channels
width	The max value of the X coordinate (65535)
height	The max value of the Y coordinate (65535)
pi	3.14.....
e	Epsilon = 2.71....

Functions and operators

Thanks to the ML Parse documentation for the following tables:

Sign	Name	Syntax	Precedence	Associatively
!	factorian	a!	18	Left-to-right
%	Percentage	a%	18	Left-to-right
+	Positive	+a		
−	Negative	−a	17	Right-to-left
~	Binary negate	~a		
^	power	a ^ b	16	Right-to-left
nCr	Combinations	a nCr b	15	Left-to-right
nPr	Permutations	a nPr b		
*	Multiply	a * b		
/	Division	a / b	14	Left-to-right
mod	Modulo	a mod b		
div	Integer division	a div b		
+	Addition	a + b	13	Left-to-right
−	Subtraction	a − b		
<<	Bitshift left	a << b	12	Left-to-right
>>	Bitshift right	a >> b		
<	Less than	a < b		
<=	Less-or-Equal than	a <= b	11	Left-to-right
>	Greater than	a > b		
>=	Greater-or-Equal than	a >= b		
==	Equality	a == b	10	Left-to-right
<>	Inequality	a <> b		
&	Bitwise AND	a & b	9	Left-to-right
xor	Bitwise XOR	a ^ b	8	Left-to-right
|	Bitwise OR	a | b	7	Left-to-right
&&	Logical AND	a && b	6	Left-to-right
^^	Logical XOR	a ^^ b	5	Left-to-right
||	Logical OR	a || b	4	Left-to-right

Function name	Function description
not(a)	binary not
sin(a)	sine
cos(a)	cosine
tan(a)	tangent
degrees(a)	convert radians to degrees
radians(a)	convert degrees to radians
sqrt(a)	square root
power(a, n)	a^n
round(a)	rounds to nearest integer
floor(a)	rounds downwards to integer
ceil(a)	rounds upwards to integer
frac(a)	returns fraction part of number
abs(a)	absolute value
arcsin(a)	invert sine
arccos(a)	invert cosine
arctan	invert tangent
exp(a)	e^a
ln(a)	natural logarithm
log2(a)	base 2 logarithm
log(a)	base 10 logarithm
logn(a, n)	base n logarithm
lerp(min, max, ratio)	Returns a number weighed between min and max
random(min, max)	Returns a random number between min and max
random_normal(mean, standard deviation)	Return a random number with a normal distribution

The timeline mode

Brief usage guide

New to LasershowGen 1.0.0 is the timeline mode (currently still in beta), which allows you to create longer and more complex laser frames, even full shows synced to music. The timeline mode lets you place previously created frames, either made in the editor mode, or imported from ILDA files, in a timeline with layers.

To enter the timeline mode from the editor mode, press [Tab], or use the button in the corner of the window, or the "View" category in the top menu.

To add content to the timeline, first **select a position** by clicking on a layer. The selected position will be marked with a **small red line**. Then, you can send the frames from the editor mode to the timeline by pressing [I], or using the **"Send to timeline"** button. You can also use the buttons in the "File" area in the window to **import** ILDA files or IGF files directly to the timeline.

To create a new layer, press the **+** button in the rightmost area of the layers, below the lowest existing layer. To delete a layer, press the **–** button located on the layer itself.

Once you have placed frames on the layer, they can be **moved around** by dragging and dropping them with the mouse. You can also **resize** them (change their duration) by clicking and dragging the far right edge of the frames. If you resize a series of frames by more than the number of frames it contains, it will loop from the beginning after the last frame. By double-clicking on an object on the timeline, or selecting it then clicking the button "Send to editor", you will open the frames in the editor mode for editing. You can copy and paste frames in the timeline by selecting them and pressing [Ctrl+C] and [Ctrl-V] respectively.

By pressing the **"Env."** button on a layer, you can create an **envelope** for the layer. Envelopes are flexible ways to edit and add effects to the content of the layer. An envelope appears as a graph, and you can edit the graph by clicking or dragging the mouse over it. Hold [D] while dragging the mouse to delete parts of the graph and restore it to its default. Each envelope controls a single property, such as horizontal or vertical displacement, intensity/brightness, or color hue. It envelopes the content of a layer and changes its chosen property in real-time according to the value of the graph. Using this you can achieve many effects easily, such as fading in or out, changing colors, etc.

You can load music to the timeline by clicking the "**Load audio**" button. When you do this, the audio will be parsed to show a **audio visualization** in the timeline, above the layers. NB: It can take a few minutes for the parsing to complete. There are several different colors in the

visualization for more accurate cues: Green is the volume of the music, red is the amount of bass, and blue is the amount of treble.

You can click on the timeline (except on a layer) to change the playback cursor position. Press **space** to **play or pause**.

You can navigate the timeline by using the scroll bars, and the mouse wheel or [F7]/[F8] to zoom.

By pressing [L] or using the "**Add Marker**" button in the "Timeline tools" area, you can add a visual marker to the current cursor position. You can for example use this to tap to the beat of the music in order to align frames properly. The markers can be moved around by dragging them.

In the timeline tools area there are also settings for playback speed, and audio offset.

Once you are happy with the project, you can click the **EXPORT ILDA** button to export it to an ILDA file. You must remember to end the name of the file in ".ild", or the program creates a file with no extension and you need to rename it for other programs to be able to recognize it as an ILDA file. By right-clicking on the export button, you can choose between **optimized and minimized exporting.** If you have not yet entered a **license code**, you will be asked to do so when you export.

You can save and load the whole LasershowGen project by using the **SAVE- and LOAD PROJECT** buttons so you can continue your work later. Remember, this is different from exporting the ILDA file, the saved project can only be opened by LasershowGen itself.

The **blue and red line marked "Start" and "End"** marks the start frame and end frame of what will be exported if you click the EXPORT ILDA button. You can drag and drop them to change their position to envelop the portion you want to export.

Keyboard controls in the timeline mode

Mouse)	Select object or time on timeline (Ctrl to select multiple objects)
Left/Right Arrows)	Move one frame back or ahead
Control)	Hold and click objects on the timeline to select multiple of them
Space)	Play/Pause
Tab)	Enter frame editor mode
P)	Changes previewing mode between 2D and 3D (simulated scanner)
I)	Send frames from editor mode to timeline mode
L)	Insert marker on timeline
D)	Hold to delete points in envelopes when dragging mouse
Delete)	Delete selected objects
Ctrl+Z)	Undo
Ctrl+C)	Copy selected objects
Ctrl+X)	Cut selected objects
Ctrl+V)	Paste
0)	Jump to first frame
Mouse wheel or F7/F8)	Scroll/Zoom (where applicable)
M)	Reset window size
F11)	Toggle fullscreen
F1)	Open this document

Settings

The **settings/options** can be accessed either by clicking "Settings" in the top menu or the SETT. button.

Settings are saved in **presets**, or profiles. You can select the active preset by clicking on the preset indicator in the "LasershowGen" area in the bottom-left corner of the window. In the drop-down menu with the preset selection, there are also options to create or delete setting presets.

Optimization and adjustment

In this area you will find settings related to the output of LasershowGen. As of version v1.2 this means mostly **optimization settings**, including the ability to turn optimization off completely. NB: Unoptimized output is only meant for simulation or to optimize it in a separate program later, attempting to play an unoptimized file on a scanner might damage it.

- **The scan rate** is the intended speed of the scanner in the laser projector, measured in points per second. The total number of points in each frame is scan rate divided by FPS (adjustable in "Properties" in the top menu).

- **Dwell** is the amount of points to dwell at the end of segments. Setting this too low might cause stress on the scanners, warped corners or color bleeding.

- **Max travel** is the maximum length between points allowed before the optimization is considered failed. The unit is one where the total width or height of the frame is 65535 (16-bit).

ILDA file format can also be selected. It is recommended to use the default **format 5** for most purposes, but some older programs and SD card readers may only support **format 0**. Note that because format 0 uses a color palette limited to 63 colors by default, some effects like gradient coloring and fading will not work properly. When exporting to format 0, LasershowGen will automatically fit the colors of the frame into the closest available palette color, using the CIE94 color comparison definition.

Troubleshooting

"Error defining an external function"

If you get this error message at startup, try downloading and installing Visual C++ Redistributable Packages for Visual Studio 2013.

Exported files don't play on my projector at all or are unrecognizable

First of all, make sure you have exported an ILD file by using the "Export ILDA" button instead of the "Save Frames" button, which is LasershowGen's own file format not supported by other programs or projectors.

The most likely problem is that your projector or software may not support ILDA format 5. Try choosing the legacy ILDA format 0 in the "Options" menu at the top of the screen, then export the file again. For more info on this, see the paragraph about the export button on page 13.

Exported files don't play well on my projector (warped, bad quality)

LasershowGen tries to optimize the exported ILD files to play well on scanners, but sometimes the optimization may be inadequate. If LSG thinks this is the case, it will warn you during export. The easiest way to make a frame scan better is to reduce it's complexity. Large amounts of text is especially hard for scanners to project properly.
You can try experimenting with some settings to make it better. These three settings are particularly relevant, found under the "Options" menu at the top of the screen:

"Set max travel distance": Try reducing this value to make it easier for low-speed scanners to draw the image without warping.

"Set max dwell": Try increasing this value if some light bleeds into segments that are supposed to be blanked, or opposite, or if sharp corners get rounded.

"Set scanning speed": Set this to the speed of the scanner in your projector. For example 20Kpps would mean a value of 20000.

If nothing works, you can use a separate program to optimize the frames instead. Examples include LaserBoy (free and included, see next chapter in this manual) and ILD SÔS (commercial). LasershowGen will continue to improve the built-in optimization in future versions.

Buttons and menus in the program don't work or react slowly

You may have a program installed that interferes with LasershowGen, blocking mouse and button presses. One such program is ClipboardMaster, if you have this program installed and experience problems, please close it while you are using LasershowGen.

Anything else

If you experience any other problems, or need support, please contact the developer at
gitlem@gmail.com

LaserBoy

Included with the Windows version of LasershowGen is the open-source project LaserBoy, by James Lehman, Extra Stimulus Inc. james@akrobiz.com, © GPL v3 2003...2014. http://laserboy.org

LaserBoy is a great supplement to LasershowGen as you can do further editing of ILDA files exported, like manipulating individual points, and converting to additional formats like ILDA version 0 and 1, wave files for playing on sound card DACs and more.

LaserBoy can be installed by unzipping the zip file found in the installation folder of LasershowGen. You can also always find the newest version here: http://laserboy.org/forum/index.php?topic=10.0

To start LaserBoy, first check out its README.txt file and set its window size in LaserBoy.bat, then double-click on LaserBoy.bat.

Fonts

LasershowGen uses ILDA font files in much the same way as they were originally designed to work in LaserBoy. LasershowGen comes with font_arial.ild by permission of James from the LaserBoy distribution. There is a nice collection of other font files included in the LaserBoy distribution, inside of the ild folder, all starting with the name font_(name).ild

The following glyphs are available:

!"#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

This is the Latin Alphabet, digits, punctuation and other symbols from the standard ASCII text table symbols 33 to 126 in the same order. The space character, ASCII 32, is an implied part of the available characters but is not visible.

Each single glyph is a frame in a standard type 1 ILDA file, in the exact order as listed above. The coordinate location (0,0), also known as the origin, is the baseline for each glyph. Each glyph is mostly in the all positive quadrant of coordinate space but some glyphs my descend into negative Y space (in case you want to make your own font files). You can open and examine any of the LaserBoy font_(name).ild files as you would open any other ILDA file.

Loading files into LaserBoy

To load and edit ILDA files in LaserBoy, they must first be moved or copied into the ild sub-folder inside the LaserBoy folder.

With your ILDA files in place, press the "i"-key to input or import a file and then the "1"-key for type ILDA. Type the name of the file you want to load and press [Enter]. Now select what you want from the options on the screen, for example press "1" to replace everything with the loaded file. You should now be back to the main menu, with the file loaded. You can use the left and right arrow keys to preview all the frames in the file, one frame per key tap or the "`"-key (below the ~) to show the frames as a continuous animation (any key to stop).

Optimizing and converting to other formats

While in the main menu of LaserBoy, press "x", this brings you to a menu where you can adjust various on-off settings of the application's behavior. You can see all the options with their keys listed in the window.

If you plan to use LaserBoy for optimizing your frames it is imperative that you turn option "a" off before you save your ILDA file! Otherwise your optimizations will be stripped out (minimized) in the resulting file.

Use option "b" to toggle exporting to legacy ILDA format 0/1 (off), or 4/5 (on).

NOTE: If you turn option "b" off and your vector art uses any palettes other than the "Default_" palette of 63 colors, LaserBoy will save that palette as an ILDA file section 2 in front of all the frames that use it. This is not widely compatible with other laser applications, even though it is a standard part of the ILDA file format specification. If any or all of your frames are "-24-bit-" (possibly from importing formats 4 or 5), then LaserBoy will save a section 3, RGB color table in front of every 24-bit frame, which is no longer part of the ILDA file specification.

When you are finished, press [Esc] to go back to the main menu.

If you want to save any settings you have changed, from the main menu, hit "o" to output a file, "6" for type wtf and simply hit [Enter] for the default file name of "LaserBoy.wtf". This will save all settings. When LaserBoy starts it reads this file and adopts these settings. You can also save wtf files of different names and load them by name any time the application is running.

If you want your frames to be saved as the most common and widely compatible formats 0 or 1, then you can match all of your colors to the standard "Default_" palette by hitting "p" from the main menu to go into the palette transforms menu. From there you will see two palettes side-by-side. The one closest to your art will be the current palette for the frame in the view (possibly "-24-bit-" no palette). Use the up and down arrow keys to find the "Default_" palette in the target palette position. Hit "B" (capital B) to do a best color match for all frames to the target palette. Now when you save your frames they will be either format 0 (3D) or 1 (2D) standard ILDA files with no palette saved in the file.

To export the file, simply press "o" to output while in the main menu. Then select the desired file format, for example "1" for ILDA. Now press "3" to export the whole file, or one of the other options on the screen. Now give your file a name, for example "test", and press Enter. Your file will now have been created in the same folder as the file you loaded.

System Requirements

Minimum:
- Windows XP, Vista, 7 or 8 with DirectX (Windows version)
- Modern browser with HTML5 support (web version)
- 512MB RAM
- 128MB graphics

Recommended:
- Windows Vista, 7 or 8 (Windows version)
- 2GB RAM
- Modern graphics card with at least 256MB memory
- Modern CPU

Extra credits

Thanks to:

James Lehman, Extra Stimulus Inc. james@akrobiz.com
for LaserBoy and the included ILDA font files
© GPL v3 2003...2014.
http://laserboy.org

Paul Weijtens, paul23
for ML Parser 2.0
© GPL v3
https://code.google.com/p/ml-parser/

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for FileSaver.js
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https://github.com/eligrey/FileSaver.js

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http://www.fmod.org/

icuurd12b42
for GMFMODSimple FMOD wrapper
http://gmc.yoyogames.com/index.php?showtopic=333705

Dr. A. V. Hershey
for the Hershey vector font set
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