

# KB2D Interactive Device

## 2D detection – Laser Harp

The KB2D Interactive Device is a detection system working as a MIDI controller. It enables to send customizable MIDI messages just by touching / interacting with lasers, and can be used with any scanning laser projector system in order to create an interactive projection.

With the various detection modes available, it can be adapted to any show, from the easiest laser Harp system to the most complete Interactive “laserman” show. It also features laser tracking modes.

Thanks to an exclusive and innovative detection system (patent pending) and powerful algorithms, it is actually the most compact, stable, competitive and versatile Laser interactive device on the market.

The KB2D Interactive device can be combined with a 45° mirror to project the beams vertically for a Laser Harp configuration. Lightdiction proposes a special Mirror Holder for this purpose. It can be fixed both on KB2D device and on KVANT laser projectors.

Footswitches or other external MIDI controllers can be used to improve the flexibility of the device during shows.

### FEATURES

- **Compact and light design, easy to use**
- Can be used with **external MIDI controllers** like Footswitches or AKAI APC40 for instance
- Up to **130 FPS detection rate**
- **Polyphonic detection** (it can detect multiple positions / play multiple notes at the same time)
- **Discrete mode** with up to 16 notes, or **Continuous mode** (127 positions) for laser tracking
- **2D detection** (angle and height)
- Power and communication through **USB**
  - **Dual MIDI In and Out** via USB
  - Low power consumption
- **Laser sensitive**
  - Not sensitive to daylight
  - Extremely resistant to parasitic lights
- **Highly versatile and flexible system**
  - Can be used with any laser projector
  - No synchronization or communication with the laser
  - Detection parameters highly configurable
  - Can be connected to a Footswitch or any external MIDI device
- **High detection range**
- **Can be combined with Lightdiction’s Mirror Holder** to project the beams vertically



### TYPICAL APPLICATIONS

- Laser Harp
- Laser tracking
- Laserman shows
- Interactive games

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## GENERIC INFORMATION

The latest upgrades can be found for free on the following link:

<https://lightdiction.com/Ressources/>

- KB2D User Manual
- KB2D Technical Sheet
- Lightdiction – KB2D Laser harp Interface
- Latest Firmware Version
- Quick Start guide

It is recommended to always use the latest version of Firmware and KB2D Laser Harp Interface, to benefit from all the performances and options available.

Also, Tutorial videos will be regularly released on this same link, or on YouTube channel:

<https://www.youtube.com/watch?v=UkKCysByNcc&list=PL9pm3pVWGOjRc8xiM9ge5fBcOkJKMc88E>

You can also follow the Updates and tutorial videos by following Lightdiction on Facebook, or register to Newsletters by sending an email to [contact@lightdiction.com](mailto:contact@lightdiction.com).

## DESCRIPTION OF THE DEVICE

The KB2D detection systems can be used with any scanning laser projector. The KB2D is not communicating with the laser projector, so there is no direct dependency between the KB2D Interactive Device and the projector.

To create a laser interactive scene, you only need:

- A scanning light source (typically a laser projector) to project the beams to interact with.
- The KB2D interactive device with a USB (A – B) cable.
- A computer with Windows (8, 10) with the KB2D Interactive software (and a software to control the laser projector). The last KB2D setup can be downloaded at <https://lightdiction.com/Ressources/>.

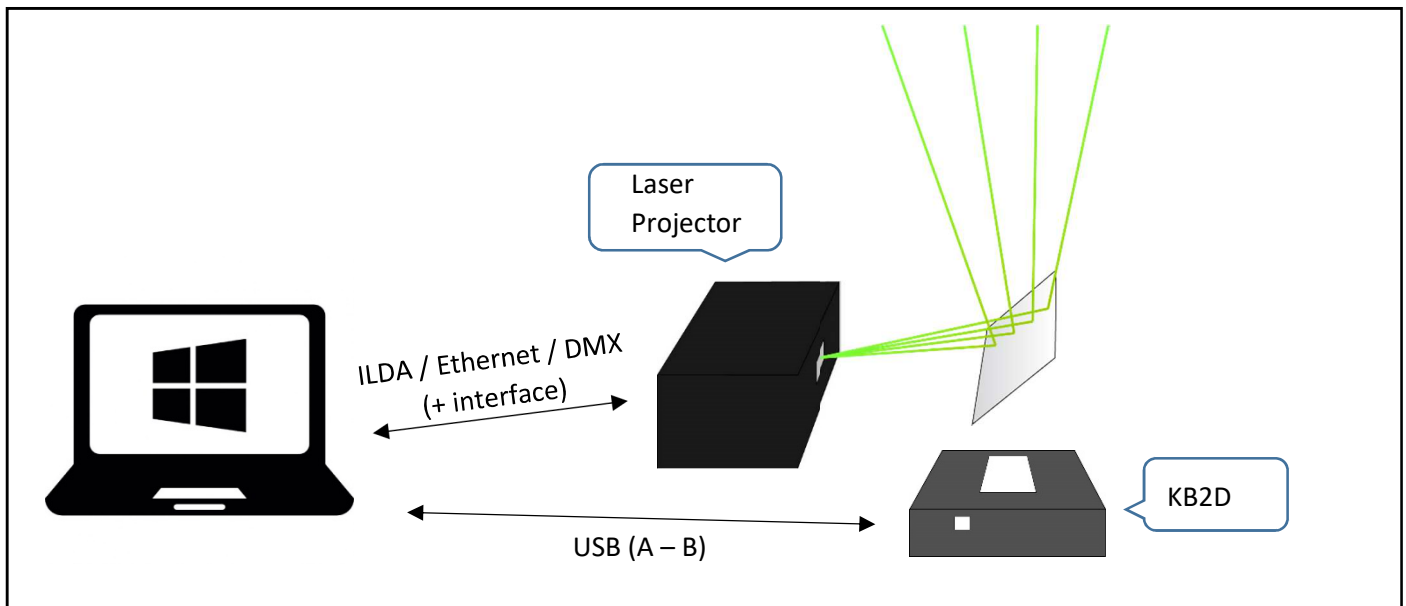


Fig. 1: Typical installation of the KB2D interactive device for a laser Harp application.

- In order to improve the accuracy, the KB2D should be aligned with the (virtual) cross of the beams.
- The length of the KB2D device must be aligned with the plane formed by the beams.

MIDI ports should be connected as follows:

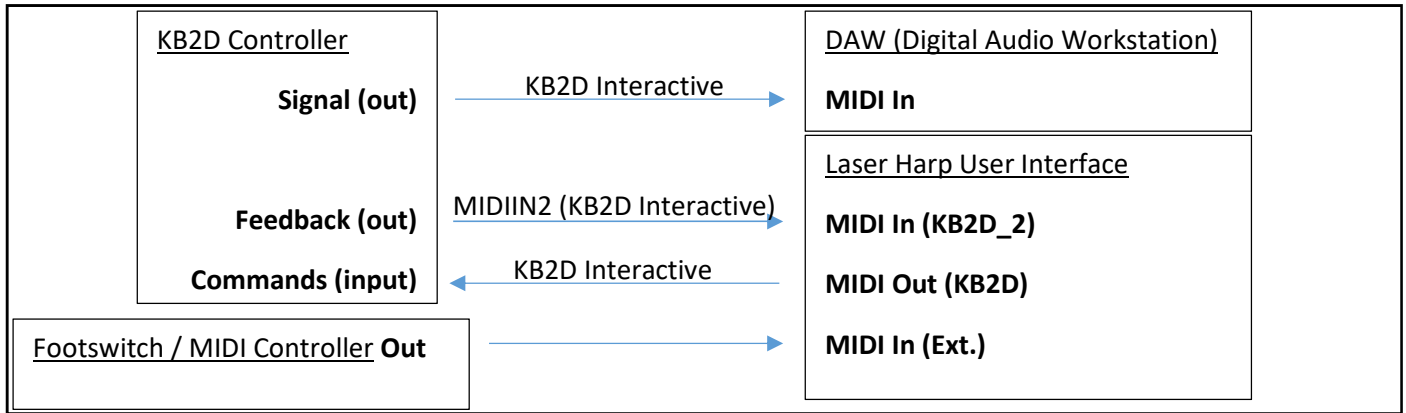


Fig. 2: Recommended MIDI Mapping

## HOW TO QUICKLY SET A LASER HARP SYSTEM

All the commands and functionalities of the KB2D interface are grouped in 3 Tabs.

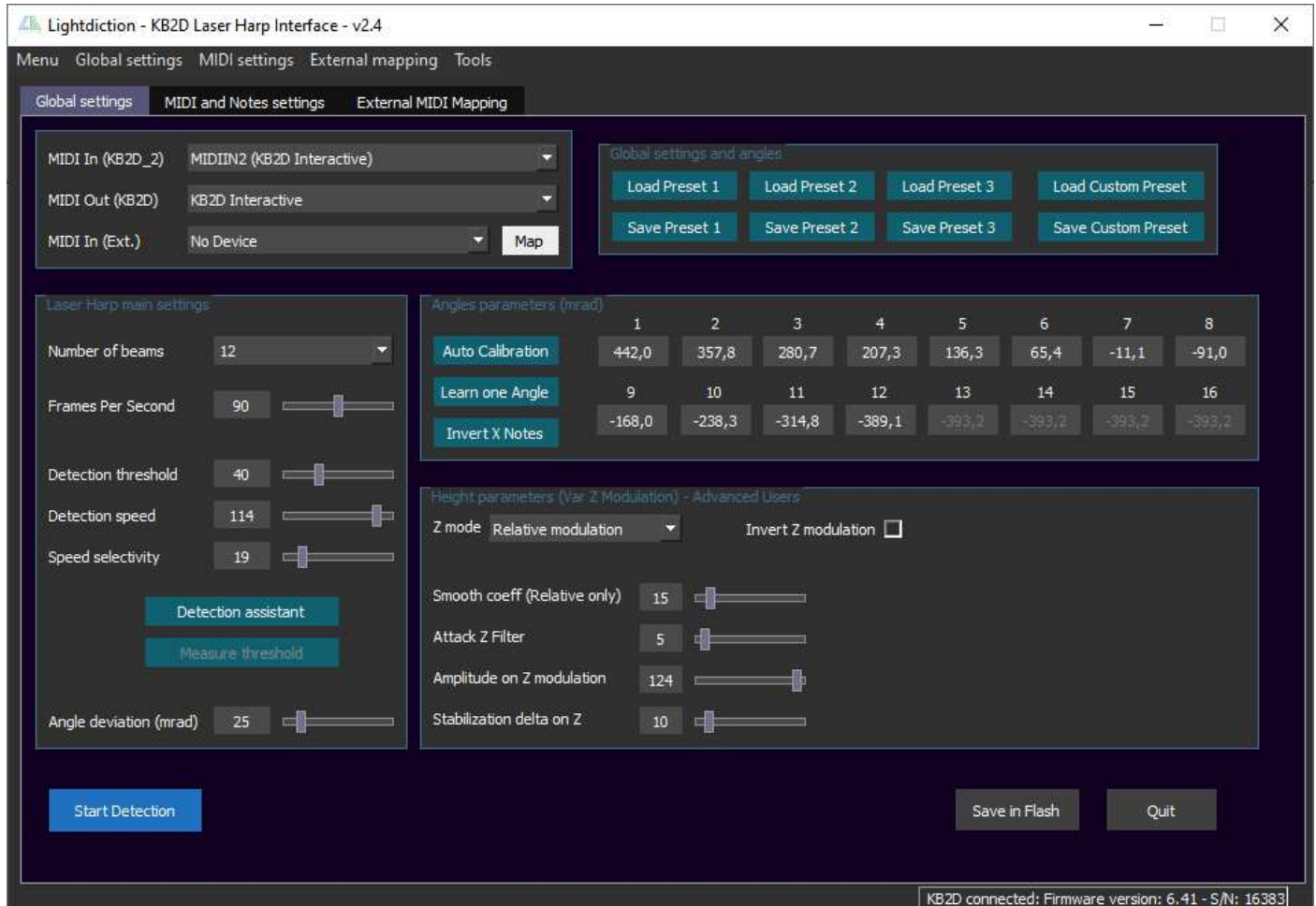


Fig. 3: Display of Tab 1, once the MIDI ports have been correctly selected (design and functionalities can change).

A Laser Harp system can be set in a few steps using the KB2D Interactive Device.

- 1- Download the last KB2D setup on <https://lightdiction.com/Ressources/> and install it. If necessary, download and install vcredist package, if you do not already have Visual C++ Redistributable files installed.
- 2- Place your KB2D device accordingly to Fig. 1 on page 3. Connect the laser and KB2D on your computer and project a laser harp pattern on your laser. If you have the standard KB2D (with green dichroic filter), the beams should include green wavelength (at least, it can be teal, yellow, white...) in order to be detected.
- 3- Start the KB2D user interface. If the KB2D is connected, the correct MIDI port are automatically set: **MIDIIN2 (KB2D Interactive)** as input port and **KB2D Interactive** as Output Port, as shown on Fig. 2. If this is not the case (or if the manual selection returns an error), the port may be used by another software. Once the correct ports have been set, the interface will display all the parameters saved inside the KB2D.
- 4- Then open your Digital Audio Workstation (DAW) and use the MIDI In “**KB2D Interactive**” on your DAW to play the notes sent by the KB2D. Eventually, also connect the Footswitch or any other external MIDI controller on the KB2D Interface, and Map it (in tab “External MIDI Mapping”).

- 5- Select the MIDI Notes you want the KB2D to send with “**Notes parameters**” (Fig. 4). Then click on “Send Note 1 (test)”. This will force the KB2D to send the note you selected on beam 1 in **Notes parameters**. If you cannot hear anything, check that “KB2D Interactive” MIDI In port is correctly connected on your DAW.
- 6- Click on “**Detection assistant**” (in first tab) and follow the instructions. Eventually, adjust the detection threshold using “**Measure threshold**” to help. The distance of detection can be adjusted with “**Detection threshold**”.
- 7- Click on “**Auto Calibration**” (In first tab), and follow instructions. Use preferably a white and plane surface (like Lightdiction business cards) to interact with the beams for calibration. After this calibration, the KB2D is automatically in “**Start**” state: the blue LED on the KB2D device is now On.
- 8- Your system is now calibrated. You can play each note by interacting with the corresponding beam. You can fine tune beam position by clicking on “**Learn one Angle**”, and fine tune detection settings by following the details in ANNEX 2. When all parameters correspond to your needs, you can save them by clicking on “**Save in Flash**”. Thus, the KB2D will retrieve these values if you disconnect and reconnect it.

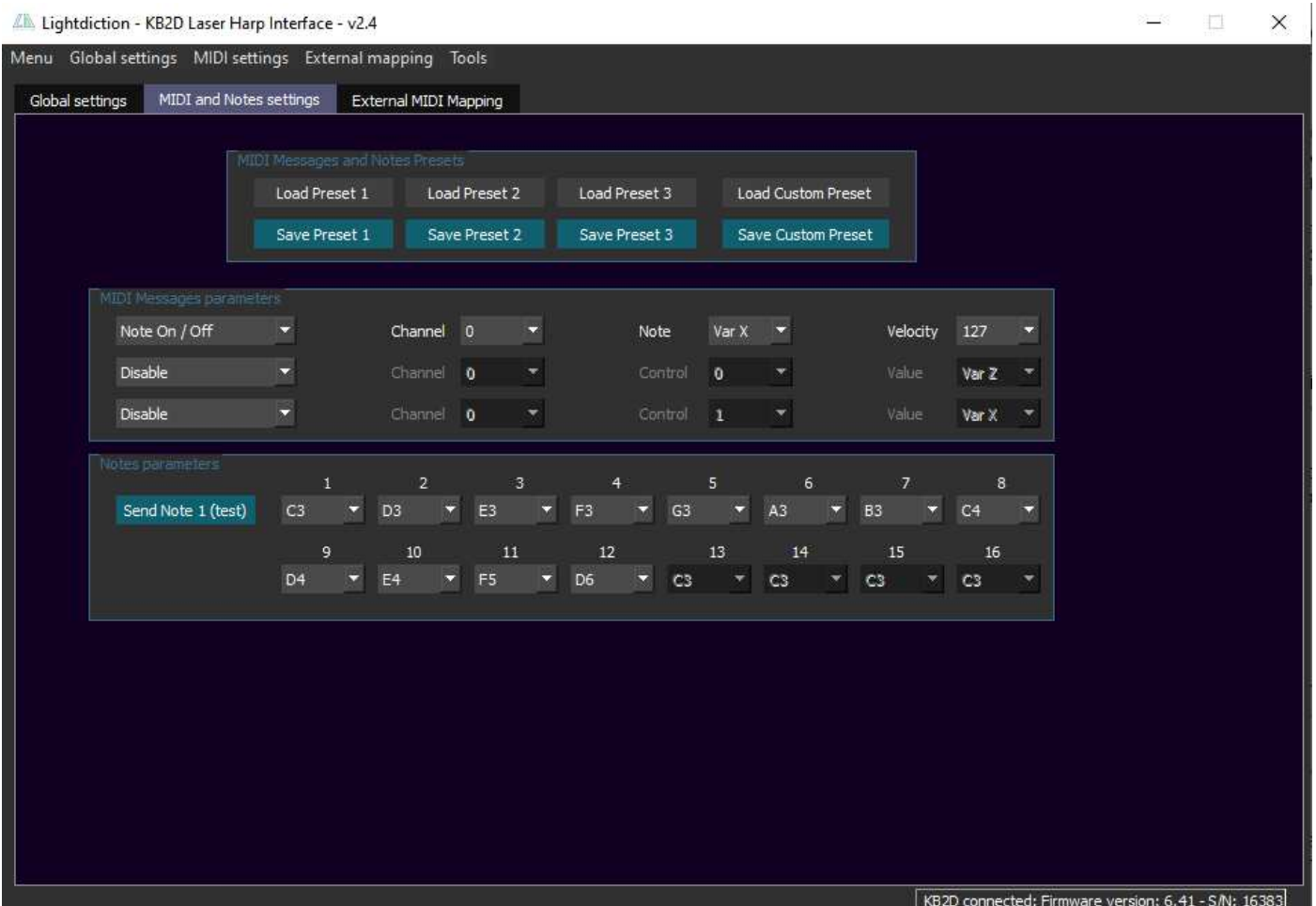


Fig. 4: MIDI and Notes Settings (Second tab)

If you encounter a problem during settings, report to ANNEX 3.

To interact with the beams it is preferred to use white gloves, or uniform surfaces. It is possible to play directly with the hand, but the detection threshold would probably need to be lowered, because of the low reflectivity of the hand.

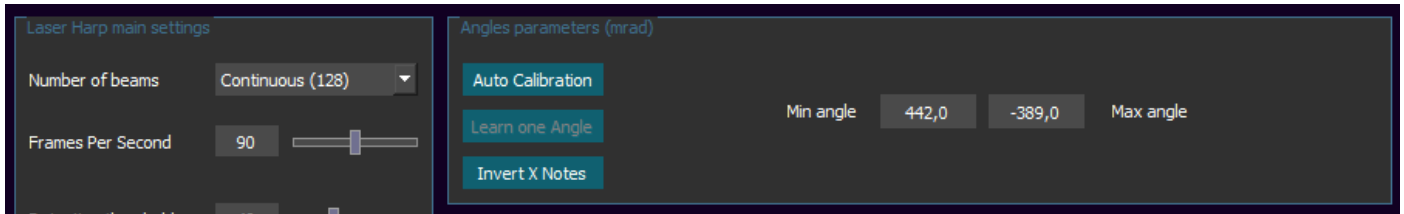
Depending on the option you chose, the KB2D is detecting only Green, Red or Blue beams (by default Green). This means your beams have to comprise at least this wavelength (white will always be detected, since it has all 3 colors).

## PRECAUTIONS ON USE

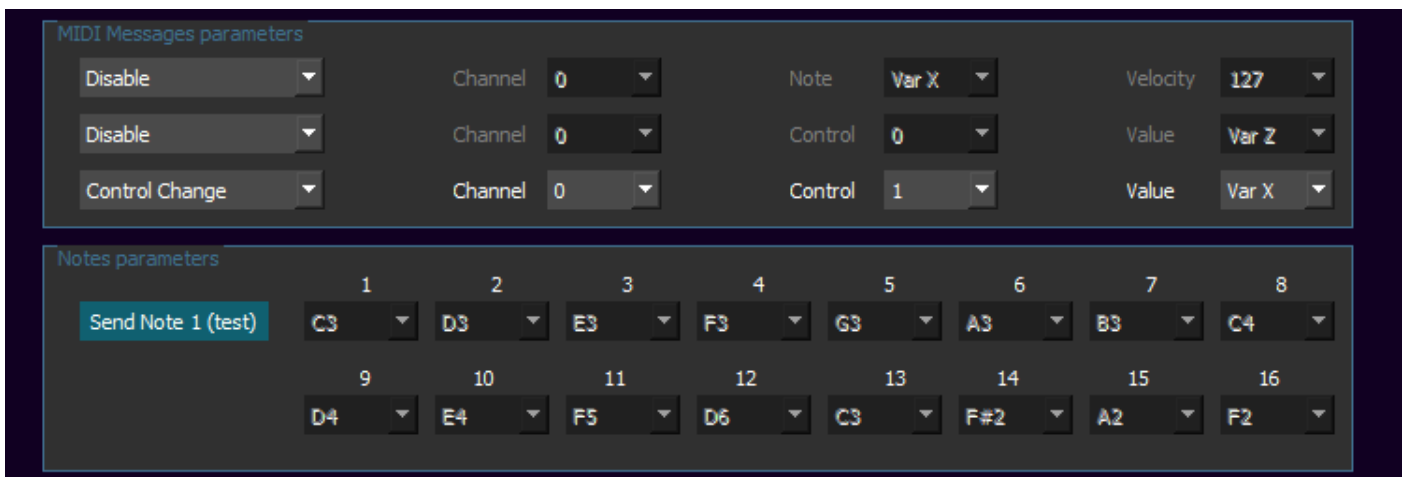
- Be careful not to aim at the KB2D with direct lasers. This can damage irreversibly the photo-detection system. The KB2D device is detecting light diffusion caused by objects (or hands) interrupting the lasers.
- In order to reduce parallax error (variation of detection angle with height), the KB2D should be placed preferably close to the origin of the laser source (as shown on Fig. 1).
- In order to optimize detection parameters and reduce false alarms. The “background” projection surface should be dark or at a long distance compared to the desired distance for interactions.
- The KB2D device is able to detect variations on 2 dimensions: angle X (in the plane aligned with the length of KB2D box), and distance (height) Z. Place your device accordingly (see Fig. 6).
- Any interaction with the laser beams can be detected. Thus, a background too close can cause false detections. Also, white surfaces are more reflective than black surface. Using a white glove can thus help detecting the hand instead of the background.



## ADVANCED MODE: CONTINUOUS DETECTION – LASER TRACKING



- 1- To enable this mode, you have to select “Continuous (128)” in “Number of beams” Combo Box.
- 2- In this mode, you can only calibrate min Angle and max Angle. You can use Auto-calibration, just like in discrete mode. Also, Invert X will invert min angle and max angle.



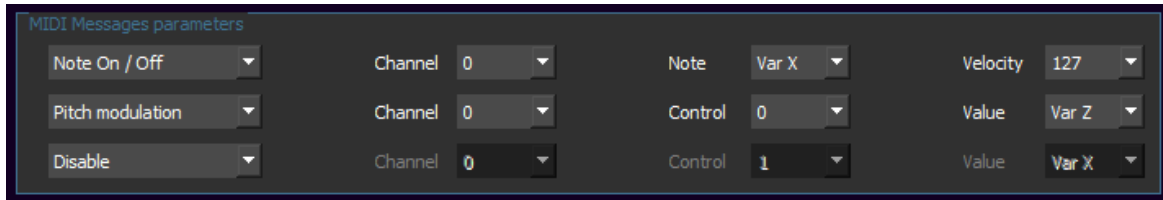
- 3- In this mode, you cannot select any note. VarX varies from 0 to 127 on the whole angle range you defined.
- 4- You can play notes on this range, but the usual application for continuous mode is laser tracking.
- 5- Control Change is more appropriate for laser tracking: enable it, and set “VarX” in Value. Also, select the Channel and Control you wish

### Your laser tracking mode is now set!

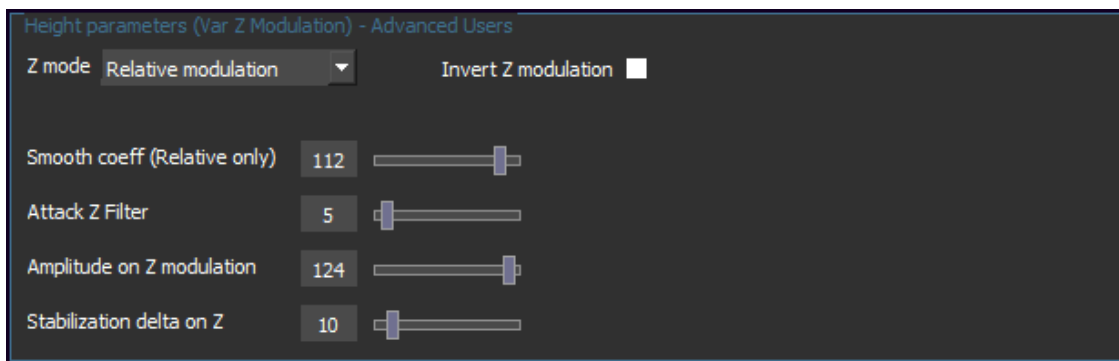
The KB2D controller will send CC messages with a value varying from 0 to 127 in function of the position angle. 0 corresponds to Min Angle (or lower), 127 corresponds to Max Angle (or upper).



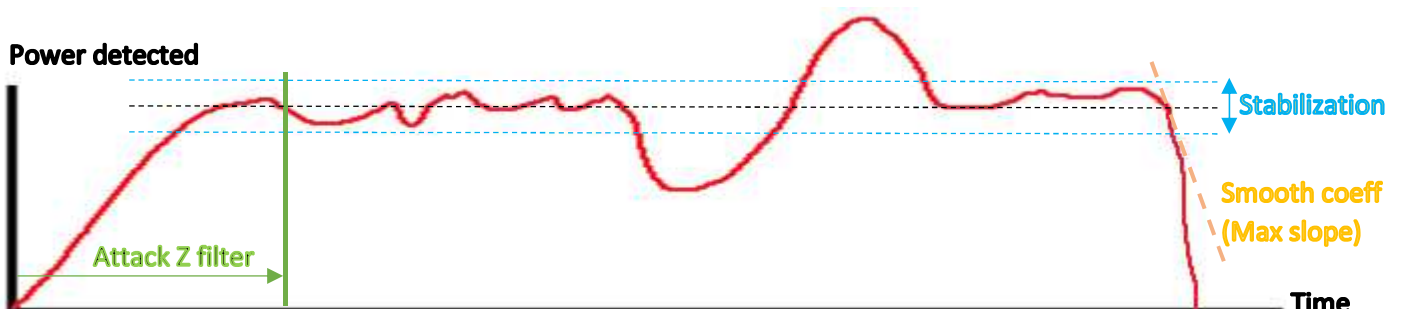
## ADVANCED MODE: HEIGHT MODULATION



- 1- To enable Height detection, you have to use **Var Z**. Usually we use it for pitch modulation for instance.
- 2- Keep Note On / Off enabled to be able to play notes, but enable Pitch modulation too, and the “Value” to **Var Z**.
- 3- Just like classic laser harp mode, select the notes you want to play



- 4- Switch to main tab. For Pitch modulation with height, select relative modulation. This will always start the pitch at 64 (no pitch), and then the pitch will vary in function of the variation of height during the interaction.
- 5- Smooth coeff allows to filter height jumps (caused by the transition when an interaction stops for instance). The higher smooth coeff is, the smoother the modulation will be.
- 6- Attack Z filter allows to ignore the first detections. The higher Z filter is, the more detections are ignored.
- 7- Amplitude on Z modulation defines the amplitude of variations of **Var Z** in function of height.
- 8- Stabilization delta on Z defines the delta around the height of interaction where **Var Z** will remains the same (no modulation).



## ADDITIONAL COMMANDS - EXTERNAL MAPPING

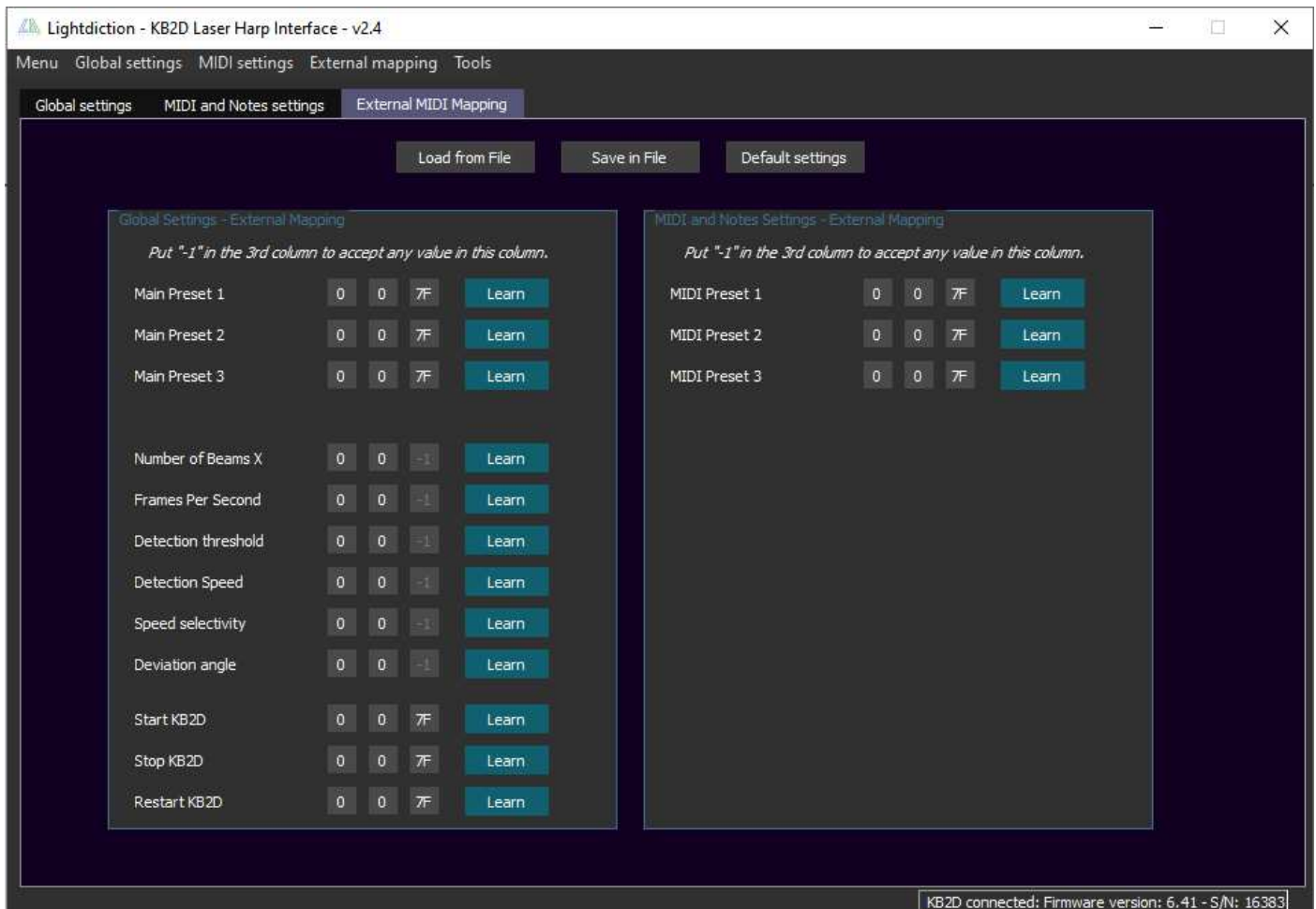


Fig. 5: External MIDI Mapping settings (third tab)

The version 2.2 of the interface implements this new features that enables to map almost any parameter or button to an external MIDI controller.

For instance, you can use a slider of an APC40 to change the Detection threshold, or a button of the pad to activate a “MIDI and Notes preset” you previously saved.

To Map a button or command to an external controller, you first have to connect the external controller (Tab 1), and click on “Map” (or directly on the 3<sup>rd</sup> Tab).

Then, simply click “Learn” on the command you want to be mapped, and press a button / move a slider on the external controller to link the button / slider / knob to the command. The KB2D will automatically recognize the button / slider. Note that all commands that need a Value (like Number of Beams X) will take the value in the 3<sup>rd</sup> column of the MIDI message as the parameter.

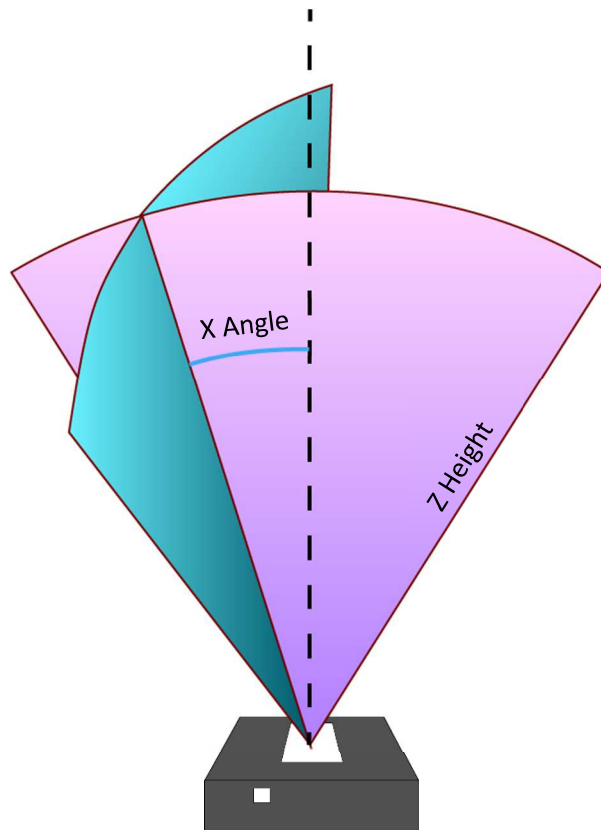
If you want a button command (like Main Preset 1) to be triggered whatever the Velocity is, you can put a -1 in this column (all Data can be entered manually).

If you want to keep your preset for your next session, save your preset in a file (click on “Save in File”), and Load these Presets at your next session.

## HOW DOES IT WORK?

The KB2D is detecting the position angle of each incident light interaction. With the help of a complex algorithm, it can then precisely separate each laser beam from parasitic light source, and send a MIDI signal associated with a specific interaction. Multiple interactions can be detected simultaneously (so it is possible to play a “polyphonic” laser Harp for instance).

Interactions can be detected in a 3D environment, but position measurement is in 2 dimensions with the KB2D. The X (angle) and Z (distance) variables correspond to the coordinates of the interaction.



*Fig. 6: The 2 dimensions on detection with KB2D.*

Every interaction in the blue plane will have the same “X angle” coordinate. The “Z height” coordinate is determined in function of the luminous power received by the KB2D, which is directly correlated with the distance between the interaction and the KB2D module. Thus, it can introduce a variation on Z height coordinate if the laser source has not a constant emission power.

As the KB2D is measuring the angle and not just detecting light (or laser) interactions, it does not have to be synchronized with the scanning system of the laser source. Thus, it can work with many laser sources at the same time.

## LIST OF COMMANDS

MIDI Device selection (Tab 1)	
MIDI In (KB2D_2)	Select <b>MIDIIN2 (KB2D Interface)</b> as MIDI In port. If the selection of this port returns an error, the port may be used by another software. This " <b>MIDI IN 2</b> " is used to receive feedback from the KB2D (MIDI Out 2, when a command is sent. If this port is not connected, the user interface will not recognize the KB2D.
MIDI Out (KB2D)	Select KB2D Interface (or MIDIOUT2 (KB2D Interface)) here.
MIDI In (Ext.)	Select an external MIDI controller here, like footswitch or AKAI APC40 for instance.
Detection parameters (Tab 1)	
Number of Beams	Number of Discrete notes to play with (generally, this correspond to the number of beams projected).
Detection Threshold	Defines the threshold level for detection. The lower this value is, the further the system can detect an interaction, but the more sensitive the system will be (for an interaction as for parasitic lights / parasitic targets).
Detection speed	This parameter define the minimum duration of the detection necessary to count an interaction as a valid one, <b>in 1 Frame</b> . When the speed is on the maximum, a short detection is enough to consider the detection as valid. Lowering the speed will cause the system to be more selective / less sensitive.
Speed selectivity	The lower the "Speed selectivity" value is, the more sensitive, but less selective (and resistant to parasitic lights) the system is. (This parameters sets the maximum duration of the detection to count an interaction as valid, in 1 Frame).
Frames Per Second	Defines the number of Frames Per Second for detection. Ideally, this has to be as close as possible to the actual frame rate of the laser pattern.
Angle deviation	This corresponds to the detection angle error authorized on each beam compared to the angle set. This value should be less than half the gap angle between two beams. Increase this value to improve the detection. It is recommended to slightly increase this value for polyphonic detection (multi-notes).
Detection assistant	Automatically calibrate the <b>Detection Threshold</b> , <b>Detection Speed</b> and <b>Speed Selectivity</b> , as well as <b>Angle deviation</b> .
Angles parameters (Tab 1)	
Auto Calibration	Ask the user to interact with the first beam and last beam to (roughly) calibrate all beams at once. (See <b>Learn One Angle</b> for fine calibration).
Learn One Angle	Calibrate the angle of one beam in particular by interacting with it.
Send Note 1 (test)	Force the KB2D to simulate an interaction with the first beam and to send the corresponding note.
1..12	Manually set the interaction angle of each beam in function of its index (from 1 to 12).

Height parameters (Var Z Modulation) – Advanced Users (Tab 1)

Z mode	Relative modulation: <i>Var Z</i> always starts with a value of 64 at the start of the interaction. Then, a variation of height changes the value from 0 to 127. Absolution modulation (experimental): the value sent on <i>Var Z</i> varies with the absolute height of interaction. This value depends on power received.
Smooth coeff.	(Only when relative modulation is active). This sets the maximum variation of height per frame (this avoids discontinuous gaps). Lower this value to have a smoother Z variation.
Attack Z Filter	(Relative modulation) Filters the first detections before starting to calculate the height. This avoids parasitic variations caused by the start of interaction.
Amplitude on Z modulation	(Relative modulation) Amplitude of variations of <i>Var Z</i> in function of the height.
Stabilization delta on Z	(Relative modulation) Delta on Height where there is no variation of <i>Var Z</i> around the height of initial interaction. This avoids small parasitic variations.
Invert Z modulation	Inverts the variation of <i>Var Z</i> in function of height

Notes parameters (Tab 2)

Invert X Notes	Invert angles order / beams order.
1..12	Set the Note to be played by the corresponding beam index (from 1 to 12)

MIDI Messages parameters (see ANNEX 1) (Tab 2)

Note On / OFF   Disable	Select the output format of Note On / Note Off MIDI messages. Note On is sent when a detection is noticed. Note Off is automatically sent when the interaction stop.
Pitch modulation   Disable	Select Pitch modulation to start sending a pitch modulation (generally with <i>Var Z</i> in value, to have a modulation in function of height).
Control Change   Disable	Select Control Change output format. Thus, you can output a message in function of X value, or Z value (for instance). Useful for tracking with <i>Var X</i> .

External Mapping parameters (Tab 3)

Learn	Click to automatically learn the next received message from the external controller. If you want to accept any Velocity (Note On / Off) or Value (CC), write -1 in the 3 <sup>rd</sup> column.
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Other parameters

Update All (Menu)	Shortcut: F5. This command updates the parameters on the interface (does not affect the parameters loaded in the KB2D).
Quit (Menu)	Exit the KB2D interface. The KB2D will keep working by itself.
Start KB2D (Commands)	Start detection capability (Enables interactions).
Stop KB2D (Commands)	Pause detection capability (Disables interactions).
Restart (Commands)	Restart the device (and load parameters saved in FLASH memory).

Send test note (Commands)	Send one test Note to check the KB2D is correctly connected to an audio software.
Write All in Flash (Commands)	Save all actual parameters in the device, so the parameters are not reset on the next power off / power on.
Restore Defaults (Commands)	Restore default parameters. These parameters are not automatically saved in the KB2D. Thus, a Restore Defaults command can be canceled by sending a Restart command.
About (Tools)	Give information on actual software / firmware version as well as KB2D Serial Number.
Start Firmware Updater (Tools)	Start the Firmware Updater mode (KB2D will also restart in LD Firmware Updater mode). The KB2D mode can be directly restored from the Firmware Updater Mode.

## ANNEX 1: DETECTION MODES / COMMUNICATION FORMAT

This Annex refers to the “MIDI Message parameters” section of the KB2D Interactive Interface software.

The KB2D detection module can localize interactions on 2 dimensions (X angle and distance Z).

The KB2D interactive module is using MIDI protocol to communicate. The user can select the MIDI format of messages in function of the mode selected.

On each interaction, the KB2D can be set to send up to 3 MIDI messages (1 Note On and 2 Control Change).

If “Note On / Note Off” is activated, a “Note On” message is sent when an interaction on a valid position happens. A “Note Off” message is then automatically sent when the interaction stops (or when the position corresponds to another MIDI signal / does not correspond to a valid position).

If “Pitch modulation” is activated, this MIDI signal is sent when an interaction happens and when the position of the interaction changes. No specific message is sent when the interaction stops.

If “Control Change” is activated, this MIDI signal is sent when an interaction happens and when the position of the interaction changes. No specific message is sent when the interaction stops.

### About MIDI format...

A Note On message consists of:

- A channel number, from 1 to 16.
- A Note value from 0 to 127.
- A velocity value. If the MIDI signal is used to play an audio signal, the velocity should be  $> 0$  to have a note played.

A Pitch modulation message consists of:

- A Channel Number
- A Control number
- A Value to assigned

A Control Change message consists of:

- A Channel Number
- A Control number
- A Value to assigned

Note On / Note Off messages are generally used for discrete angle applications (like laser harps), or to activate / deactivate a signal in continuous applications.

Pitch modulation messages are useful to add a pitch variation when varying the height of modulation. (Add Var Z for height modulation).

Control Change messages is useful for continuous variations on angle / height.

Thus, for a Laser Harp application, Note On / Note Off messages are preferable to play the notes, and a continuous height variation can be set on Pitch variation for instance.

Control Change messages are very useful in motion tracking applications (in particular with Var X).



### About variables...

To have a MIDI message vary in function of the angle / height, it is necessary to set a variable on these messages.

There are 4 variables available: “Ind X”, “Ind Z”, “Var X”, “Var Z”.

“Ind X” and “Ind Z” can take a value from 1 to 16, whereas “Var X” and “Var Z” can take any value from 0 to 127.

*Ind X* and *Ind Z* can be set on Channel and Control, whereas *Var X* and *Var Z* can be set on notes, Value or Velocity.

Practically, in most of case “Ind X” and “Ind Z” are not useful, and everything can be done with “Var X” and “Var Z”, but in some rare cases we could need these variables. To set a Note On signal on different channels while a Control Change signal takes values from 0 to 127, for instance...

Var X can be assigned to a position with “Angle parameters”.

### About position...

Each MIDI Signal is sent correspondingly with a specific position.

Thus, in case of a continuous detection, it is necessary to correctly set the extreme angles so the system knows the value to assign on Var X in function of the position of the interaction.

In the case of a discrete mode, it is even more important to correctly set the different angles corresponding to each “beam” (step). Indeed, if an interaction happens but does not correspond to any position registered, this is not considered as a valid interaction and no MIDI message will be sent.

All positions can be set automatically by clicking on “**Auto Calibration**” or “**Calibrate Z**”. Then, there only need to touch the beam (to interact) on each extreme position. The KB2D will then save these positions and calculate every intermediate position (in case of a discrete mode). These intermediate positions are estimated, based on a regular spacing between each beam. It can be more precise to calibrate each beam independently (see “**Learn one angle**” command). This work the same with height (Z).

### Applications...

If you want to have the pitch to vary with the height, activate a CC line, in addition the Note On / Off. Then, select the desire channel and control, and set “Var Z” for the value.

If you want the pitch to always be 64 at the start of the interaction, and to modulate it in a second time, then select “Relative modulation” in Height parameters (Var Z).

## ANNEX 2: DETECTION SETTINGS

This Annex refers to the “Detection parameters” section of the KB2D Interactive Interface software.

Detection settings are very important. These settings can be optimized in function of the environment, so the KB2D module can work in almost any condition.

There are 5 main parameters:

- Detection Threshold
- Detection speed (arbitrary value)
- Speed selectivity (arbitrary value)
- FPS (Frames per seconds)
- Angle deviation

The detection threshold is the most important parameter. A wrong value on this parameter will directly cause false detections or no detection. Fortunately, this is quite easy to set it correctly. Just click on “Learn One Angle” for instance, without interacting with the laser. After a few seconds, if the KB2D sends a MIDI Note On message (as if there was an interaction), then the threshold is too low (or there is too much parasitic light). At the contrary, if the KB2D cannot calibrate when you interact with the laser, maybe the threshold is too high.

In the extreme condition where ambient light is really too high, it is possible that the system cannot detect interactions at all, because the detector is saturated. This should not happen with the standard KB2D version with a dichroic window.

The “**Detection speed**” and “**Speed selectivity**” define the percentage of a detection frame duration in which there has to be an interaction. The value entered is an arbitrary unit.

The **Detection speed** define the minimum duration of the detection necessary to count an interaction as a valid one. When the speed is on the maximum, a short detection is enough to consider the detection as valid. However it will be more sensitive to parasitic lights. Setting the “**Speed selectivity**” very low enables to interact with an entire laser pattern (it can be useful when the pattern projected is small, like tracking applications).

As the contrary, a low value in “**Detection speed**” / high value in “**Speed selectivity**” can lead to difficulties to detect interactions.

The lower the “**Speed selectivity**” value is, the more sensitive, but less selective (and resistant to parasitic lights) the system is.

The FPS value on the KB2D can be important in some applications. Generally, the FPS value on the KB2D should not be much higher than the FPS of the laser frame projected by the laser projector (if “Note On” / Note Off is activated). Else, parasitic “Note Off” will be sent by the KB2D even if the interaction does not stop.

A high FPS value will cause the system to be more reactive (this will reduce the latency of the KB2D). It can be necessary to compensate a high FPS value by reducing the “minimum time” and increasing the “maximum time”.

The Angle deviation corresponds to the detection angle error authorized on each beam compared to the angle set. This value should be less than half the gap angle between two beams. However, if this value is too low, the system can have difficulties to detect or maintain Notes.

## ANNEX 3: COMMON ISSUES

Issue	Cause	Solution
Cannot connect to midi port In and / or Out	A software may already use the MIDI port (some software automatically connect to MIDI port).	Close other music software and such before starting KB2D interface.
The KB2D does not detect anything even with detection assistant	There is no detection. Have you clicked on “Start Detection”?	Depending on the filter used ( <b>Green, red, or Blue</b> ), check that the beam at least has the wavelength of interaction.
The distance of interaction is very low	The detection threshold is not correctly set.	Lower the “Detection threshold”. Eventually use “Detection assistant” to help.
The latency is high when I interact with the beam	The software used to play the notes from MIDI (DAW) can introduce a latency.	There may be parameters to change, like buffer or samples.
The latency is high when I interact with the beam	The detection parameters on KB2D interface are not correct.	The device may have difficulties to detect the beams. Change the detection parameters or use the “Detection assistant”.
The Notes are not stable / the KB2D does not detect correctly	Detection parameters are not correct or the environment is confusing the system	Try to Autoreset detection, change the deviation angle or other settings manually. Test the system without parasitic lights.
The Notes are not stable / the KB2D does not detect correctly (Not all notes)	Angles parameters are not correct for every all notes / The KB2D has been roughly calibrated.	Calibrate each beam independently with “ <b>Learn One Angle</b> ”.
The KB2D is playing notes without interactions	The KB2D is detecting parasitic lights from the environment or because the background is too close.	Is the background is close, increase the Detection threshold, or use a dark surface on the background to reduce interactions. Try to be more selective on detection parameters, to limit parasitic interactions.
The KB2D does not play notes, even when “Detection assistant” succeeds	Notes parameters are not correct, or the KB2D is not linked to an external audio software.	Check Notes parameters and click on “Send Note 1 (test)” to verify the KB2D is properly linked to the external Software.
Monophonic detection is good, but polyphonic detection is not stable	Polyphonic detection causes a slight variation of the measured angle on each beam	Try to increase slightly the “Angle deviation” (as long as it does not go above half the angle gap between two beams).
KB2D is not recognized any more by the computer	The firmware is corrupted. Something wrong / a disconnection happened during firmware loading.	Press the start button directly on the KB2D while plugging USB cable, to force it to start in Firmware Updater mode. Then just upload the firmware again.
The KB2D always start in Firmware Updater mode / cannot go back to normal mode.	The firmware is corrupted. Something wrong / a disconnection happened during loading.	Just upload the firmware again.

## ANNEX 4: FIRMWARE UPGRADES

In order to do firmware upgrade, the KB2D has to be started in LD Firmware Updater mode.

To do this, click on Start Firmware Updater in Tools menu. If this is the first time you do it; it may return an error, because your system is installing the driver. Just wait a few seconds, and restart the KB2D User interface.

Open “Tools” Menu and click on “Update Firmware now”. Select the .kb2d file corresponding to the firmware version. The firmware upgrade will then start automatically. The Firmware upgrade process can take about one minute. Once the firmware update is complete, a message window will indicate the success of the process. You can now go to tools, **Exit Firmware Updater**. The KB2D will automatically restart in normal mode.

Else, simply press the Start button on the KB2D device while plugging the USB cable. The program will directly go to LD Firmware Updater mode at startup. Then, restart the KB2D interface. LD Firmware Updater should be automatically selected as MIDI In and MIDI Out. Follow the same procedure as above.

This last method can be useful if for any reason the KB2D is corrupted and does not start anymore (for instance if a disconnection happened during the last firmware loading).

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## Revision History

Date	Information	Version
30.08.2017	Basic KB2D information	1.0
26.11.2018	General information – interface updated	1.1
23.03.2019	Information – interface updated	1.2
13.04.2019	Content and information – interface updated	1.3
01.12.2019	Content and information – Interface updated	1.4
09.05.2020	Content and information – Interface updated	1.5