GENESIS LASER HARP CONTROLLER (LHC 1)

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THIS MANUAL WILL BE UPDATED SOON! USE THE FRENCH ONE INSTEAD I IT'S EASY TO UNDERSTAND WITH LOT OF PICTURES!

Features:

- **Multiple external sensor models (open and closed frame)**
- **Single or multicolor harp**
- **Dynamic color change**
- **The color of each beam can be set for active and inactive states**
- **Hand height sensing with the sensor number 3**
- **Number of notes (beams) can be easily set between 1 and 20 and stored in patches with instrument settings via the MIDI interface. Each patch/bank can be automatically set by the remote control / footswitch**
- **10 playlists of 20 patches with up to 20 beams each with chord up to 5 simultaneous notes with velocity ON/OFF (attack and release).**
- **Sampler / groove box "toggle" mode**
- **Easy learning mode for each note (cut the beam and play the note on keyboard!)**
- **Use of the X and Y axis of the laser (circle / arc shape laser harp or alternated notes will be possible) so 3 axis with the height sensing!**
- **MIDI remote control to select the playlist/patch and open/close the harp by remote commands**
- **4 lines with 20 characters backlighted LCD for menus and parameters**
- **MIDI IN / OUT connectors allow it to be programmed by MIDI controller**
- **Footswitch or remote control with 3 backlighted push buttons and pitch setting**
- **Optional remote display**
- **ILDA interface to control standard laser**
- **Easily upgradable via USB**
- **Window / Mac remote software coming soon**
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SUMMARY

History

The first laser harp was created and used by the music composer and artist Bernard SZAJNER. A patent was deposed for this invention.

Since this instrument was used and made popular by the music composer Jean Michel Jarre.

This project starts in 2005 on laser boards when I was building my laser projector.
As a fan of Jarre I had already worked on a laser harp using a spectra physic 107 Helium Neon laser in 1999 but I've got the idea to use the ILDA connector to have a laser harp working with a standard multicolor laser like the mine.

A musician contacted me about this project because he was searching a good Laser Harp to compose his music.
Since this moment we have worked together to add useful functions like the playlist, easy learning function and remote display placed near the musician to show which song is played.

It's like an instrument built by musician for musicians.

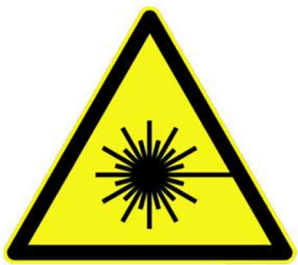
I've shared this project on the net since the beginning and we've got lot of problems like removing the ambient light.
Now we have a great system with lot of features and a sensor working with ambient light and able to detect the hand height.

Don't forget to compare with competitors, thank you if you are choosing this laser harp and a big thank you by support us by having bought a fully assembled unit.

Feel free if you have any question. Lot of features has been added by customer request simply by firmware update! (like no velocity mode for old synths, remote LCD features etc…)

Even if you have compatibility problem with your hardware we can design special adapter to works with our laser harp (footswitch cable for example).

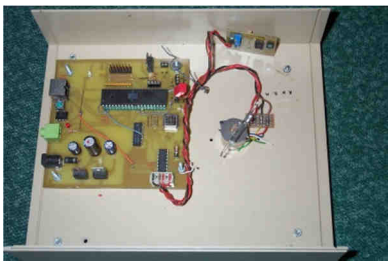
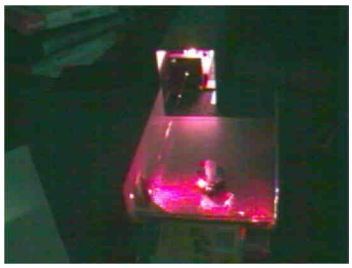
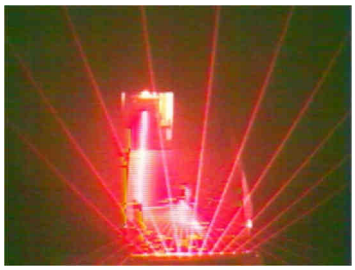
DISCLAIMER:
This Laser Harp is intended to be used with an ILDA laser.
We can't be responsible of any damages caused by the use of this controller.
Lasers are dangerous so be careful, do not look directly in the beams!
The white gloves are used to help the sensor to detect the scattered light from the hand.
The mean power of the scanned beam is not enough to cause skin damage except if there's only one beam!



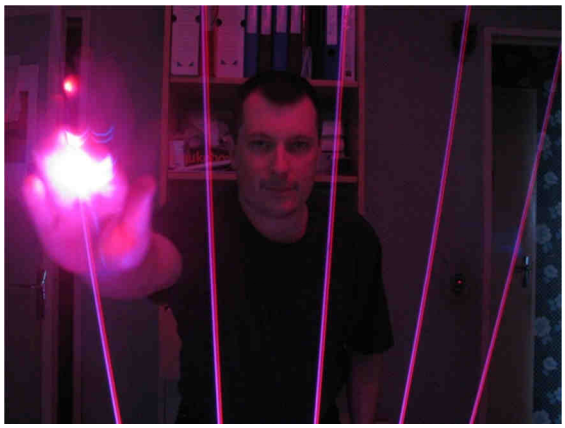
LASER RADIATION

Project evolution

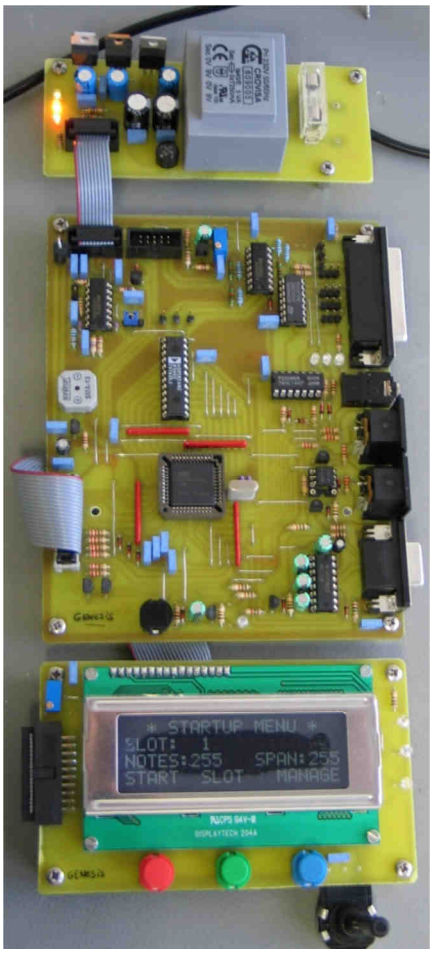
1999

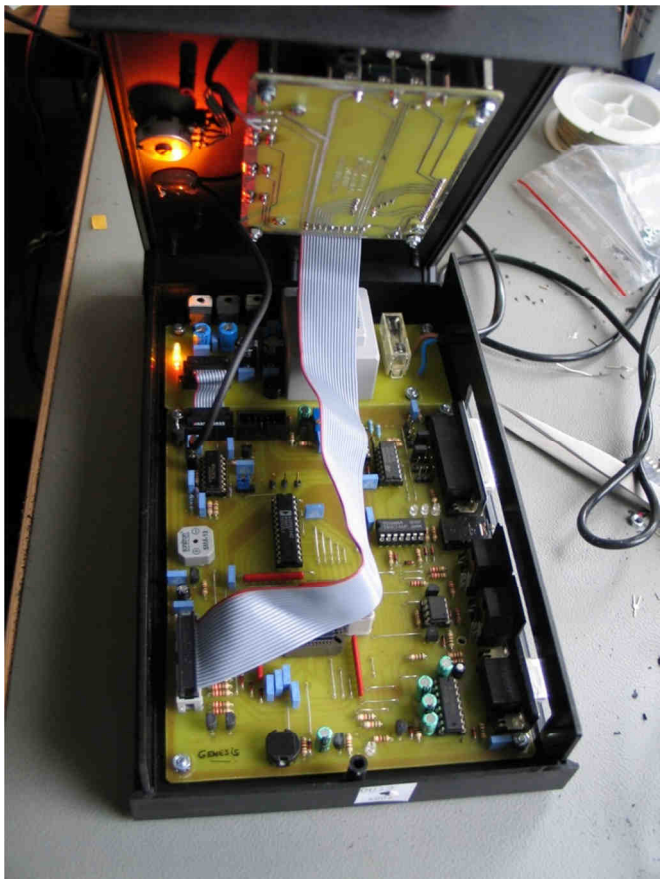




2005

2008





Before to begin…

The laser harp is a complex electronic and optical system. It's not infallible and even if the sensor 3 reject ambient light the stage condition can cause detection problem.
As you know the sensor is waiting for the scattered laser light from the hand with the glove. It must detect a small amount of laser light in a big "optical noise" so you must make a test before to play live and avoid the direct light to the sensor (it's not useful because you can't see the beams in that case!)

The smoke is another problem with the laser harp!
As you know the sensor must detect a weak echo of light. The smoke allows the beams to be seen by the musician and audience but if you see the beam the sensor also!

You must be sure to have homogeneous smoke when setting the sensor sensivity and avoid smoke density variation during the live. You can use a hazer machine instead of smoke machine or a large fan to stir the smoke.

This is why it's very hard to use it outdoor.

The sensor number 2 was made to increase the reliability of the detection by using a "light pipe" or "light guide" system. It's the "closed frame" one.

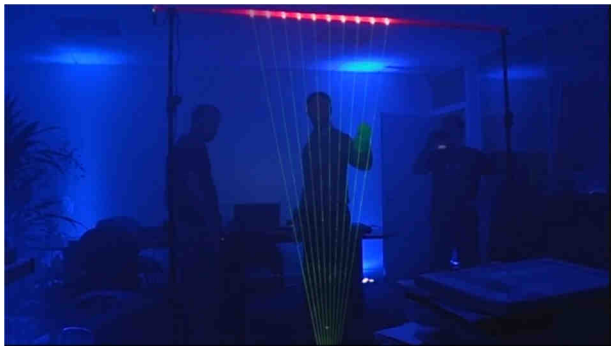
An acrylic rod is used to collect all the beams and the sensor is installed at one end of this rod.
The rod can be charged with fluorescent color (like fluorescein / rhodamin) to increase the signal/noise ratio (SNR)

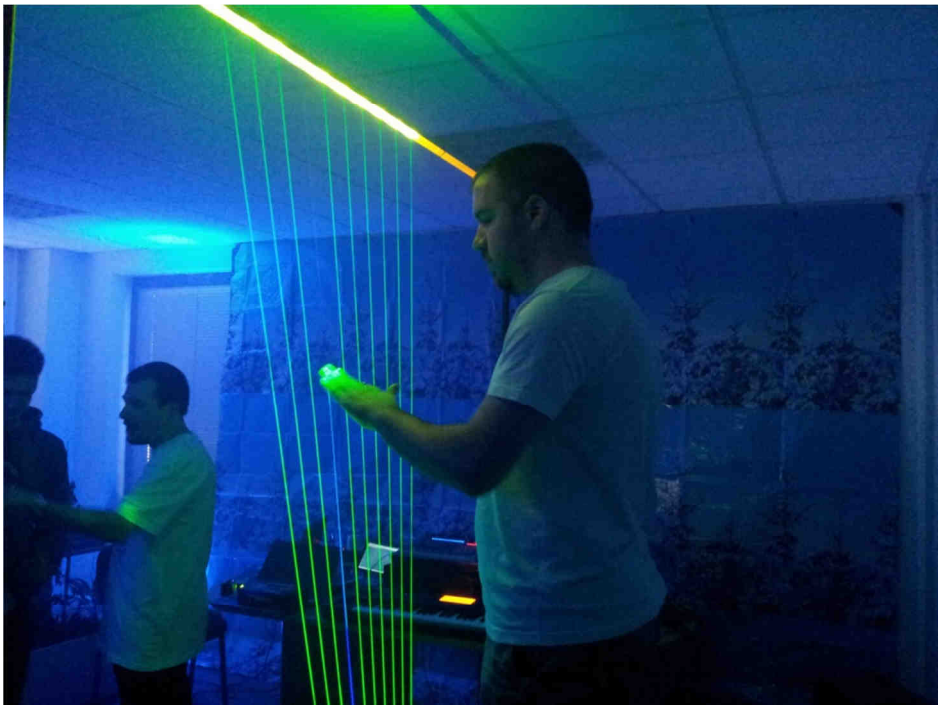
With this mode the note is played when the beam is totally cut by the hand and not by reflection.

Advantages:
- Detection more reliable with lot of smoke
- The gloves are not required
- Visually fun with the bar fluorescence the laser is green and the bar is red or orange

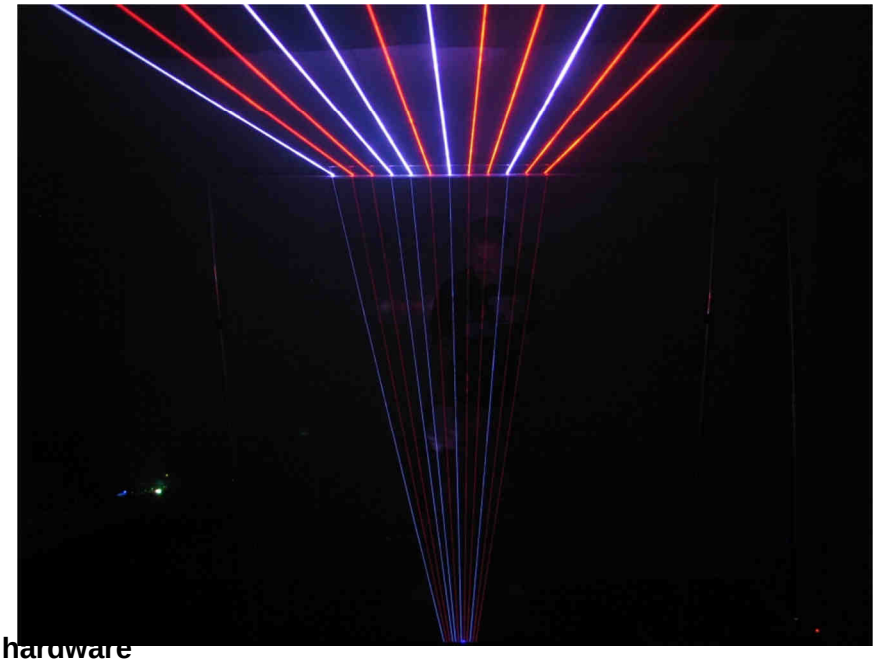
Disadvantages:
- A mechanical frame is required to install the acrylic rod
- Hand height can't be used except with a special adapter
- Top mirror can't be used
- Expensive

Here is the test setup with this sensor:





A frame can be used to install a ”top mirror” to reflect the beams over the audience (except with sensor 2)



Required hardware

This laser harp controller must be connected to an ILDA laser to have a fully functional system.

The laser can be mono or multicolor with at least 300mW of output power with 10 KHz laser source modulation speed (TTL or analog).

When using a multicolor laser you must check if the “human eye” optical output power is nearly equal for each color (nearly white color if all the sources are turned on)

The critical point is about the deflection system.
It must use real scanners and not stepping motors but it’s generally the case with ILDA laser.
The scanner speed must be at least 25 KPPS (Kilo point per second)

Some trouble can occur if the laser doesn’t respect these requirements like:

- Large beams, no light space between the beams, the sensor 3 doesn’t trig (the scanner speed is too slow / laser modulation speed is too slow)

- Space between the beams is not equal (scanner speed too slow or the driver is not accurately tuned)

- The color is constantly changing when using dynamic color mode (the optical power is not nearly the same for the two colors so the sensor detect only one of them)

The controller is programmed to have a nearly constant 60 Hz scanning speed regardless of the number of beams.

Contact us if you have some troubles with your laser. We can modify the code to have slower scan speed.

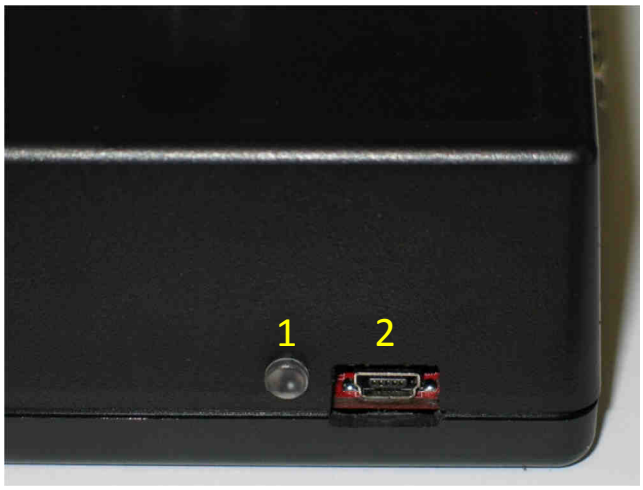
CONTROLLER FRONT VIEW:

1: 4 lines 20 characters with white backlight LCD (other color on demand)
2: Character +/- knob / sensivity for sensor 1 (option)
3: Trigger led (blue)
4: MIDI OUT led (red)
5: MIDI IN led (green)
6: Left button (blue light)
7: Middle button (white light)
8: Right button (red light)
9: Remote LCD connector (optional)

REAR VIEW:

1: Power switch
2: AC/DC IN. Connect an AC or DC adapter with an output voltage between 7 and 25v
3: ILDA interface. Connect to a single or multicolor laser
4: SENSOR. Connect the external sensor to this connector
5: MIDI OUT. Connect to the MIDI IN of the keyboard, computer or expander
6: MIDI IN. Connect to the MIDI OUT of the keyboard, computer or expander
7: REMOTE CONTROL. Plug the remote control or foot switch to this connector.

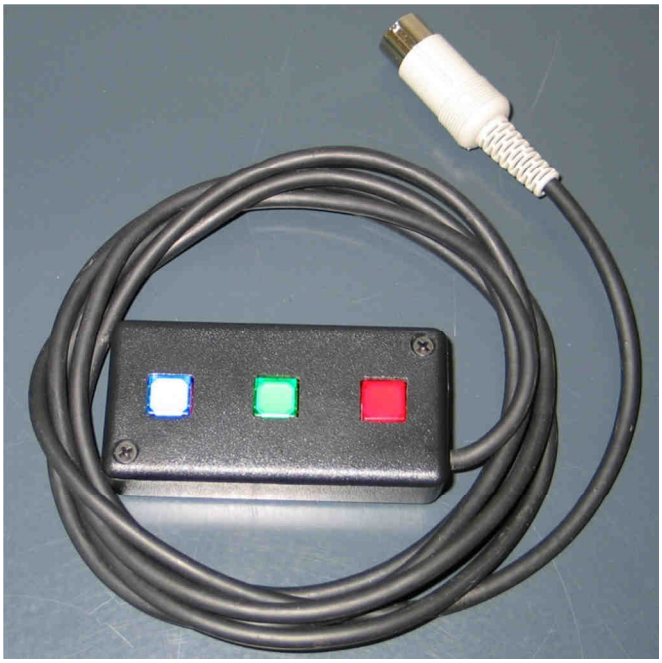
LEFT VIEW:



1: USB connection (yellow) and activity (red/green) indicator
2: Mini USB connector used for firmware upgrade and software remote control

REMOTE CONTROL:

This optional item is used to remotely control the laser harp.

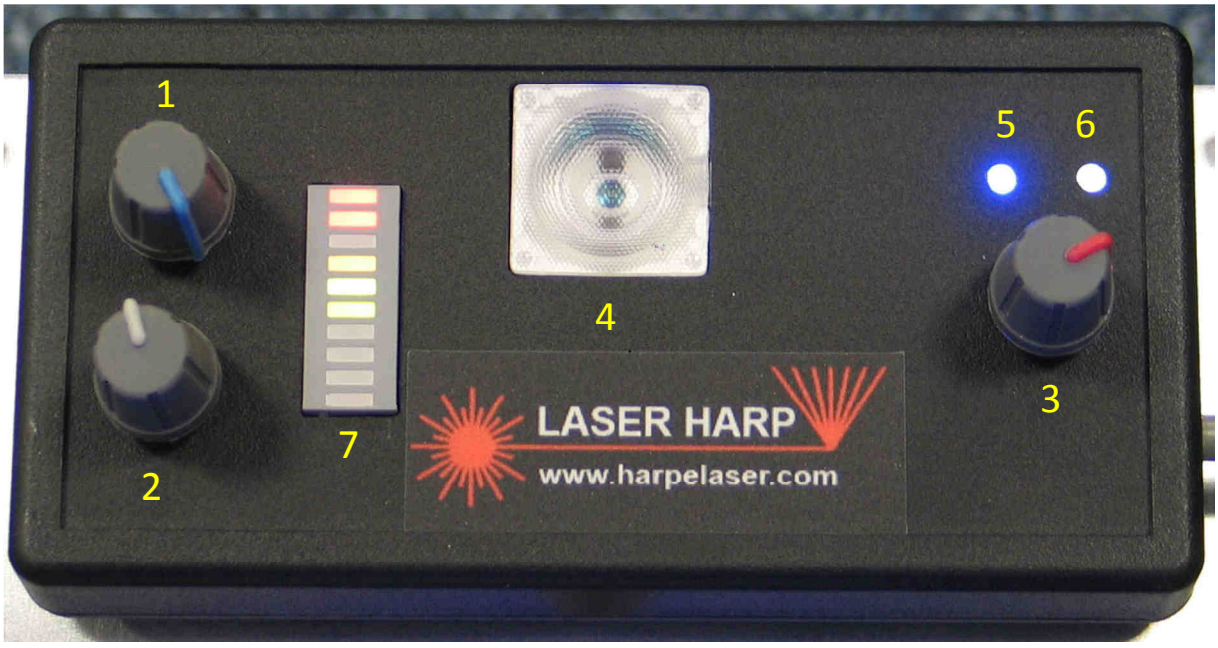


1: Blue switch
2: Green switch
3: Red switch
4: Analogue pedal input (pitch)

SENSOR NUMBER 1:

SENSOR NUMBER 3:

It’s the third and most advanced sensor. It can work with ambient light and sense the height of the hand in the beams!



1: Height offset knob
2: Height scaling knob
3: Trigger sensivity knob
4: Lens
5: Power led (blue)
6: Trig led (white)
7: Height bar graph indicator (color can be changed on demand default = yellow)

REMOTE LCD:

This optional item is used to have useful information near the musician like the actual patch/playlist setting, the next memory when the footswitch is pressed etc…
It's like a H.U.D. (Head Up Display) when the controller can't be installed on stage.

1: 20 character 2 lines backlighted LCD
2: Blue indicator
3: White indicator
4: Red indicator

ADJUSTABLE STAND:

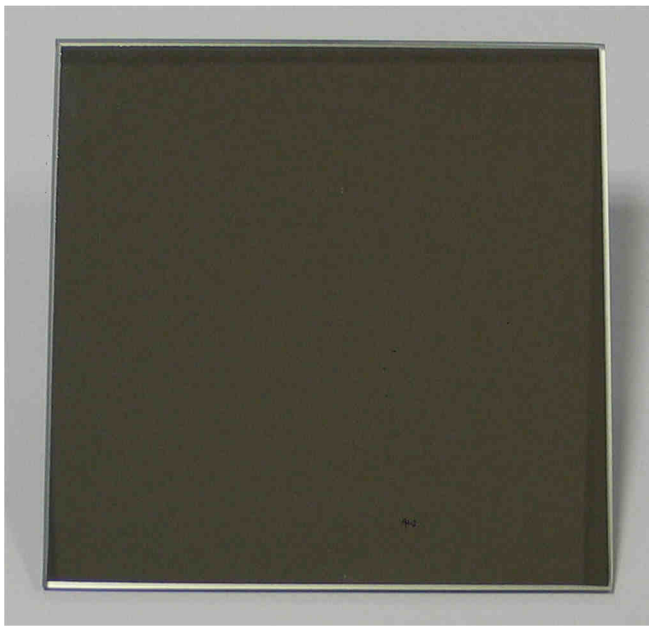
This stand is used to install the mirror and/or the sensor on the ground.
It's simply a piece of wood with an adjustable mount screwed on it.

MECHANICAL LINK:

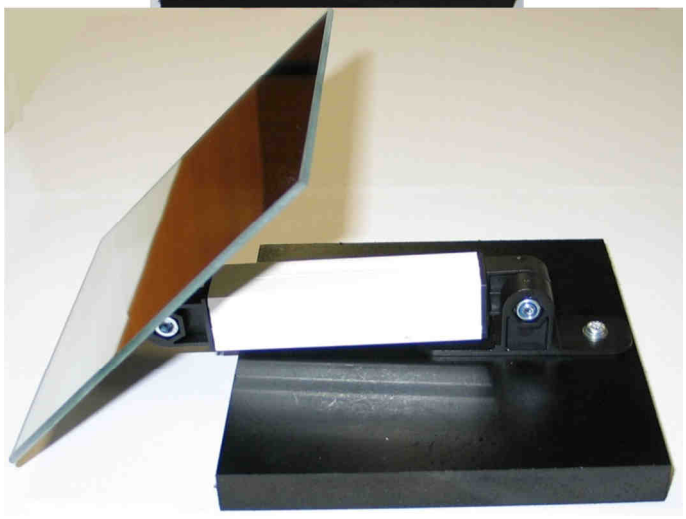
This little piece of square plastic tube is used to “connect” the stand with the mirror if required.

MIRROR:

The mirror is used to reflect the beams from the laser at a near vertical angle.
This angle can be set thanks to the adjustable mount.



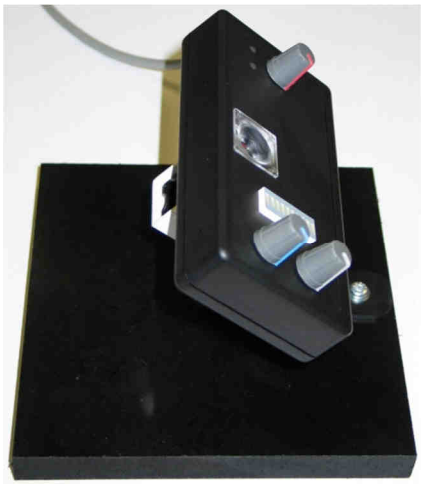
With the link and the stand other combinations can be obtained.



SENSORS STAND:

The sensors use the same system.

Allowing the angle of view of the sensor to be easily set.

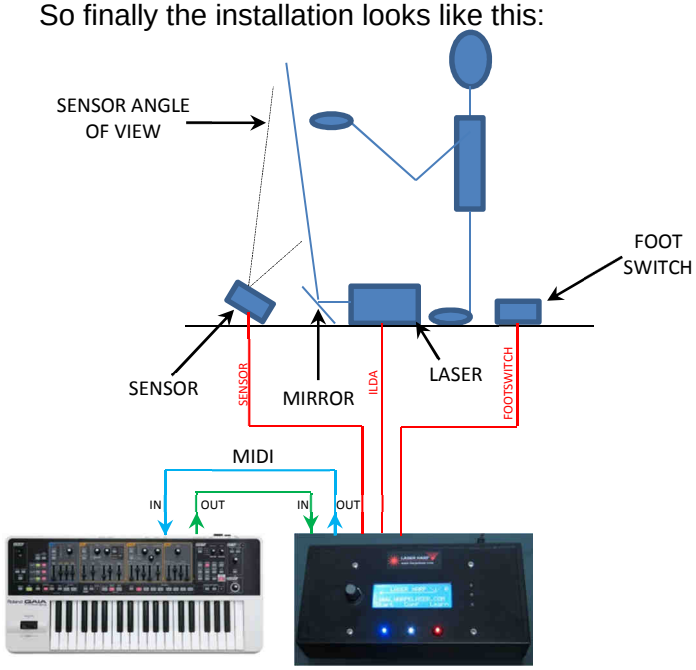


How to use our laser harp controller? Easy!

FIRST STEP: THE SETUP
This controller must be connected to a single or multicolor laser with an ILDA cable.
The laser is installed on the floor and a mirror is used to reflect the beams with a near right angle.
The user or musician is installed behind the laser source and a sensor is set on the ground and look to the front of the user to sense the echo light from his hand.

A midi synthesizer is connected to the laser harp controller with two midi cables “IN” and “OUT”.

A remote control or a footswitch is used to open/close the harp and switch between the tracks / octave / playlist.
These options can be chosen in the configuration menu.
So finally the installation looks like this:



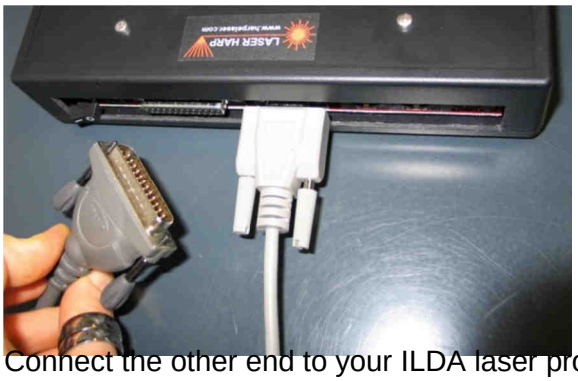
Notes:

- **You must have a MIDI keyboard to program the notes in the laser harp.**
- **The sensor must not directly see the ceiling because the reflected beams cause a wrong detection.**

Installation step by step:

First connect the sensor serial type cable on the rear of the controller

Connect the ILDA cable



Connect the other end to your ILDA laser projector

Now connect the remote control cable

Connect the MIDI cable from the OUT connector of your synth to the IN of the controller

Do the same with the one from the IN of the synth to the OUT of the controller

And the last cable is the AC/DC power input

Now you can plug the power adapter in the AC outlet.

Well done! The controller is ready to be powered on!

So, let’s go! And push the power button at the rear of the controller

Normally you will get this screen

Where “PROTOTYPE DE DEMO” is replaced by your first name and last name.
Followed by this one

It’s the main screen when you start the harp.

The “0” at the top right corner indicate the sensor model recognized by the Harp.
A “1” indicate “SENSOR 1” is recognized.
In that case “0” indicate no sensor is connected.

At the bottom of the LCD you have a LEGEND over each illuminated buttons.

In that case the blue button is used to enter in the playlist menu

The white one is for the configuration menu and the red one is for learning or patch programming procedure.

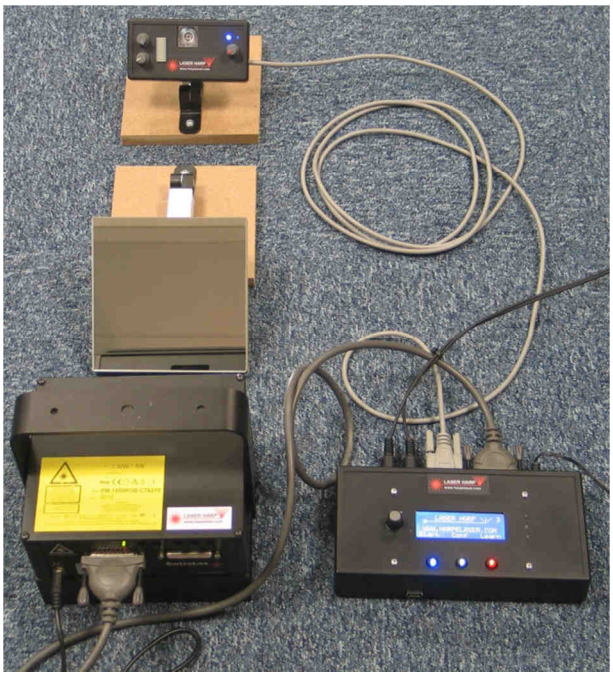
The light is turned off when the button is not used (no legend over it)

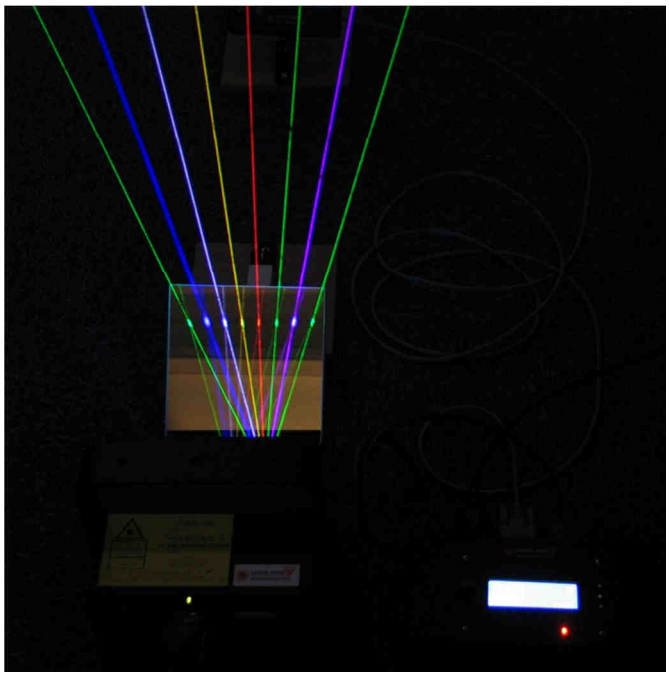
Note:
The “trigger” blue led can light if you are using the sensor 1 with “modulated laser” jumper set to “OFF” and a blinking light source over it.
You can turn the sensivity knob to the left to decrease the sensor level.

The “MIDI IN” green led can light if your midi instrument broadcast midi messages like the time code. It’s normal.

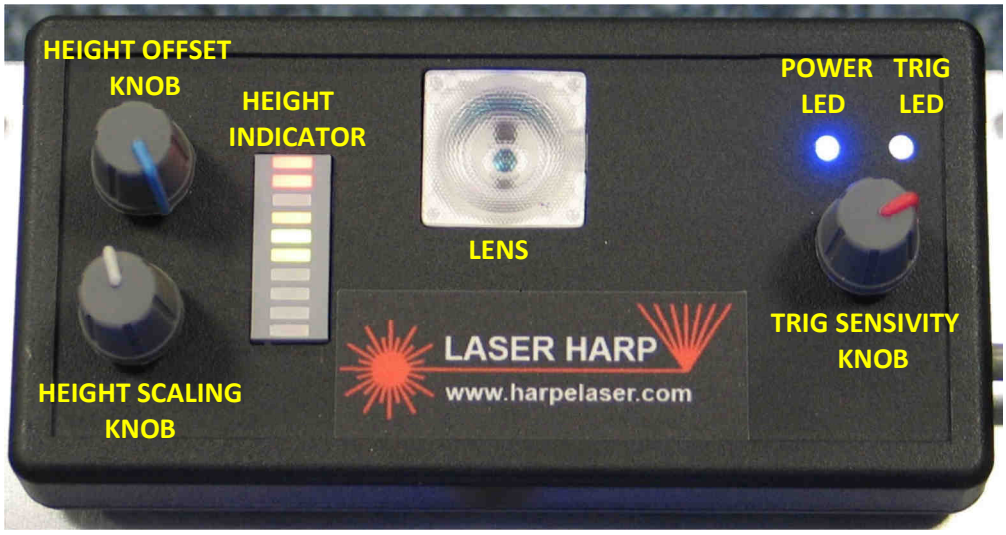
You can try to play some notes on your keyboard and check if the “MIDI IN” led is blinking to check the MIDI connections.

The final installation must be like this:





HOW TO USE THE SENSOR 3



This sensor is our latest design and is the most complex.
We have worked hard to have a sensor rejecting ambient light and allowing detecting the hand height.

Note: be sure to turn on the laser controller with the sensor 3 already connected because a recognition step is required (blue led blinking at startup).

The sensor must be installed in front of the musician with a distance comprised between 50cm to 2 meters and with an angle near 45°.
It must “look at you”.

When it’s done turn all the knobs to the left.
Start the laser harp with your patch and use white gloves.

Cut a beam where you think to play at the maximum height and turn the “TRIG SENSIVITY” knob until the trig led blink or the beam indicator of the LCD show an activated beam.

Make a test for each beam to be sure of the right sensivity setting.

Now the next step is to adjust the height sensing.
Do the same thing as before and cut a beam at your lowest desired height.
Slowly turn the “HEIGHT SCALING” knob until the top last led of the bar graph is illuminated.

Remove your hand and check if the bottom first led of the bar graph is glowing.
If yes turn the “HEIGHT OFFSET” knob to turn it off.

It may be necessary to readjust the “HEIGHT SCALING” again.
When it’s done the glowing light on the bar graph should vary with the height of your hand.
Several led should come on when you are playing simultaneous beams.

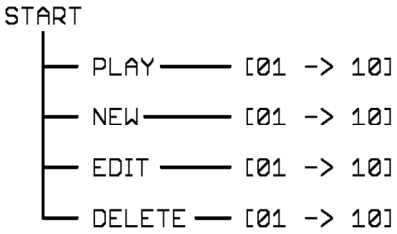
Don’t forget to set the parameter used by the height in the configuration menu.

Note:
Try to play the beam without changing a lot the angle of your hand.
With beams of different color the measured height value can slightly change.

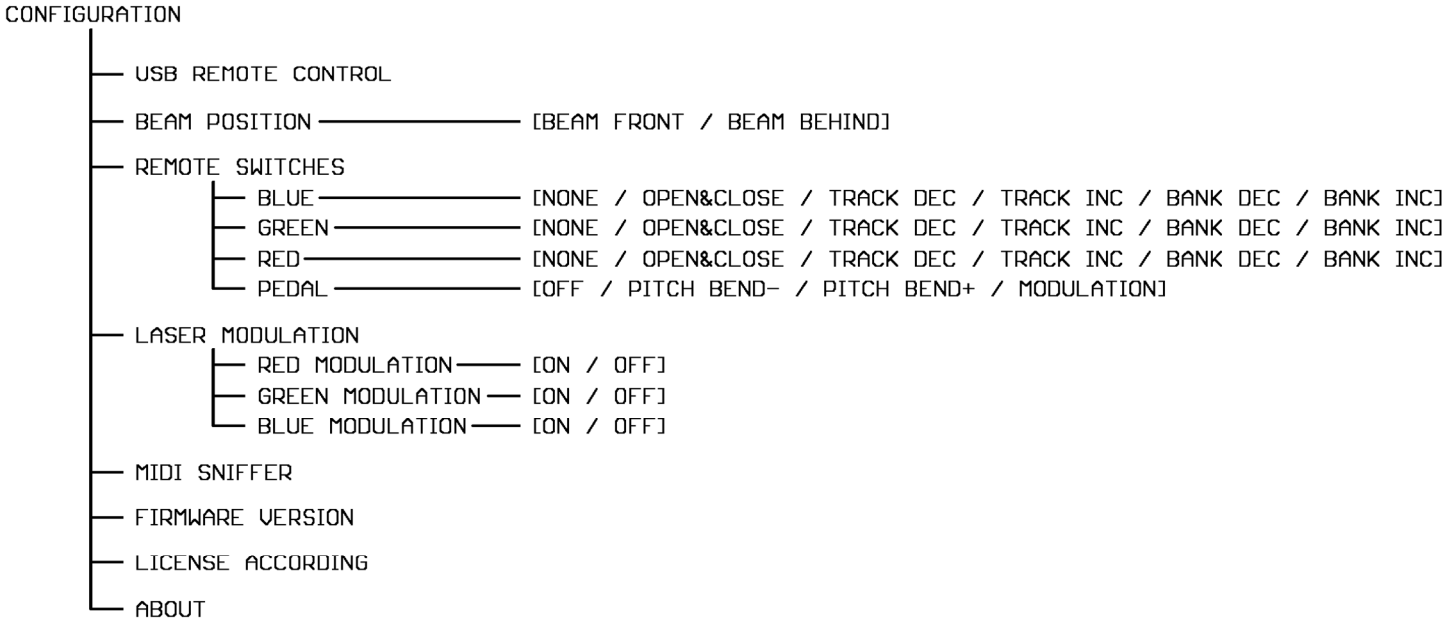
MENUS ARCHITECTURE

Here is the menu architecture when you press “**START**” button (playlist)
The values are displayed between [ ]. The first one is the default value.

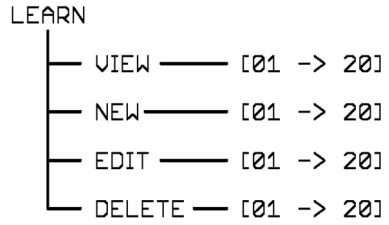
Example: GREEN MODULATION [ON / OFF]
The “GREEN MODULATION” parameter can take two values “ON” or “OFF” and “ON” is the default value.



Here is the menu architecture when you press “**CONF**” button (configuration)
The values are displayed between [ ]. The first one is the default value.



Here is the menu architecture when you press “**LEARN**” button (learning)
The values are displayed between [ ]. The first one is the default value.



MENUS DESCRIPTION

START MENU

This menu is used to manage playlists or “parts” (see next section).
Up to 10 memories can be named and filled with up to 20 patches.

Note: you must create at least one patch to use the playlist function.

PLAY
This menu is used load your playlist or “parts”.
In example when you start a concert.

NEW
This menu is used to create playlists or “parts”
You must enter a name and select which patches are used before to save the playlist slot.

EDIT
This menu is used to edit playlists or “parts”

DELETE
This menu is used to delete playlists or “parts”

CONFIGURATION MENU

It’s the configuration menu.
Here you can set several parameters such height sensing, MIDI channel or velocity sensing activation.

USB REMOTE CONTROL:
This menu allows the controller to be remotely configured by software.
With it you can easily create a patch a playlist or save and share your settings.
Note: you must disconnect the MIDI IN and MIDI OUT cables during the use of this option.

BEAM POSITION [BEAM FRONT / BEAM BEHIND]
This parameter is used to reverse the order of the beams according to whether you are.

Example: The laser can be hidden below you (like for a stand) or in front of you.
This option reverses the beam order to correct the position.

REMOTE SWITCHES

BLUE [NONE / OPEN&CLOSE / TRACK DEC / TRACK INC / BANK DEC / BANK INC]
Here you can set the function of the blue button on the remote control.
“OPEN & CLOSE” allow the user to open and close the beam for each push.

“TRACK INCREMENT / DECREMENT” allow the user to move between playlist memories.

“BANK INCREMENT / DECREMENT” allow the user to move between instrument bank on the synthesizer.

GREEN [NONE / OPEN&CLOSE / TRACK DEC / TRACK INC / BANK DEC / BANK INC]
Same as Blue.

RED [NONE / OPEN&CLOSE / TRACK DEC / TRACK INC / BANK DEC / BANK INC]

Same as Blue.

PEDAL [OFF / PITCH BEND- / PITCH BEND+ / MODULATION]
An optional analogue pedal can be connected to the remote control or directly to the Laser Harp controller and acts on a parameter like the height sensing funtion.

Note: for a footswitch the parameters depends of the electrical wiring.
Blue is for a contact from "**/RMT_BLUE_SWITCH**" signal to ground.
Red is for a contact from "**/RMT_RED_SWITCH**" signal to ground.
Green is for a simultaneous contact of "**/RMT_BLUE_SWITCH**" and "**/RMT_RED_SWITCH**" to ground (see connector pinout).

LASER MODULATION

RED MODULATION [ON / OFF]
This parameter is used to set if the laser is turned off or not between each beam.
When the parameter is set to "OFF" the notes are not separated but this mode gives more laser output power.
GREEN MODULATION [ON / OFF]
Same as red.

BLUE MODULATION [ON / OFF]
Same as red.

MIDI SNIFFER

This menu allow you to analyze your MIDI controller keyboard if you have a doubt about a message value or for debug purpose (to help firmware designer) if you have an issue.

FIRMWARE VERSION

Here you can see the ID and the firmware version with date of your laser harp controller.

LICENSE ACCORDING

Here you can see information about the owner of the laser harp and if the unit is allowed for commercial use.

ABOUT

Copyright and mail of the development team.

LEARNING MENU

This menu is used to create what you want (number of beams, color) and program the beams with the right instrument.
It's the first step to use the laser harp.

Up to 20 memories can be named and filled with up to 20 beams and store the instrument used to program it.

So yes, when you recall the memory the synthesizer is automatically reprogrammed with the right instrument!

For each memory each beam can be set with:
- The right key note on velocity (auto mode)
- The right key note off velocity (auto mode)
- Its own off state color
- Its own on color

Each beam can play from 1 to 5 simultaneous notes (chord).

VIEW
This menu is used to view or "test" your patch to check if all is working fine.

NEW
This menu is used to create a new patch.

EDIT
This menu is used to edit a patch.
Like if you want to change the number of beams, beam color or note.

DELETE
This menu is used to delete a patch.

Great! Now you are ready to program your harp….

I) How to program our harp? Easy!

But you must know how it works.

The harp has 20 memory slots used as "PATCHES"
- Each patch store the instrument you want to play
- Each patch can be in "harp" or "pattern" mode
- The harp can be opened slowly or fast
- Each patch can use between 1 to 20 beams
- Each beam can have his own active and inactive color
- Each beam can play up to 5 simultaneous notes or a chord
- Each beam store the "note ON" and "note OFF" velocity

The Harp use 10 other memory slots as "PART" or "PLAYLIST" with up to 40 patches
Moving between the patches can be automatic (when you close and open the harp) or manual by the remote control or footswitch. It's very easy for musicians.

Now you must know what you want to do with the harp.

If it's a complete song with all the notes available to be played or for example make a song where several octave up / down are used and you want to switch between them with the footswitch.

So for example you want to make a live concert and you have 3 songs to play and each song is played without octave up/down so all the beams are enough.

- **The song one use 8 beams with piano**
- **The second one 6 beams with organ**
- **The last one 12 beams with flute**

First step you create the PATCH for the song one named "SONG 1", 8 beams and piano

Second step you create the PATCH for the song 2 named "SONG 2", 6 beams and organ

Third you create the PATCH for the song 3 named "SONG 3", 12 beams and flute

When it's done you create a PLAYLIST named "LIVE CONCERT" and you set this one to play the "SONG 1", "SONG 2" and "SONG 3"
You set if you want the increment to be automatic or by footswitch and it's done!

When you start the concert you load the "LIVE CONCERT" PART and you play!

Example 2 you want to make a live concert with one piano song but this song must be played with 6 beams for the beginning and 10 beams for the second part.
Well!

First step you create the PATCH for the first part of the song named "SONG 1_1", 6 beams and piano.
Don't forget to set the closing method to "FAST" because the harp will quickly jump to the next PATCH.
Second step you create the PATCH for the second part of the song named "SONG 1_2", 10 beams and piano.
Don't forget to set the opening method to "FAST" because the harp will quickly jump to the next PATCH.

When it's done you create a PART named "LIVE CONCERT" and you set this one to play the "SONG 1_1" and "SONG 1_2"
You set the increment to be controlled by footswitch and it's done!

When you start the concert you load the "LIVE CONCERT" PART and you play the first part of your song and you press the footswitch when you reach se second part of your song.

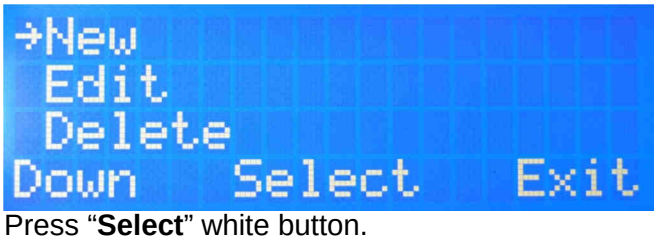
Note: a MIDI controller or Synth keyboard with MIDI out is required to program the Harp because the system is waiting a MIDI message to be stored in memory.

HOW TO CREATE A PATCH

OK Let's go!
Install the Laser Harp like explained before (with multicolor laser for this example) and let's try to create a simple "Harp mode" patch named "**TEST3**" with 10 beams with blue color in "**OFF**" state and white color in "**ON**" state.
For the fun let's modify the last (10th) beam "**OFF**" state color to **RED.**
The opening speed must be set to "**FAST**" and closing speed to "**SLOW**".

Start the controller and go in the "**LEARN**" menu by pressing the red button.

Scroll the text in front of the arrow and choose "**New**" by pressing the "**Down**" blue button.



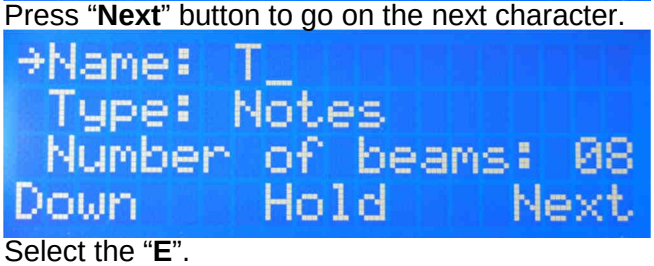
Press "**Select**" white button.

Well as you can see the TEST1 and TEST2 already exists and are patches in "**HARP**" mode like explained by the "**H**" before the name.
TEST1 has 8 beams and TEST2 12 beams.
Now let's create the third patch by pressing "**Down**" button to reach an empty slot.

Well! The slot 3 is highlighted. Now press "**Select**".

Now enter the name “**TEST3**” using the sensivity knob as a rotary encoder. Rotating it clockwise increase the character and going counter clockwise decrease the character. When you are at the end of the rotation press and hold the “**Hold**” button and make a complete rotation in the opposite way and release “**Hold**”.
Let’s begin with “**T**”.

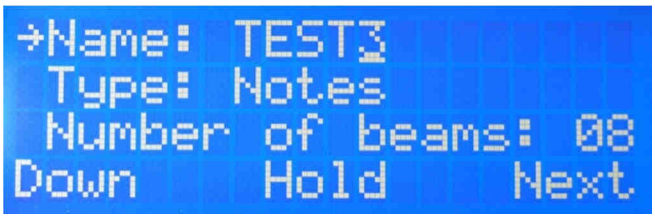
Press “**Next**” button to go on the next character.



Select the “**E**”.

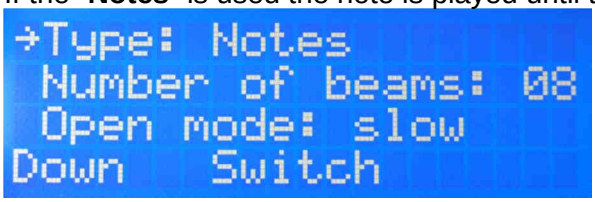
Press “**Next**”.

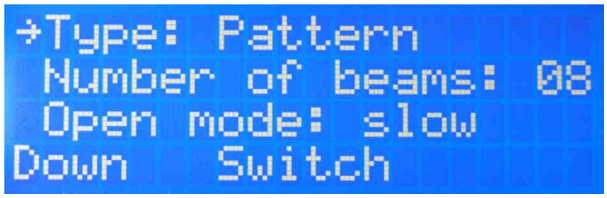
And continue to enter the name “**TEST3**”.



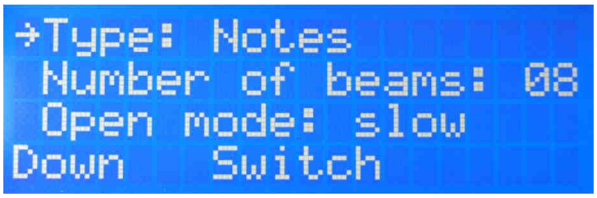
Well! Now press “**Down**”.

Here we can select the “mode” of the patch.
If the “**Notes**” is used the note is played until the hand is removed of the beam.

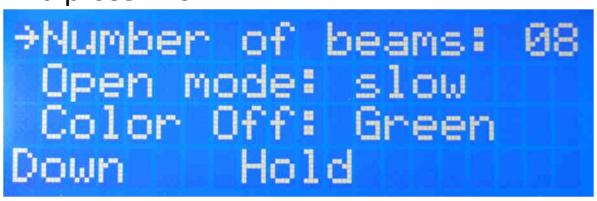




If the “**Pattern**” mode is used the Harp acts as a toggle switch used to control a sampler or grove box. In this mode the beam switch between “ON” and “OFF” state each time the hand cut the same beam.
For our example lets the type to “**Notes**”.

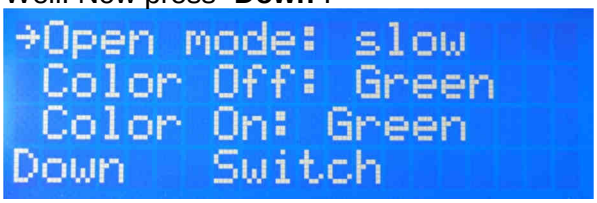


And press “**Down**”.

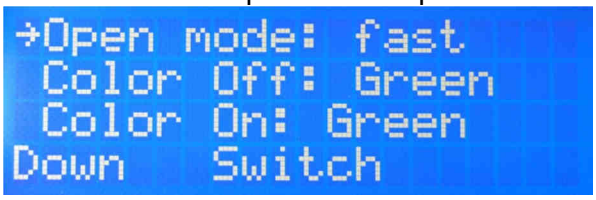


Now choose the number of beams. We want 10 beams so turn the sensivity knob to reach 10.

Well. Now press “**Down**”.



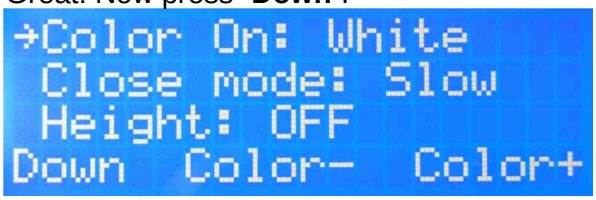
Here we can choose the opening speed of the harp between “**slow**” and “**fast**”.
We want the fast speed so let’s press “**Switch**”.



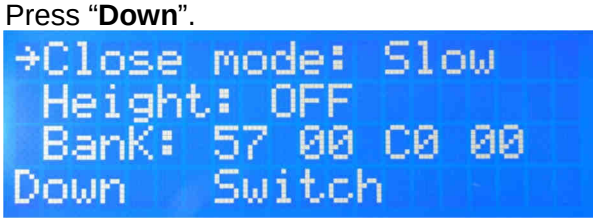
And press “**Down**”.

Now the Harp should open and you should see the 10 beams with green color (default).
Here we can choose the color of all the beams in “OFF” state.
For the example we want the Blue color so let’s press “**Color+**” or “**Color-**“ to choose “**Blue**”.
You should see the beam color changing in live.

Great! Now press “**Down**”.



And do the same for the “ON” state with white color.
Press “**Down**”.



And let the slow speed value for the closing speed.
Press “**Down**”.

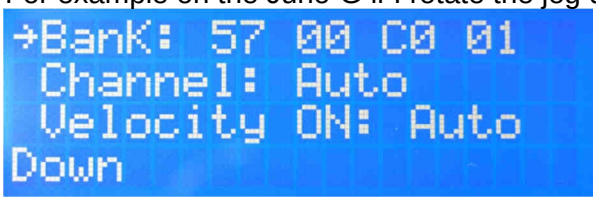
Here you can enable the height sensing function thanks to the sensor 3.
You must choose on which parameter the height should influence.
Like the pitch

The modulation etc…

But here let the value to “**OFF**”
And press “**down**”.

Here is the bank instrument used by the patch. When you call a path the Harp automatically send this programmed bank to the instrument.
This value can be programmed anywhere in the patch menu. You will see the value change if you rotate the jog dial of your synthesizer to change the instrument.
The green led “MIDI IN” in front of the laser harp must blink for each change. 

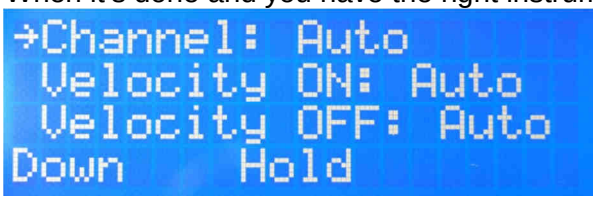
For example on the Juno-G if I rotate the jog dial I have:



For “**Autotrance**” instrument
And more step further:

“**13**” for “**Groove007**” on the Juno-G.

You can try to play some notes on the synthesizer to select your desired instrument.
But don’t worry you can do that when you are programming beams.
When it’s done and you have the right instrument press “**Down**”.



Here you can choose the Midi channel used by this patch. The value must be comprised between “**1**” and “**16**” or leave “**Auto**” to automatically store the value from the controller.

Leave it to “**Auto**” for our example and press “**Down**”.

This parameter is used to define the “**Velocity ON**” mode. If you leave it to “**Auto**” the keyboard key velocity or “attack” is automatically stored for each beam. You can choose “**None**” to disable this function.

You can even give your own pressure value with the rotary button between “**00**” for a light pressure

to “**7F**” for a hard pressure.

Leave the value to “**Auto**” for our example and press “**Down**”.

Here is the same thing for the “release” of the pressed key.
Leave it to “**Auto**” and press “**Down**”

Ok here we are at the most important part of this menu.
For this example we don’t want to program the note now. Only change the color of the 10th beam so….press “**Start**”!

And….yes! The Harp should open and you should see the 10 beams in blue color with this menu:

"**BEAM01**" is the selected beam to be programmed.
You have two solutions to select the Beam to be programmed.
1) The sensor is connected and adjusted and you cut the desired beam.
2) Use the "**Down**" button to navigate.
Ok let's use the "**Down**" button.

Press "**Down**" again.

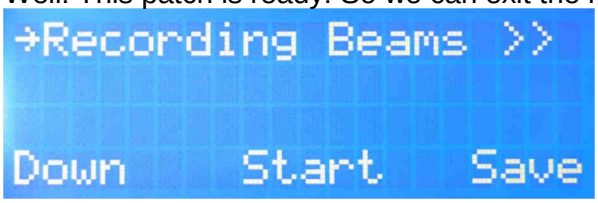
And again….

Here we are on the "**BEAM02**" parameter. So continue to press the "**Down**" button to reach "**BEAM10**"

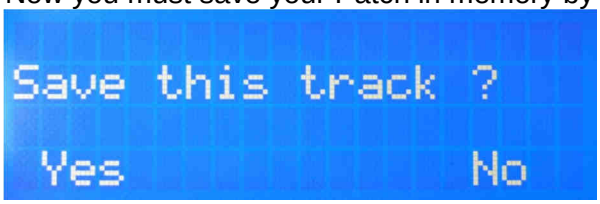
Well! Now as you can see the "**On**" state color is set to white and "**Off**" state color is set to Blue. Now use the "**Down**" button to go to the "**Off**" state option.

And change the color to “**Red**” by pressing “**Color**” button. You should see the beam color changing in live.

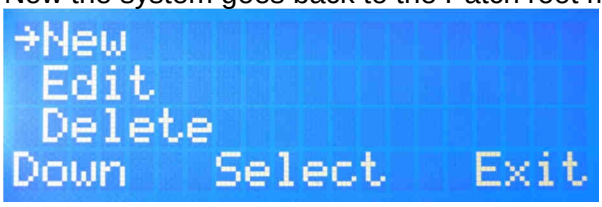
Well! This patch is ready! So we can exit the recording menu by pressing the “**Exit**” button.



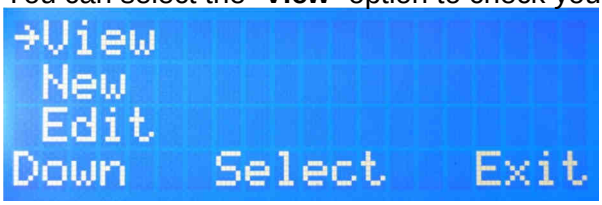
Now you must save your Patch in memory by pressing “**Save**” button.



And “**Yes**” button.
Now the system goes back to the Patch root menu.



You can select the “**View**” option to check your settings.



Press “**Select**” button.

Well done! The TEST3 patch exists with 10 beams.

HOW TO PROGRAM A PATCH

Well now we know how to create a patch with the desired number of beams, color, name…but how to program the patch?
It's very easy! But before you must be sure to have a MIDI controller or Synthesizer connected at least on the MIDI IN port of the laser Harp.

You can try to press some keys on the controller to be sure. The green MIDI IN led at the right of the LCD must light. 

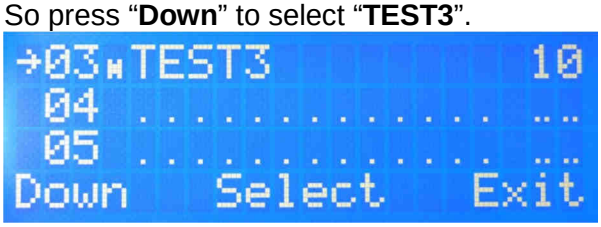
If all the system is ready with the laser and sensor installed we can start to program.
Go to the root menu.

Press "**Learn**".

Press "**Down**" to select "**Edit**".

And press "**Select**".

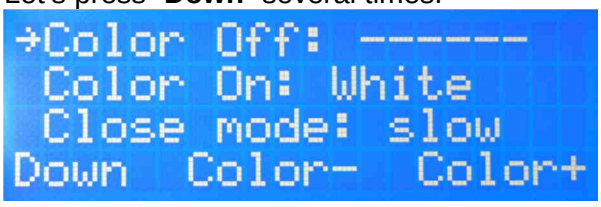
Let's go to edit the patch number 3.
So press "**Down**" to select "**TEST3**".



And press "**Select**".

As you can see it's the same menu as before when we have designed the patch.

But now we want to program the patch and we must go to the "**Recording Beams**" option.
Let's press "**Down**" several times.



Don't worry about the "**------**" for the "**OFF color**" parameter. It's because we have edited the setting for the 10th beam (remember: red instead of blue).
So continue to press "**Down**" to reach the "**Recording beams**" menu.

Now we can start the beam assignment procedure by pressing "**Start**" like when we have changed the color of the beams.

You should see the harp opening and got this screen

Now you must adjust you sensor and laser/mirror if it's not already done.
If the sensor is working fine you will get this screen if you cut the third beam.

And this one when playing the 6th beam

As you can see it's very easy to jump between the notes by cutting them with the hand.
The programming procedure uses this method.
1 -> select the beam to program by playing it on the laser harp
2 -> play the note or chord (up to 5) on the synth
3 -> a mistake? Don't Panic! Select the beam again and play it again on the synth!

Note: you can change the instrument at any time.

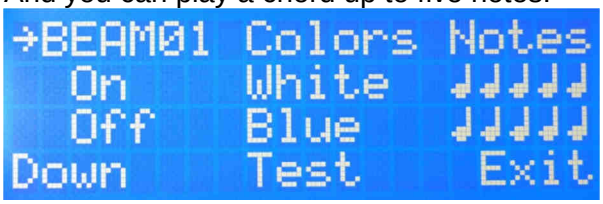
So, to program the beam 1 you must play it and the LCD confirm your selection

Now press the right note or chord for the beam 1 on the synth.
Remember: the controller store the velocity of the played note!

A pictogram indicate when you press the key and when you depress it

If you press more keys, the notes are stored but will be played as a chord.

And you can play a chord up to five notes.



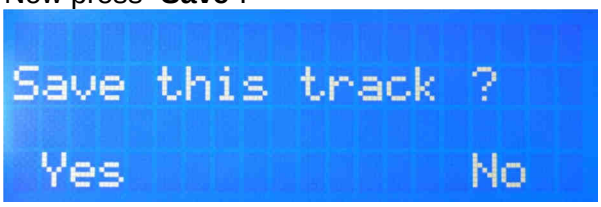
Simply cut the beam again and play the right note/chord if you have made a mistake.
You can test the sound by pressing "**Test**"

Play the next beam to continue programing. Select the number 2.

And play the note on the synth

Well! When it's done for each beam and you want to save press "**Exit**"
The harp will close and you go back to the "Patch edit" menu.

Now press "**Save**".



And press "**Yes**". That's all! The patch is now programmed and you go back at the Learn root menu.

You can choose the "**View**" option to check your work or press "**Exit**" to go at the main root menu.

HOW TO CREATE A PLAYLIST

Ok we have created a patch but how to use it?
Imagine you have created 3 patches like on the screen before and you want to use them for your live concert with the remote control (or footswitch) to open and close the harp and go to the previous or next patch.

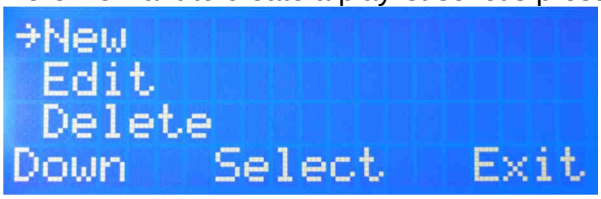
First go to the configuration menu (if it's not already done) and set the **blue** button for "**OPEN&CLOSE**" function.
Do the same thing for the **green** button and set the function to "**TRACK DEC**" and "**TRACK INC**" for the **red** button.

Well the remote control (or footswitch) is set. Now you must create a playlist.
For our example we want to name it "**PLAYLIST1**" and use the patches **01, 02** and **03** with this order: **03 -> 02 ->01**.

Well, to do this start on the main menu screen.

Press the "**Start**" button.

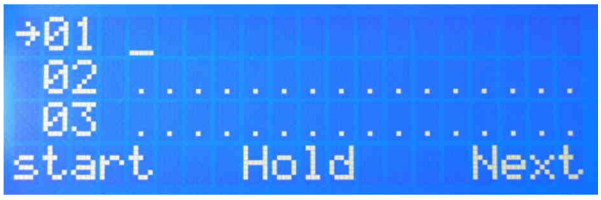
Here we want to create a playlist so let's press "**Down**" to choose "**New**".

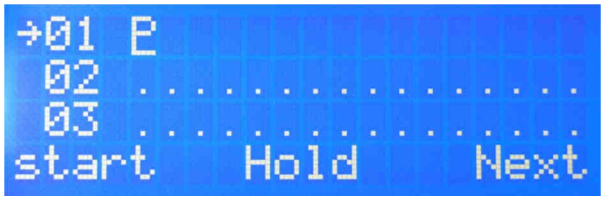


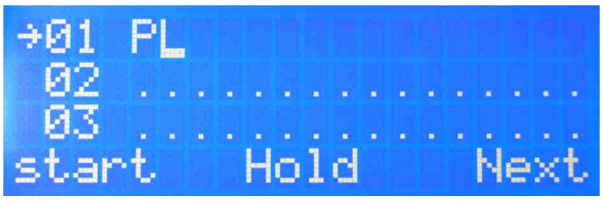
And "**Select**" to enter in the menu.

Here we can see the playlist slots. All are empty.
Let's create the first one by pressing "**Select**".

Enter the name “**PAYLIST1**” using the sensivity knob, the “**Hold“** and “**Next**” buttons like for the patch.







Well! The memory slot is named. Now press “**Start**” button.

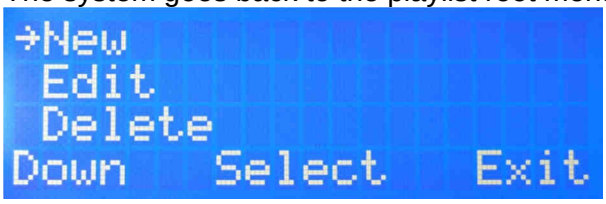
Now you can enter the order of played patches.
We want to use **03 -> 02 ->01** order.
Use the rotary and “**Hold**” buttons knob to choose the patch number “**03**”

Now press “**Next**” and choose the patch number “**02**”

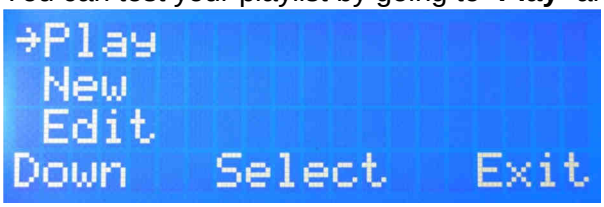
Press “**Next**” again and enter the next patch used “**01**”

When all the required patches are entered you can exit and save your playlist by pressing "**Exit**".

And "**Yes**".
The system goes back to the playlist root menu.



You can test your playlist by going to "**Play**" and pressing "**Select**".



Now choose your memory slot to test followed by "**Select**".

Well! The system is now ready to play your playlist and it's the most used configuration because it's here where you must go to be ready for the concert.

On this screen you can see the first patch used by your playlist. It's the number "**03**" named "**TEST3**".
The "**H**" indicates a Harp Mode.
The number "**10**" indicates 10 beams, the vertical lines are the virtual beams and the letter below the color of each beam.
So for this patch the colors are "**B**" or Blue for the first nine and "**R**" or Red for the tenth one (so like previously configured in the patch menu).

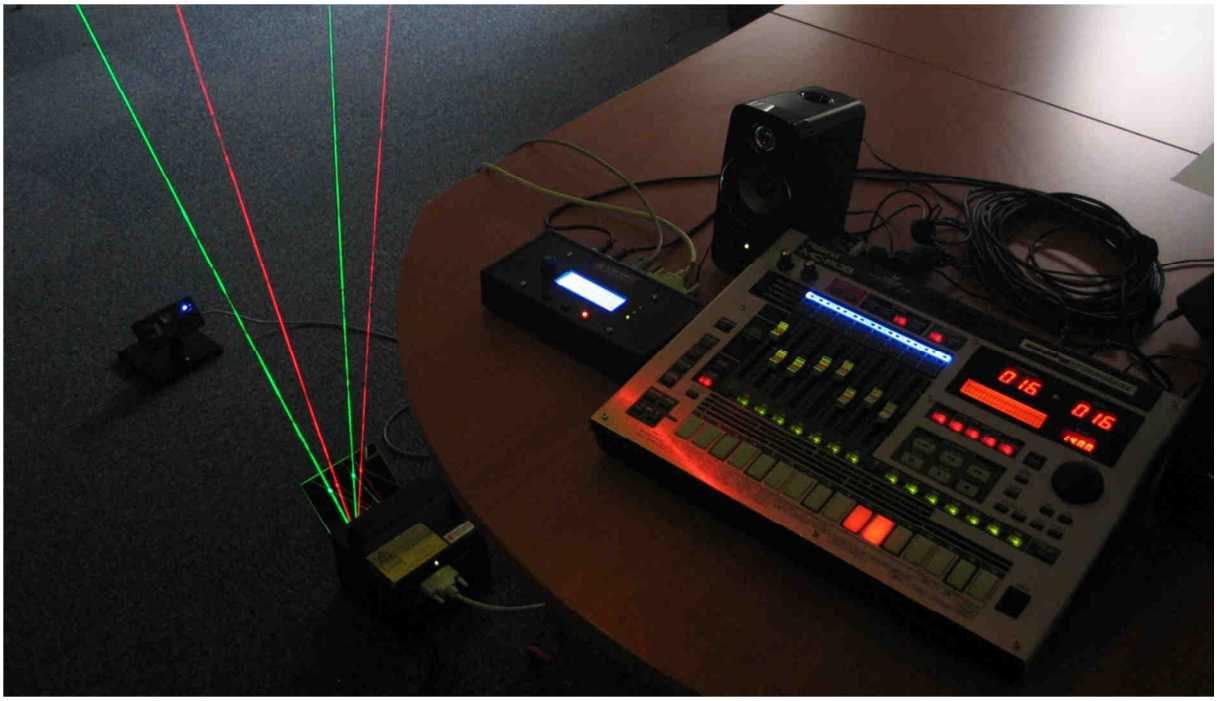
If you press the "**Open**" button or blue remote button the Harp will open and you will be able to play the harp. You will get this screen where only the "**Close**" option is available.

HOW TO CREATE A PATCH IN PATTERN MODE

This mode is useful to control a sampler, groovebox or other Midi events.
The best to use this mode is to have at least a two color laser because the beams will act as toggle switches. The color change of the active beam is a perfect state indicator.

For this example we have used an MC-808 groovebox from Roland.
Here is the setting:

And a wider view:



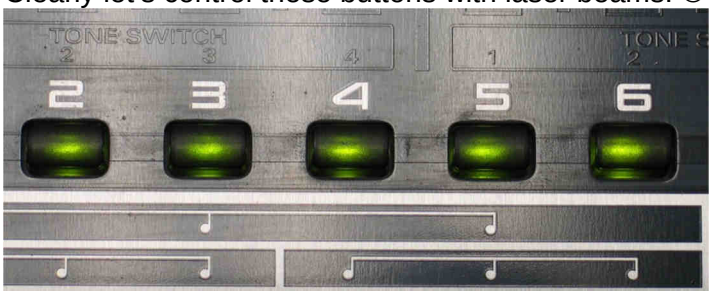
Before to go further you must have installed the laser, sensor with a MIDI IN/OUT cross link set between the groovebox and the laser harp controller.

Like you must know the groovebox have toggle switch to play or mute the parts.
You can see them on the MC-808:

This function is available after pushing the "**PART**" button (in red)
The parts 1 to 16 are played when the right button is solid green and muted when the button is blinking.

The selected patch on the picture uses 13 parts.

Let's try to create a pattern patch on the harp to control the parts **2-3-5-6** with a space between the two lefts and two rights beams. The beams must be green in "**mute**" mode and red in "**play**" mode.
Clearly let's control these buttons with laser beams! ☺



We must create a patch to do this. So let's do it step by step:
At the root menu

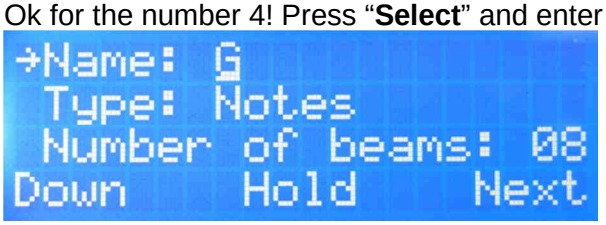
Press "**Learn**".

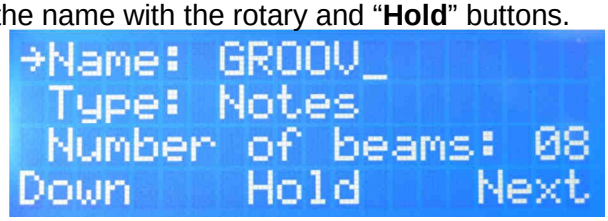
Select "**New**" by pressing the "**Down**" button several times.

And press “**Select**”.

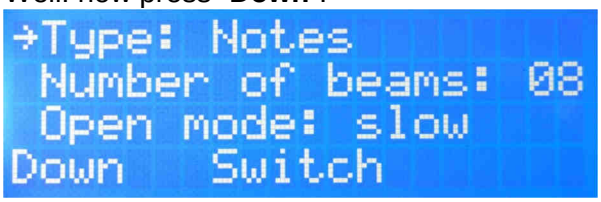
Now choose an empty memory by pressing “**Down**”.

Ok for the number 4! Press “**Select**” and enter the name with the rotary and “**Hold**” buttons.

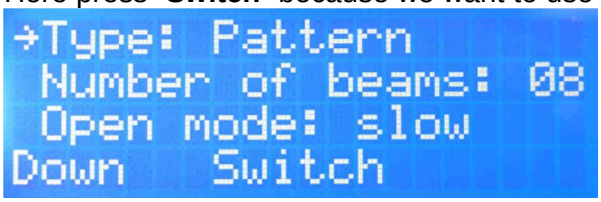




Groovebox is a good choice for this demo!
Well! now press “**Down**”.

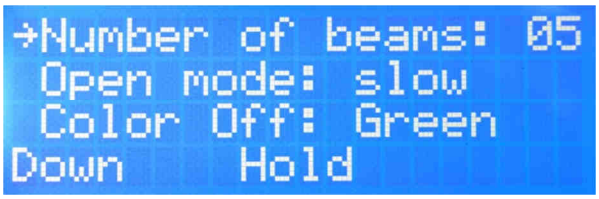


Here press “**Switch**” because we want to use the “**pattern**” mode.

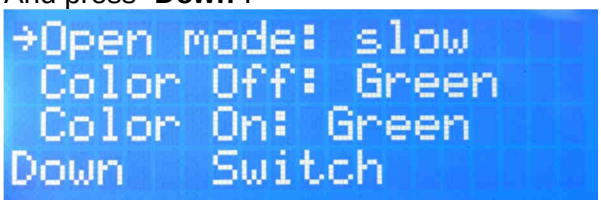


Press “**Down**”.

As explained before we want to control 4 buttons but with a space in the middle. We must choose 4+1 = 5 beams. Select 5 beams with the knob.



And press "**Down**".

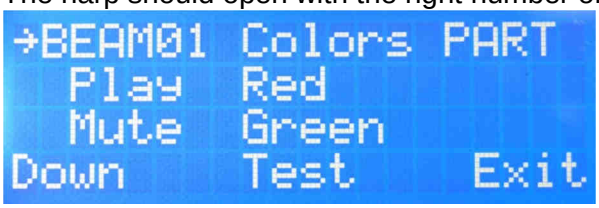


Here we can choose the opening speed. Let's go for "**slow**". And press "**Down**".
The harp should open slowly with the right number of green beams.

Here we must choose the color of the beams for the "**Off**" or "Mute" state.
We want the green color so let's keep the default value and press "**Down**".
Same thing here but for the "**On**" or "Play" state. We want the red color.
Choose "**Red**" with the "**Color-**" and "**Color+"** buttons.

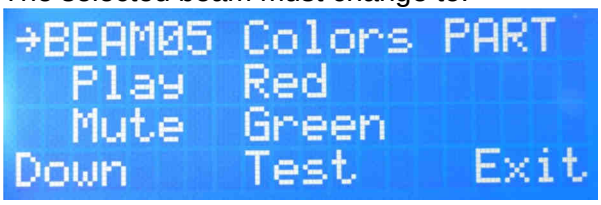
Press "**Down**" when it's done.
The harp should close slowly.
The "**Bank**" parameter is not used in pattern mode and the menu jumps to "**Recording Beams**"

Now like in the "note" mode, we must teach the MIDI messages to the controller.
Press "**Start**"
The harp should open with the right number of beams (5) and this screen.



By default the "**Beam01**" is selected.

You can try to cut the 5th beam with the hand to test the sensor settings.
The selected beam must change to:



Ok now cut the first beam to go back.

Press “Play” on the groovebox and press the “**Part 2**”  button to assign this switch to the beam 01.
You will get:

To confirm the process. If you cut the first beam the color must switch between green and red and the groovebox must mute or play the part number 2.
Pressing the switch “**part 2**” on the groovebox will change the color of the first beam on the harp too.
Ok now let’s assign the other switches by cutting the beam number 2 and pressing the “**part 3**” on the groovebox.

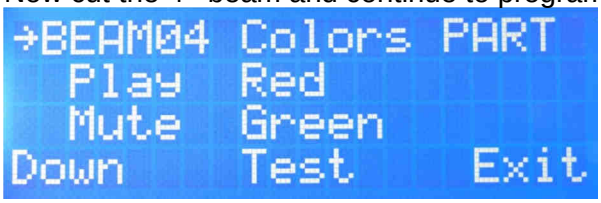
Now cut the third beam.

As explained before, we want a space instead of a beam for this one.
To do this, you must choose “**------**“ for the “**Play**” and “**Mute**” color.
Press “**Down**” to go to the “**Play**” option.

And change the color to “**------**“

Press “**Down**” and do the same thing for the “**Mute**” option.

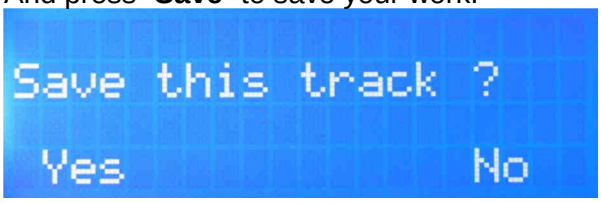
The beam number 3 must have disappeared and make a space.
Now cut the 4th beam and continue to program the two other parts button like before.



Cut the 5th beam.

Great! Now the controller is programmed and you can quit the teaching process by pressing “**Exit**”.

And press “**Save**” to save your work.

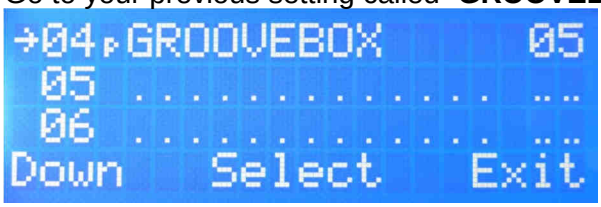


Press “**Yes**”. The controller came back to the “**Learn**” root menu.

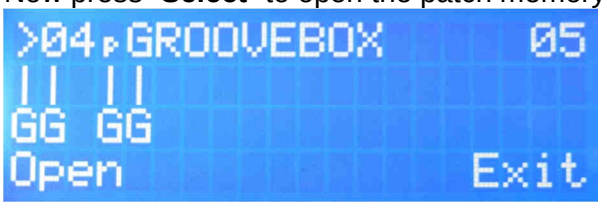
Here you can press “**Exit**” to go back to the root menu or test your settings.
If you want to check your settings go to the “**View**” option by pressing the “**Down**” button.

And press “**Select**”.

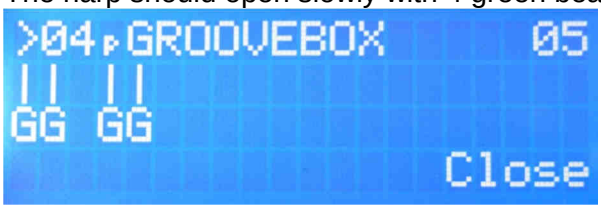
Go to your previous setting called “**GROOVEBOX**” by pressing “**Down**”.



As you can see the pictogram is a “**P**” instead of “**H**” to show the pattern mode of this patch.
Now press “**Select**” to open the patch memory.



The memory is now opened and the controller is ready to start.
Press “**Open**” to open the harp.
The harp should open slowly with 4 green beams and a space in the middle.

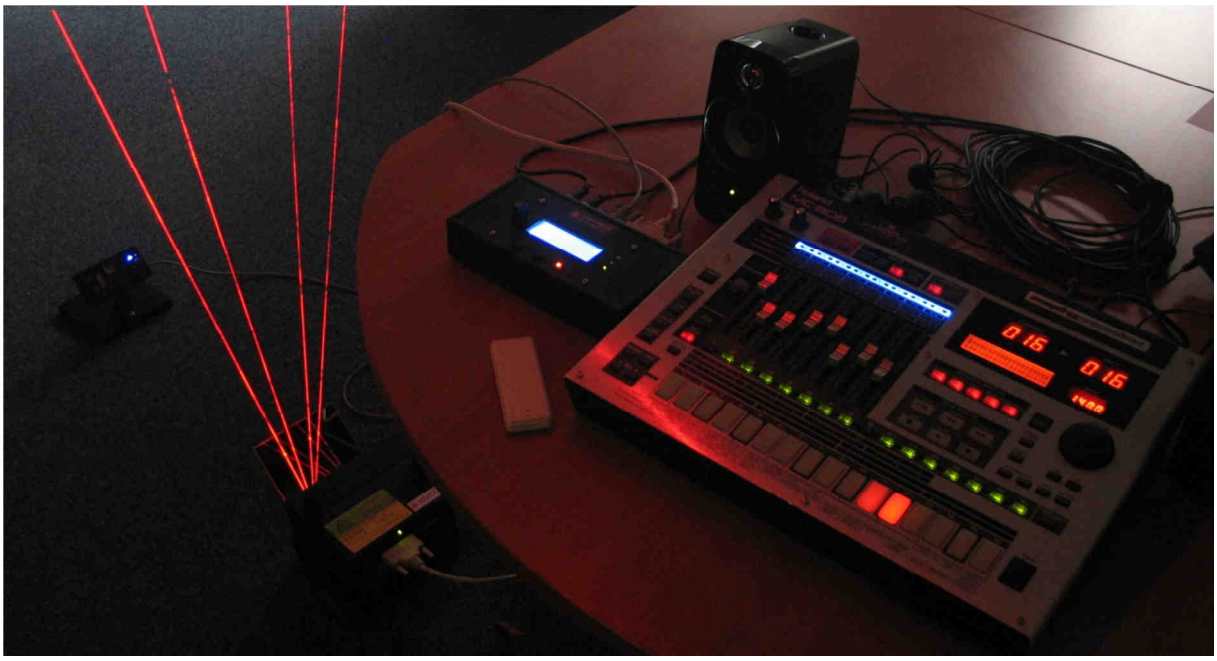


Cutting a beam should enable the right part on the groovebox and the right part must be played.
The virtual beams on the screen show an active part by this pictogram for the beam 1:

After cutting the beam 4:

And after cutting the beams 2 and 3.

Or this, on the Harp:



Now you can cut again the 4 beams to disable all the parts.

And press “**Close**” to close the harp.

You can now go back to the harp root menu by pressing “**Exit**”.

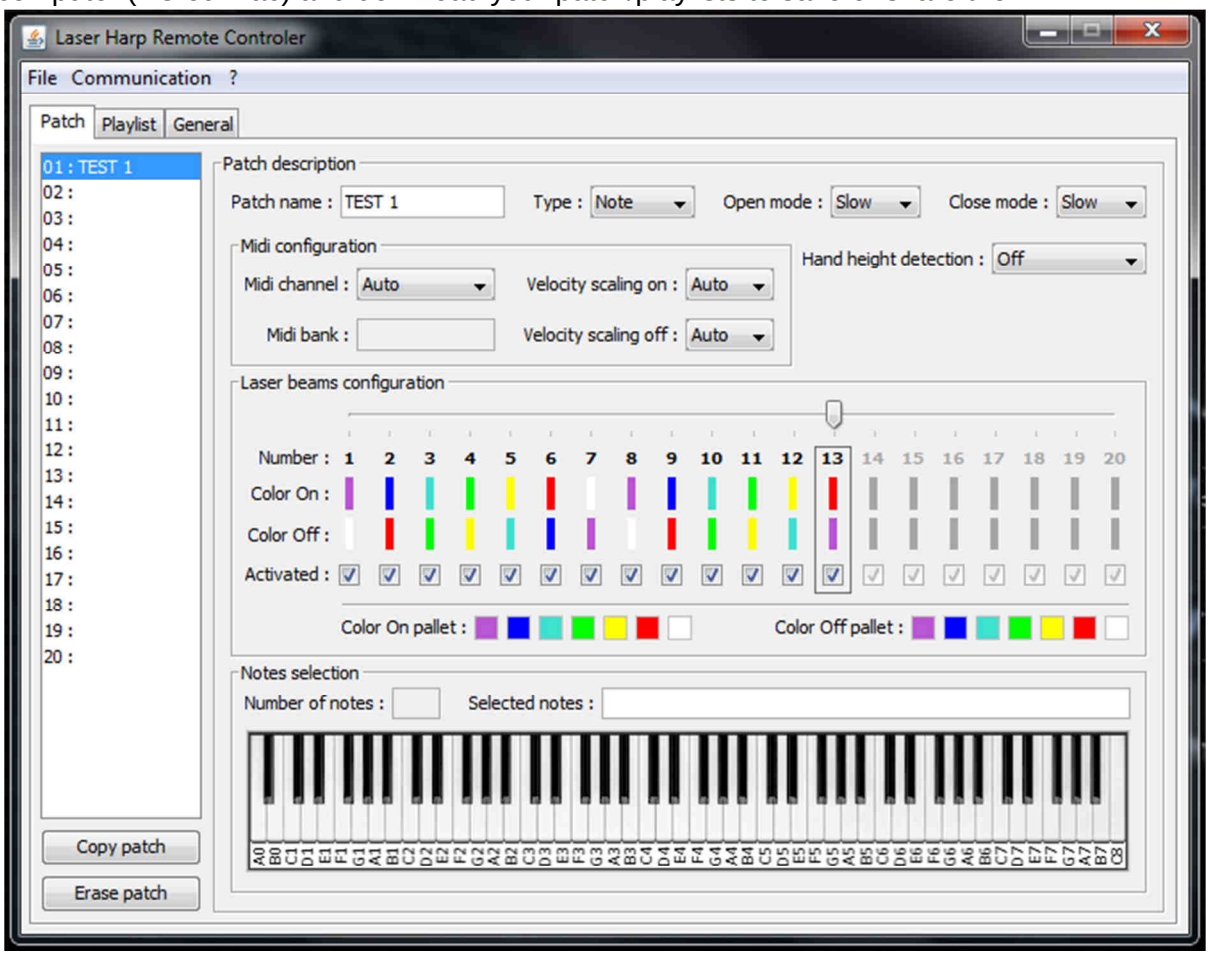
Press “**Exit**” again.

And again.

Well done! Now you know how to program a patch in pattern mode!

REMOTE SOFTWARE

This feature is under development. It will be possible to program the controller directly on a computer (PC ou Mac) and download your patch/playlists to save or share them.

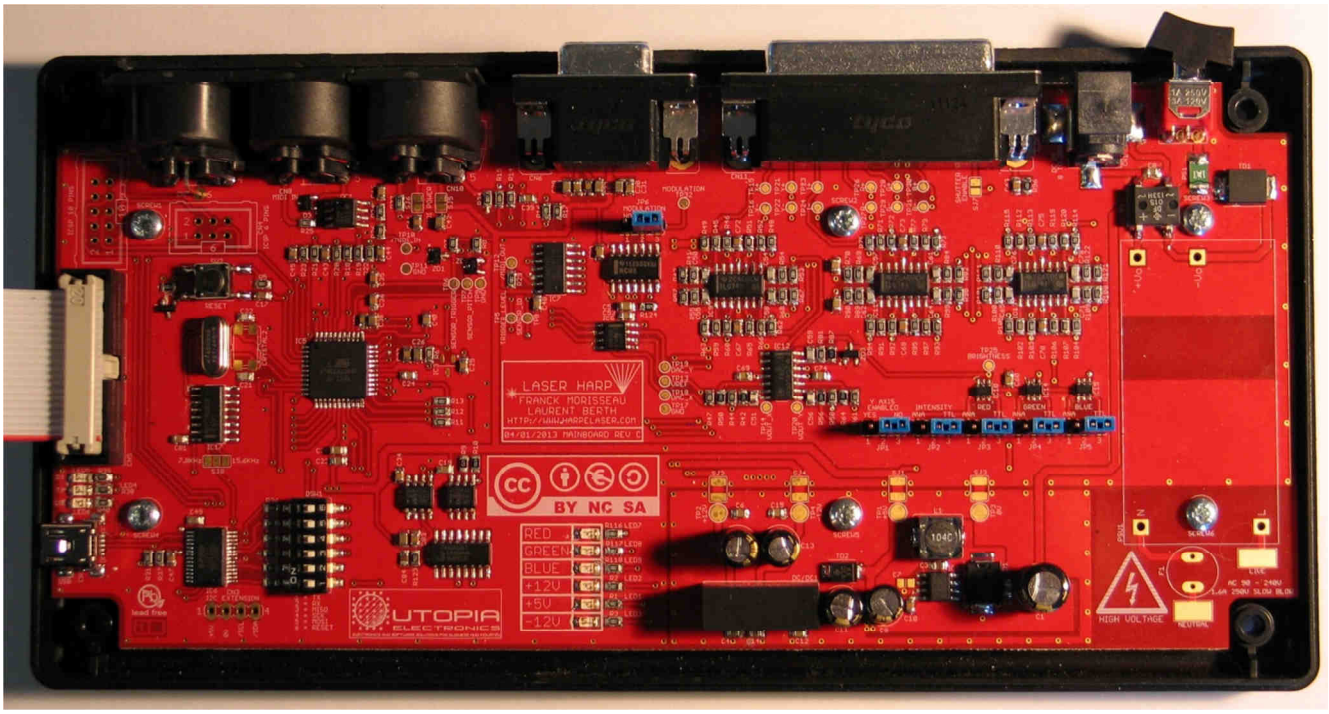


WHAT IS INSIDE?

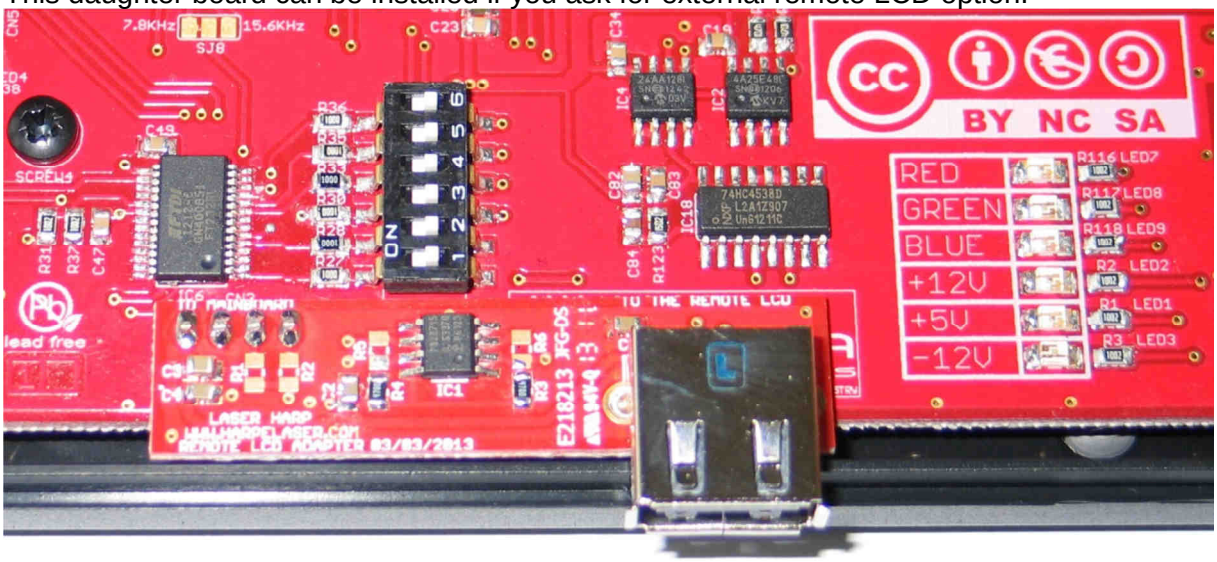
Unlike the others we do not hide our hardware and we invite customers to check the quality of what they have in hands from other brands even if this voids the warranty (a warranty seal can even be used to hide the build quality of something…).
And some would be surprised to see the build quality of what they bought...

We have no shame to show the inside of our system so you can open the Laser Harp Controller if you want but be careful with the components inside ;)

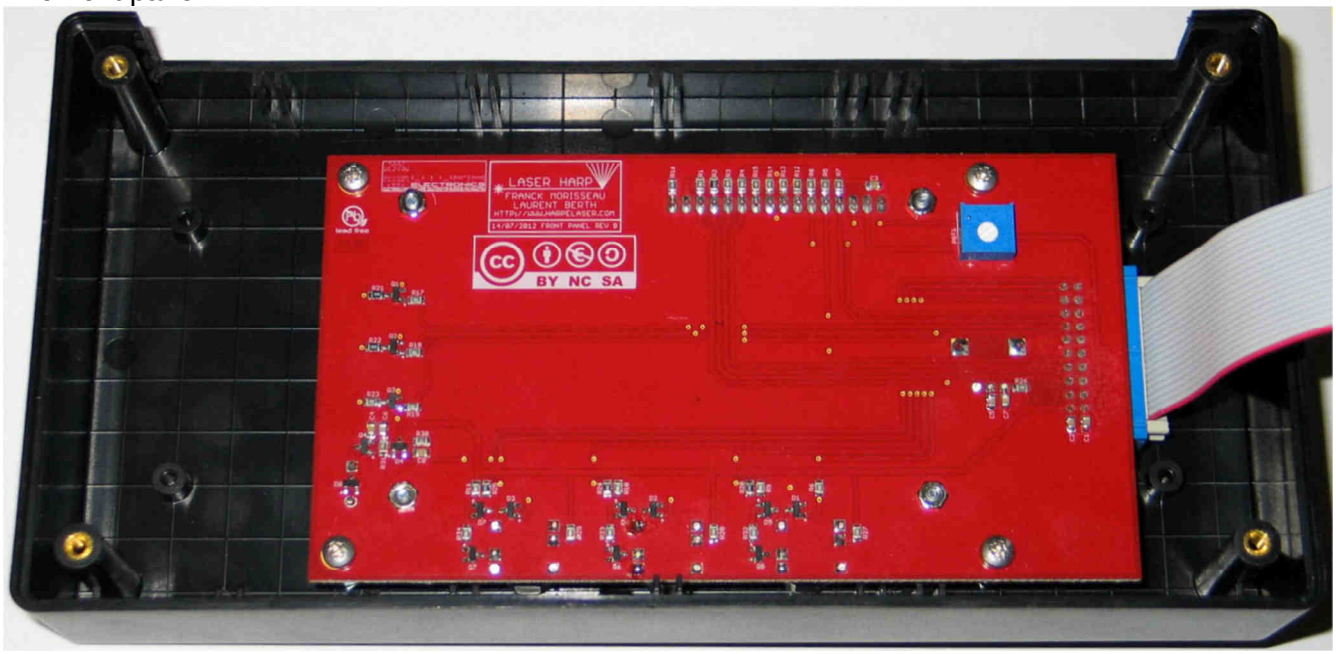
If you open it (by curiosity of for a firmware upgrade) here is what you will see inside:
The mainboard:



This daughter board can be installed if you ask for external remote LCD option.

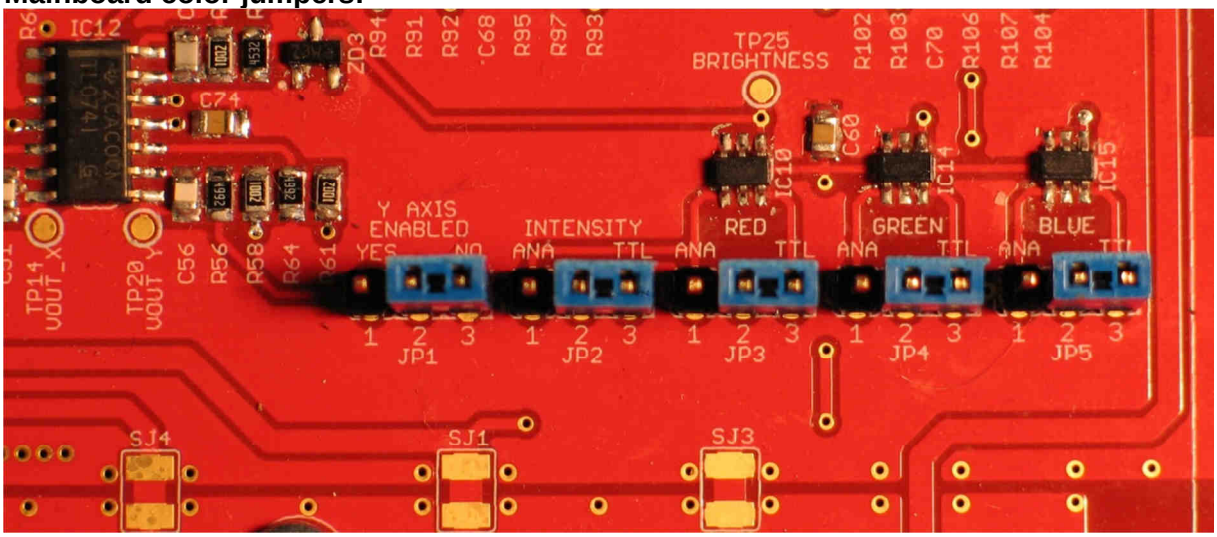


The front panel:



You can use the blue trimmer to adjust the LCD contrast if needed.

Mainboard color jumpers:

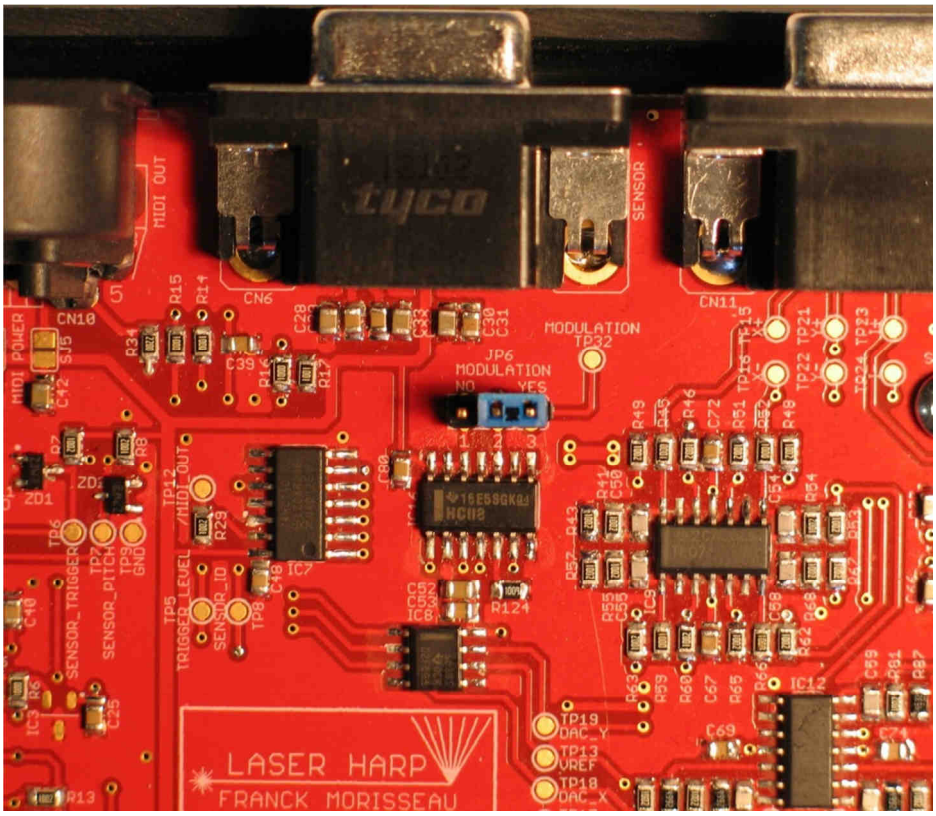


These jumpers (in default position on the picture) are used to choose the modulation mode of the laser sources for **JP2** to **JP5**.
At this time only TTL mode is supported. (7 colors).
JP1 is used to enable the Y axis of the laser and create a 2D laser Harp (X-Y) to have a beam form in the future by firmware update.

Used with the sensor 3 and his height detection ability, a 9 degrees of freedom "9DOF" system will be possible!

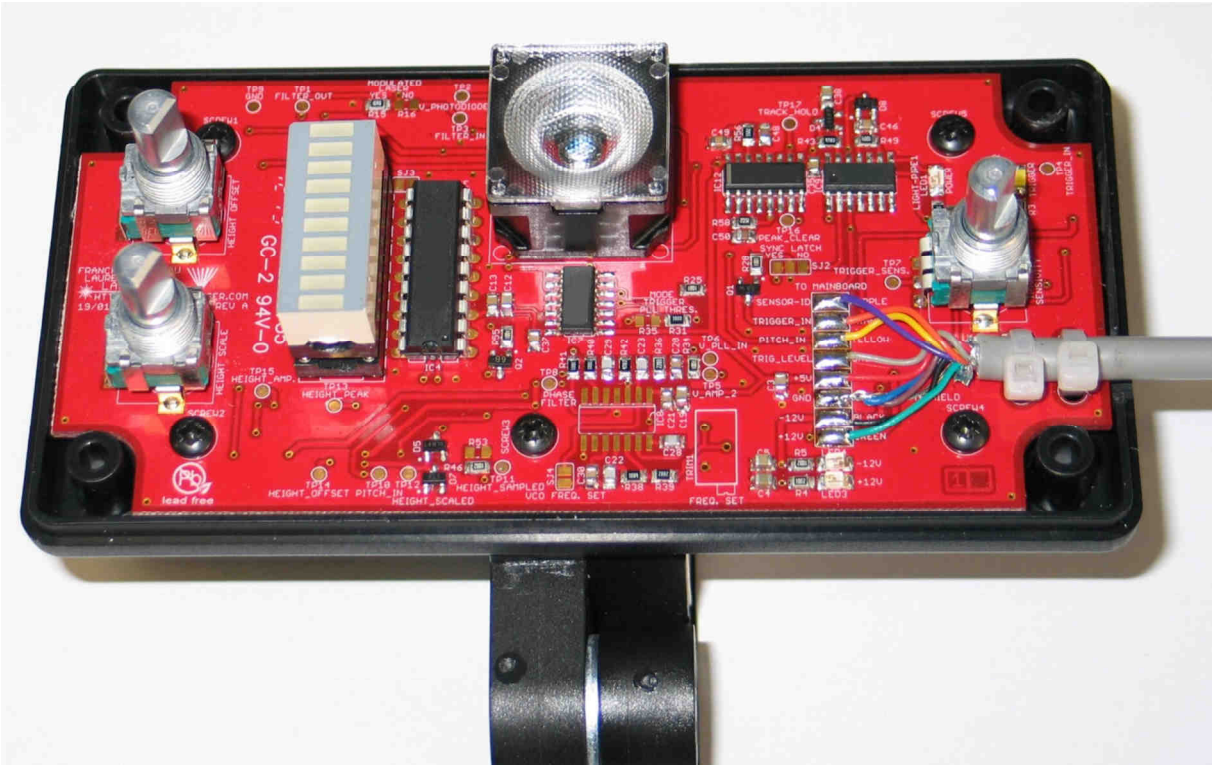
It will be possible to have staggered beams to separate chromatic from diatonic notes for example or to have an Arc, Circle or square harp. Perhaps with the musician "inside" the harp if the laser is under the musician and with a transparent stand! The laser will turn around the musician!

Mainboard laser modulation jumper:



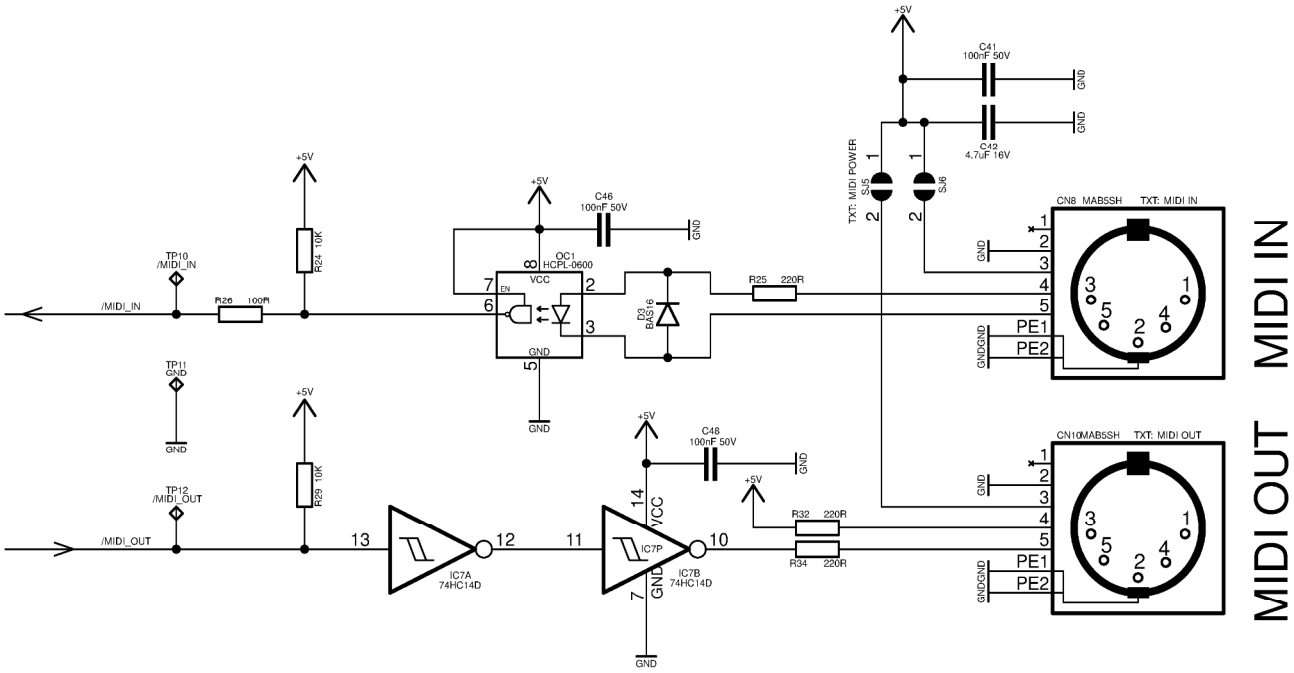
This jumper (in default position on the picture) is used to add a high frequency modulation on the laser signal.
It's required to use the senor 1 and 3 to reject ambient light.
This mode requires a laser source able to be modulated up to 10KHz (the most of the actual source can do it).

Here is the internal view of the sensor 3:



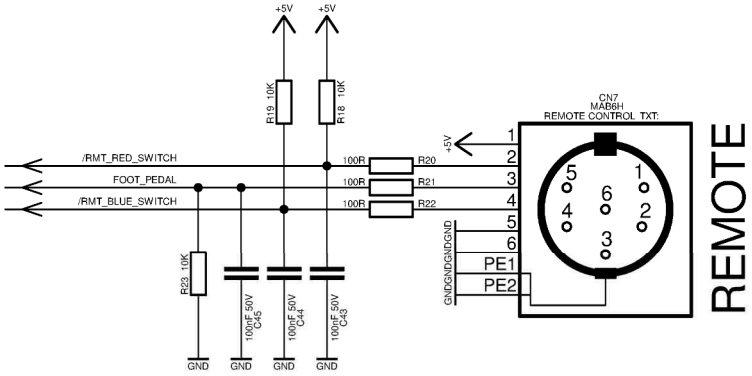
CONNECTORS DESCRIPTION

MIDI IN / OUT



It's a standard MIDI connection with optically isolated input and current loop.
A power supply can be available by solder join to supply external system like MIDI THRU adapter.
Connect your synth/expander/groove box MIDI INPUT connector to the MIDI OUT of the Laser Harp controller and the MIDI OUT to the MIDI IN of the Laser Harp (crossed connection).

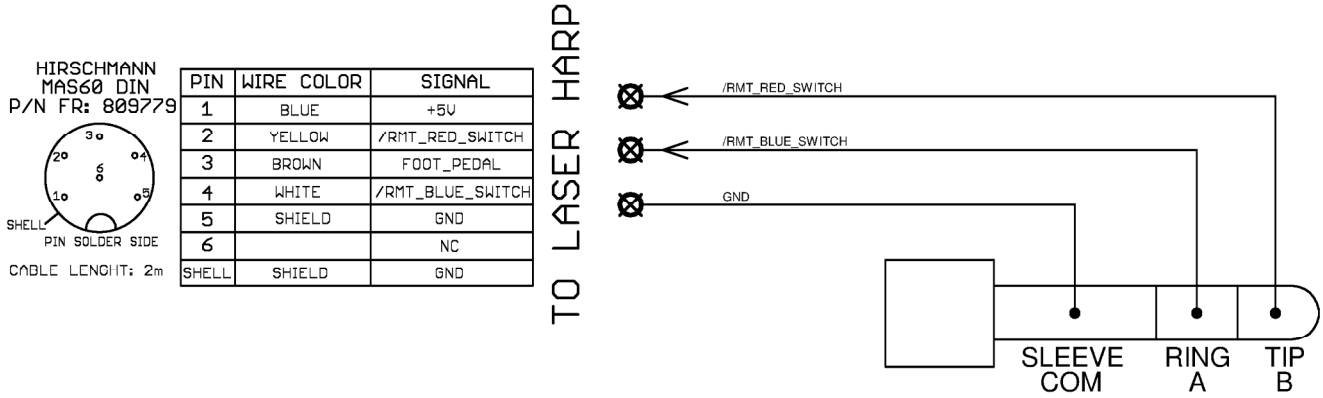
REMOTE CONTROL



This connector is used to remotely control the Harp.
A power supply is available at the pin number 1.
Connect the pin 2 to the ground (pin 5 or 6) to activate the "/RMT_RED_SWITCH" signal.
Connect the pin 4 to the ground (pin 5 or 6) to activate the "/RMT_BLUE_SWITCH" signal.
Connect the pins 2 and 4 simultaneously to the ground to activate a third button (Green switch).

You can connect these inputs to a footswitch.
Here is an example with a standard **FS6** double footswitch from BOSS/Roland:

The footswitch must be set to “momentary” and “normal open”.
The middle jack pinout is:
TIP = B
RING = A
SLEEVE = COMMON
So to connect this footswitch to the Laser Harp controller you must create a cable like this:



We can make such cable for you if you want.

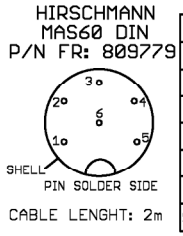
With this wiring you must set the “**BLUE**” option in the remote control configuration menu for the “**A**” footswitch and “**RED**” option for the “**B”** one.

Another example with the **DP8** footswitch from Roland:

This one can be set as switch or continuous mode.
The continuous mode is perfect to control volume or pitch.

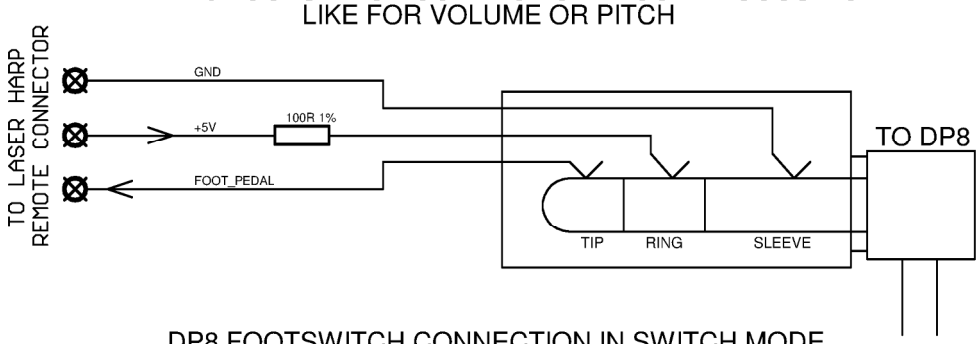
Don’t forget to set this switch before to connect the pedal to the Laser Harp controller.

Here is a wiring example for such footswitch with the two modes explained.

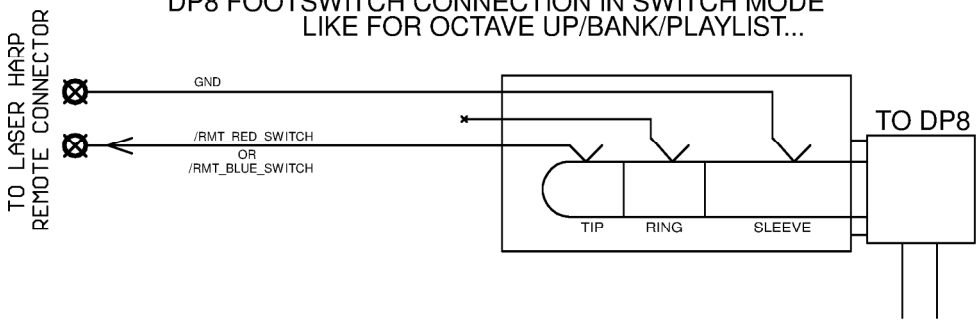


PIN	WIRE COLOR	SIGNAL
1	BLUE	+5V
2	YELLOW	/RMT_RED_SWITCH
3	BROWN	FOOT_PEDAL
4	WHITE	/RMT_BLUE_SWITCH
5	SHIELD	GND
6		NC
SHELL	SHIELD	GND

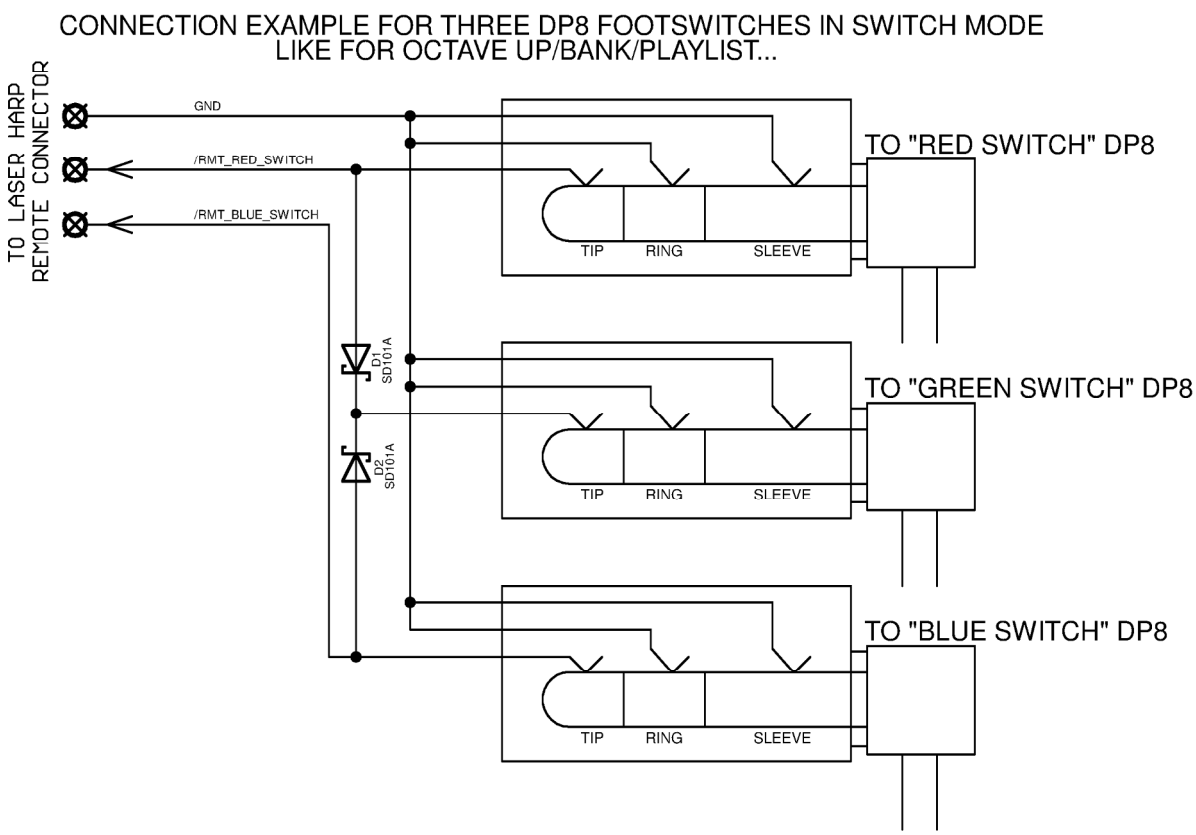
DP8 FOOTSWITCH CONNECTION IN CONTINUOUS MODE
LIKE FOR VOLUME OR PITCH



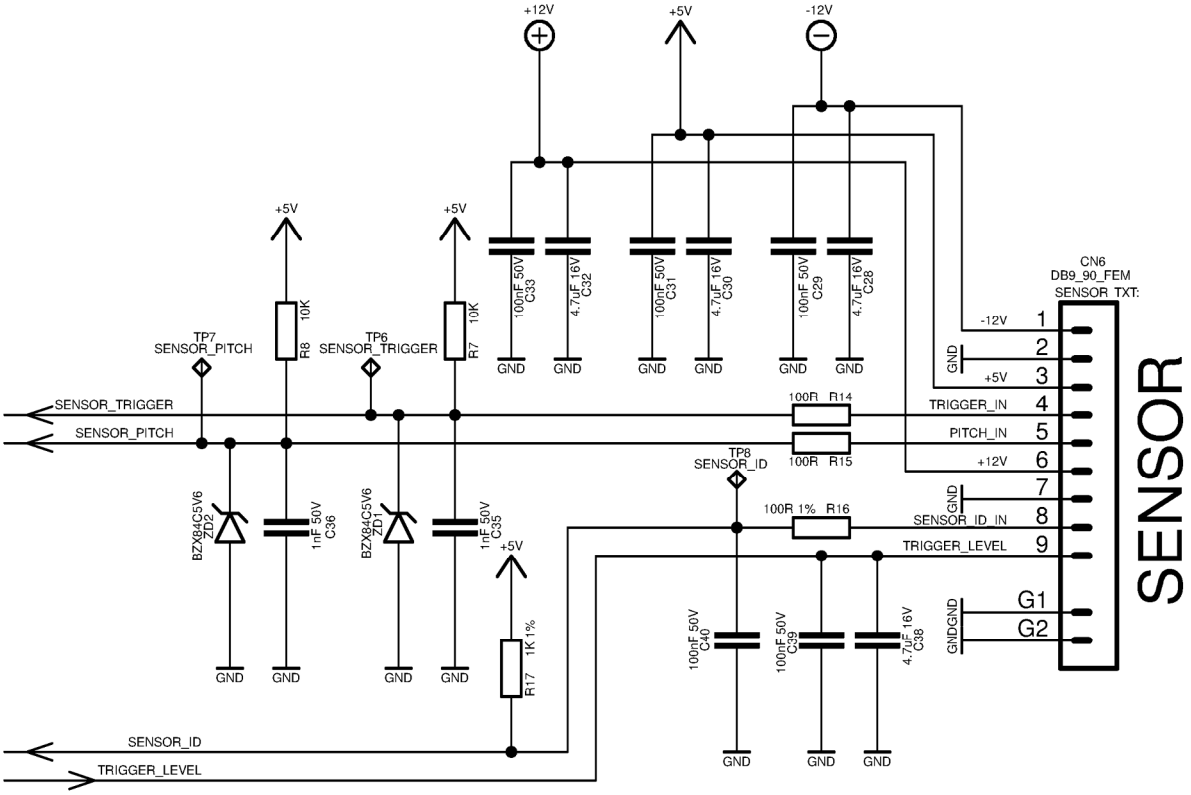
DP8 FOOTSWITCH CONNECTION IN SWITCH MODE
LIKE FOR OCTAVE UP/BANK/PLAYLIST...



CONNECTION EXAMPLE FOR THREE DP8 FOOTSWITCHES IN SWITCH MODE
LIKE FOR OCTAVE UP/BANK/PLAYLIST...

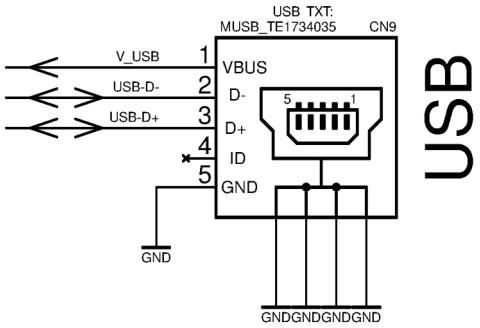


SENSOR CONNECTOR



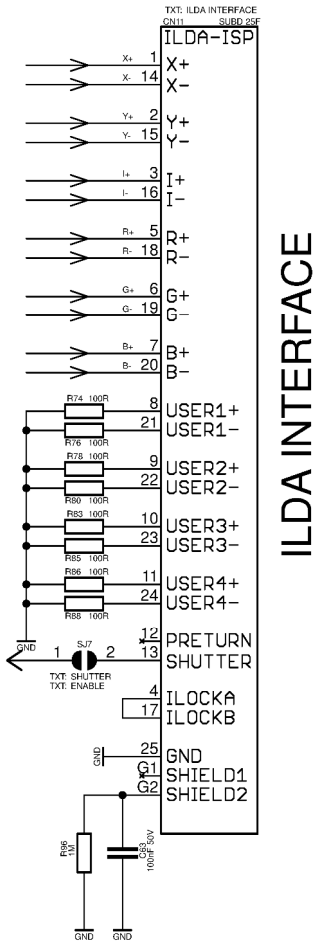
Here is the sensor connection for information purpose.
Power supply rails are available for the sensor electronics.

MINI USB CONNECTOR



This connector is placed at the left side of the controller.
It works as virtual com port and is used to update the firmware of the controller and future use with special software to download/save memory patches/playlists and to remotely set the parameters.
Like with drop boxes to select the color for each beam etc….

ILDA CONNECTOR

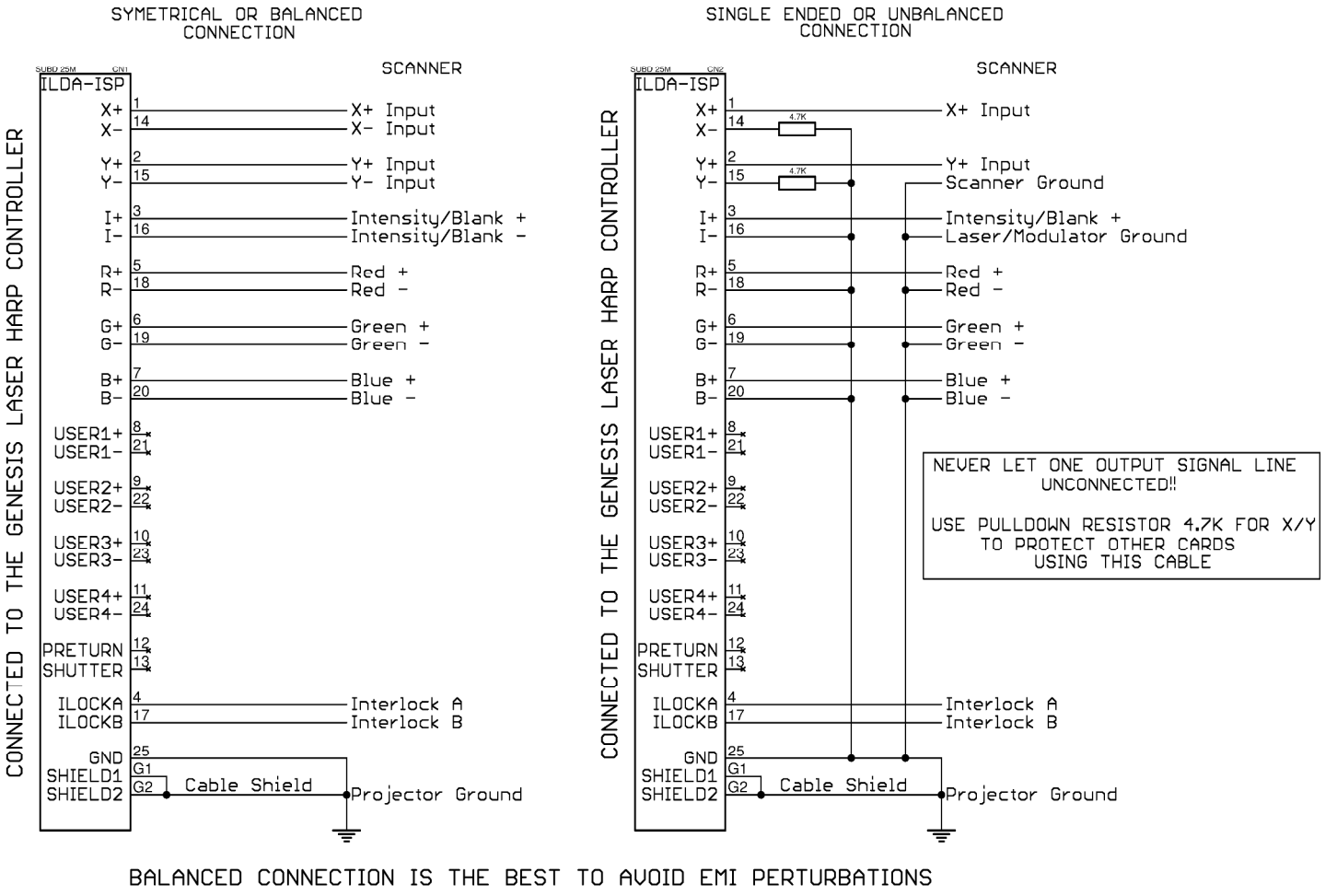


Here is the International Laser Display Association or ILDA connector.
It is used by the most of laser projectors on the market.

The Laser Harp controller uses special output hardware allows the use of balanced or unbalanced connection.

The best is to use balanced connection because the EMI perturbations are automatically removed by the differential input amplifier at the laser side.
You can use standard “printer type” DB25 male to female cable to connect the laser to the Harp controller but you must be sure to use a complete straight wiring model.

LASER CONNECTION



BALANCED CONNECTION IS THE BEST TO AVOID EMI PERTURBATIONS

TROUBLESHOOTING

The controller won't turn on:

- Check the AC/DC adapter / cable
- Check the power switch

The beams at the left and right won't trig:

- Check the sensor sensivity
- Check the sensor angle of view (the sensor is perhaps too close of you)

The MIDI IN indicator never turn on:

- Check if the MIDI connection is a crossed one (MIDI OUT of the synthesizer to the MIDI IN of the LH controller and MIDI IN of the synth connected to the MIDI OUT of the LH controller.

TECHNICAL SPECIFICATIONS

Power input: AC/DC 7 to 25V

Laser control: ILDA interface with special structure allowing balanced or unbalanced signals.

ILDA voltage swing: +/-10v for X and Y axis and -2.5/+2.5v (balanced) or 0/5v (unbalanced) for R/G/B/I signals.

CPU: AVR 8 bits with 128K code memory

DAC resolution: 12 bits

LCD: 20 characters 4 lines backlighted (color can be changed on demand)

Input/output human interface: 3 backlighted buttons and 1 potentiometer used like rotary encoder, 6 leds (sensor trig / midi in message / midi out message / USB link / Tx / Rx) and power switch.

Connectors: MIDI IN / MIDI OUT / USB / REMOTE / SENSOR / ILDA / POWER INPUT.
Optional connector: Remote LCD with USB A like connector.

Dimensions: 220mm x 110mm x 65mm with knob

CE: by design. CE conformity certificate in progress (PONY laboratories group).

Revision history:

V1.0 20/02/2013 : creation
V1.1 04/04/2013 : add menu description / disclaimer / history/ sensor 3 setting
V1.11 05/04/2013 : add technical specs and patch creation menu
V1.2 06/04/2013 : resizing screenshots, add playlist creation menu, add “what is inside” section and minor changes
V1.3 07/04/2013 : add connectors pinout / remote control examples / laser connections
V1.4 09/04/2013 : add how to program the patches
V1.41 21/04/2013 : minor changes
V1.5 05/05/2013 : update of all the LCD screenshots (based on firmware 01.03.52)
: adding the up/down/hold function to the sensivity knob
: adding the Bank parameter in the patch creation
: modification of the patch programming method (bank)
: adding the description of the stand, mirror, sensor, view of the controller
: adding the patch teaching method
: adding the troubleshooting section
: adding the summary
: adding informations about the remote software
V1.51 07/05/2013 :disclaimer update
:adding setup pictures
:adding “before to begin”
:adding info + pictures to “History”
:adding required hardware
V1.6 25/05/2013 :modification of the configuration menu (MIDI channel, velocity)
:adding these funtions in the patch menu
:update of the software printscreen

LASER HARP USER MANUAL
V1.6 25/05/2013
Franck MORISSEAU
http://www.harpelaser.com