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DIAMOND CONTROLLER

USER MANUAL

Rev. 1.1 / 2017-11-06
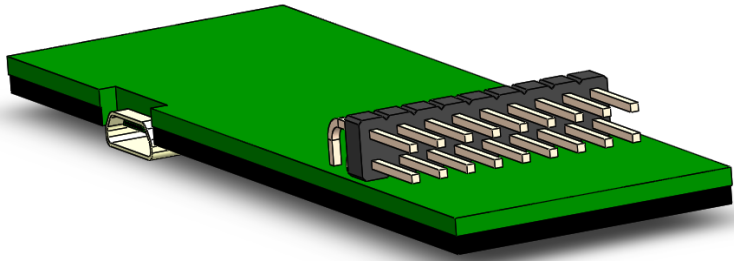
By **RSX Engineering**

CONTENT

Click on any title to jump to the corresponding section!

1. OVERVIEW

Diamond Controller is the complete sound and light controller of your saber. It responds to motion by triggering sound and light effects. It is fully configurable through the USB port using the Ultrasabers Launcher software on PC and MAC.

The Diamond Controller is a sound board combined with an LED driver. The sounds are loaded on the board from a computer and stored in a **large internal memory**. A dual sensor detects any motion and a powerful processor runs advanced detection algorithms, allowing it to recognize not just basic saber actions such as a swing or a clash, but also complex moves. Such complex moves, called **gestures**, can be learned from you after a single execution and when they're recognized they trigger special sound and light effects. Gestures can be used for practice, saber artistry, and if you're really skilled, even in combat!

The Diamond Controller is able to drive up to 8 LED channels: 4 power channels, which are usually combined to drive a single Red-Green-Blue-White LED, and 4 accent channels, which drive independent, low power LEDs, for accessories such as an illuminated switch or a crystal chamber. Any accent channel can be used by the **built-in battery monitor** to signal the charging state of your batteries. For special configurations such as **double-blade** or **cross-guard** sabers, each accent channel can be turned into a power channel by using an Onyx buck regulator.

On the Diamond Controller the sounds and lights are synchronized, packed together into a single entity called an **effect**. Effects are triggered by your actions and they define how your saber looks and sounds. The identity of your saber is composed by 15 effects, which define a **font**. You can have up to 16 different fonts loaded in the internal memory and you can easily select any one of them with just a few simple moves, without the need to connect the board to the computer.

Disclaimer
This version of the user manual is valid for Diamond Controller firmware version 2.40 and Ultrasabers Launcher software version 2.40. Any other firmware or software version may differ. Changes can be made without notification.

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2. GETTING STARTED

Power On!

The Diamond Controller comes already configured to drive a Red-Green-Blue-White LED and with preinstalled fonts. There's no need to connect your saber to the computer unless you want to make some significant changes. It is ready to use and full of possibilities straight from the box.

A **font** is a collection of effects that define how your sabers looks and sounds. Your board can hold up to 16 fonts and comes with 9 preinstalled:

- Obsidian
- Black Star
- Sith
- Ancient Saber

- Episode I
- Episode II
- Episode IV
- Episode V
- Episode VI

An **effect** is a package of lights and sounds that are triggered and played simultaneously. The Diamond Controller can store and play up to 15 effects per font, each assigned to a specific action. Most effects are triggered by motion (basic moves or gestures – see following paragraphs), while 4 of them are static:

Tag Effect — When you power on your saber by connecting the batteries or removing the kill switch, you'll hear a sound and see the blade changing colors. This is the Tag effect ("boot sound" on ancient sound boards), which identifies the current font that runs on your saber. After playing the Tag effect, the Diamond Controller will go in standby mode.

Power On — When the saber is in standby mode, you can turn it on with a short press of the switch. What you'll see and hear is the Power On effect, and then your saber will get in active mode.

Idle Effect — While your saber is in active mode and no motion is detected, it will play continuously the Idle (Hum) effect. Each time a motion is detected the saber will play a different effect – this is detailed in the following paragraphs – and then return to playing the Idle effect.

Power Off — If you keep the switch pressed for 2 seconds, the saber will run the Power Off effect and then go in standby mode.

Basic moves

The Diamond Controller detects 5 different types of basic moves and reacts to each one with a different effect:

SWING

The Swing effect is triggered by a swing motion of the saber in any direction.

IMPACT

The Impact (Clash) effect is triggered every time the blade encounters a rigid object, e.g. hits another blade in combat.
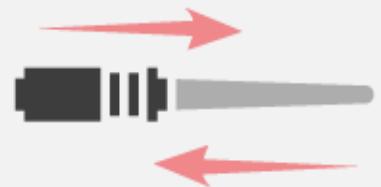

SPIN

The Spin effect is triggered by a 360° in-plane rotation of the saber, in any direction.

STAB

The Stab effect is triggered by a forward / backward thrust of the saber (stab motion).

FORCE

The Force effect is triggered by rotating the saber from your wrist, continuously, clockwise and counter clockwise at least ¼ of a full rotation on each direction.

LOCKUP

Although not triggered by a special move, the Lockup effect is closely associated with combat moves. It is triggered by a short press of the switch and is played repeatedly until the switch is pressed again.
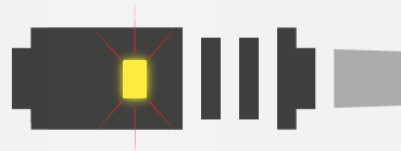
PRESS THEN RELEASE

Tips

♦ You can see an instructional video on Diamond Controller basic moves, *here*.

♦ When your saber is in lockup mode, it will not react to basic moves, gestures or menu commands.

♦ You can adjust the detection sensitivity, for each of the basic moves, to suit your own style. This is done on the "Diamond Controller" tab of the Ultrasabers Launcher software. See *chapter 4* for details.

Motion detection sensitivities		
Swing:		127
Impact:		128
Spin:		127
Stab:		128
Force:		127

Gestures

One of the most advanced features of the Diamond Controller is the ability to learn and recognize gestures. A gesture is a sequence of moves of any complexity that lasts up to 5 seconds. It is learned by the Diamond Controller from a single execution and can be detected any time while the saber is in active mode. Each time a gesture is recognized you'll be rewarded with a special effect. They can be used for practice, saber artistry, and if you're really skilled, even in combat!

Each font can hold up to 5 gestures. You can have the same gestures on all fonts or you can have different ones on each font, so your saber can recognize up to 80 distinct gestures.

The Diamond Controller comes from factory with the same 5 gestures programmed on all fonts. You can see the default gestures in the video below.

https://www.youtube.com/watch?v=oHeOli1DUhU

Gestures can be learned directly from the on-board menu – see *chapter 3* for details.

Gestures can be saved in files, loaded to another font or even to another saber and have their sensitivity adjusted through the Ultrasabers Launcher software – see *chapter 4* for details.

3. DIAMOND CONTROL

This chapter teaches you how to control your Diamond saber using just the saber itself. More advanced control capabilities are available through the Ultrasabers Launcher software, which is dealt with in the *following chapter*.

Adjusting the volume

1. Initiate

Trigger two clashes in less than 1 second while keeping the switch pressed. The easiest way to do this is by hitting the blade or the hilt with your hand.
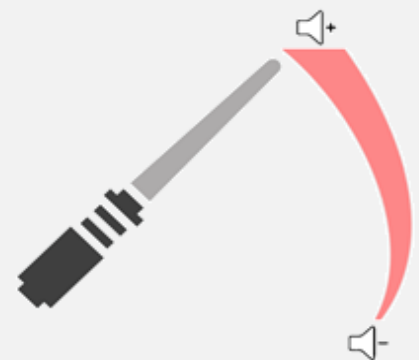
Release the switch. The saber will turn off the lights, pause for half a second then play the idle hum of the current font.

KEEP PRESSED

2. Adjust

You can now adjust the sound volume in real-time while the Diamond Controller is playing the idle hum.

Point the tip of the saber upwards to increase the volume and downwards to decrease it.

3. Confirm

Press and release the switch. The light will turn on and the saber will resume normal operation, with the volume set at the new level.

PRESS THEN RELEASE

Tip

You can also adjust the volume using the Ultrasabers Launcher software. See *chapter 4* for details.

Changing fonts

Your saber can store up to 16 fonts in the internal memory and comes from factory with 9 preinstalled. You can select which is the active one using the on-board menu.

1. Initiate

Execute a STAB motion with the switch pressed.

Release the switch. The saber will play the tag effect of the current font

KEEP PRESSED

2. Select

Rotating the saber clockwise will select the next font and rotating it counter-clockwise will select the previous font. You can cycle through the entire list of installed font in any direction.

Each time you choose a new font, the Tag effect of that font will play once.

next

previous

3. Confirm

Press and release the switch. The saber will exit the menu and resume normal operation with the new font selected.

PRESS THEN RELEASE

Tips

♦ If you change your mind and wish to cancel the font selection, keep the switch pressed for 2 seconds. This will exit the font selection menu without making any change.

♦ When the Diamond Controller detects a rotation, it will not react to another one for 1 second. This gives you time to rotate your wrist back to the initial position without triggering an opposite command.

♦ You can adjust the detection sensitivity for the menu rotations using the Ultrasabers Launcher software. See *chapter 4* for details.

Menu: 128

Learning gestures

A gesture is a sequence of moves of any complexity that lasts up to 5 seconds. It is learned by the Diamond Controller from a single execution and can be detected any time while the saber is in active mode, triggering a special sound and light effect.

Each font can have up to 5 gestures. When your saber is learning a new gesture, it will be stored in the current font. Here's how to teach your saber a new gesture:

1. Initiate

Execute a FORCE motion with the switch pressed.

Release the switch. The saber will turn off the light and enter the gesture learning mode.

KEEP PRESSED

2. Select

Rotating the saber clockwise and counter-clockwise will cycle trough gestures 1 to 5, and for each one you'll be informed if is an empty slot or already in use.

When you're at the number you wish to program, press the switch to confirm selection. If the gesture you selected is already in use, it will be overwritten.

next

previous

confirm

PRESS THEN RELEASE

3. Record

Place the saber in the start position and press the switch to start recording.

Execute the gesture. The saber will pulse a white light, signaling that it is now recording your moves.

When done, press the switch again to stop recording. The saber will play a confirmation message, then exit the menu and resume normal operation.

start

PRESS THEN RELEASE

move

stop

PRESS THEN RELEASE
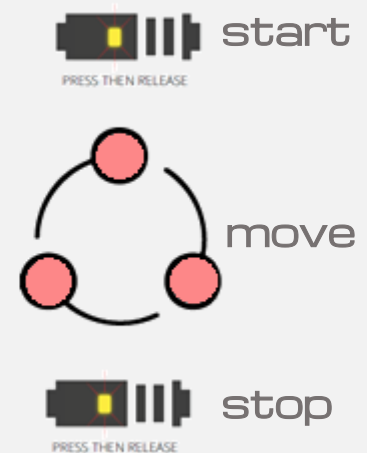
♦ You can see an instructional video on Diamond on-board controlls, *here*.

♦ Execute the gesture a few times before recording it, to make sure you'll reproduce it accurately.

♦ Take your time. The saber records the last 5 seconds of the gesture you're executing, so you don't have to start moving the saber the instant you pressed the switch to start recording.

♦ While recording the gesture the blade will pulse once a second.

♦ If your Diamond saber has the volume set to 0 (mute), it will still play the audio messages at about 1/3 of the maximum volume. When you complete recording the gesture and return to normal mode, it will revert to mute.

♦ You don't have to listen to the full instruction message "*Place your saber in the start position…*". If you know what to do, just press the button. The message will stop and you can start recording the gesture.

♦ When you stop the recording, if the board doesn't play the confirmation message it means the gesture was too short, the motion too slow or there's a problem with the internal memory. If there's no confirmation message, the gesture was not recorded.

♦ If you change your mind and wish to cancel learning the gesture, keep the switch pressed for 2 seconds. This will exit the menu without recording the gesture.

♦ If you're recording gestures that are too simple, they might be triggered too easy so you will end up with the gesture effect each time you move the saber. If this happens, overwrite the gesture or decrease its sensitivity using the Ultrasabers Launcher software.

♦ For accurate gesture recognition it is very important to adapt the detection sensitivity to the complexity of each gesture. Simple gestures need lower sensitivity to avoid false detection and complex gestures need higher sensitivity to make sure they're recognized at all. You can adjust the sensitivity for each gesture of each font using the Ultrasabers Launcher software. See *chapter 4* for details.

♦ Gestures can be saved on your computer as files and loaded to another font of your saber or even to another saber, using the Ultrasabers Launcher software. See *chapter 4* for details.

```
Gesture1

Sensitivity: 77.4  Length:3.44 s
```
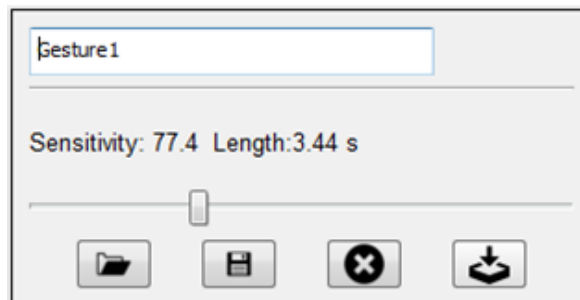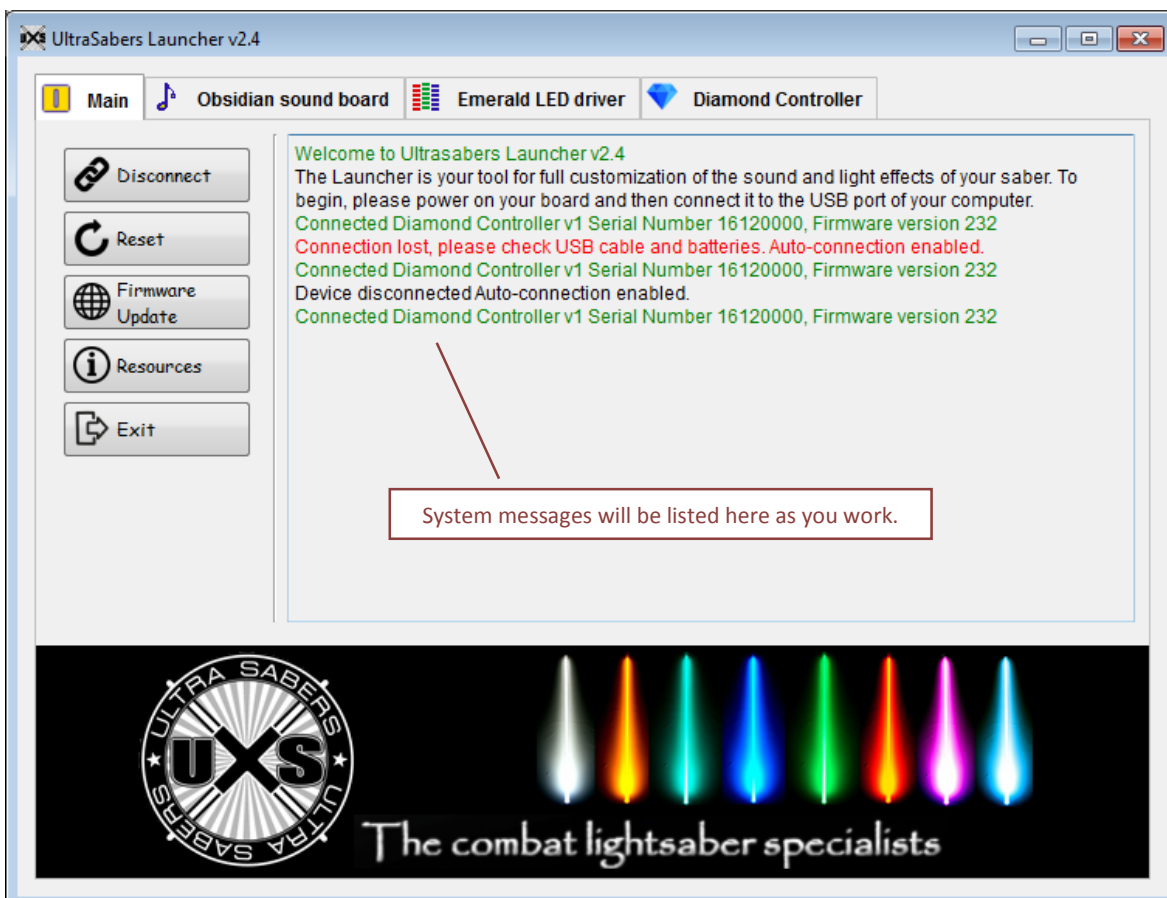
4. THE LAUNCHER

Ultrasabers Launcher is the software that allows you to fully configure the Diamond Controller. This chapter teaches you how to use it.

Installing and connecting

Do not connect the Diamond Controller to the computer until Ultrasabers Launcher is installed. For Windows 7 and 8, the Diamond Controller USB driver will be installed together with the application; on Windows 10 and on MAC, the USB driver is built into the operating system.

First uninstall any previous version of the Ultrasabers Launcher (if any), then run the installer and follow the steps on the screen. Under Windows you'll need to run the installer "As Administrator".

The Launcher is organized into 4 tabs: "Main", "Obsidian sound board", "Emerald LED driver" and "Diamond Controller". It will start with the **Main** tab active, where you can control the connection, upgrade the firmware and get system messages. Also from here you can access the documentation of all our saber electronics using the **Resources** button.

System messages will be listed here as you work.

To connect the Diamond Controller to the Launcher:

♦ Make sure the board is powered and the batteries are charged at least 50%. If the batteries discharge completely when you're writing something on the board, you might end up with a corrupt memory. The built-in battery monitor can help you prevent that.

♦ Press the switch to turn on the saber. You should hear the idle hum and see the LED lighting.

♦ Connect the board to your computer using a microUSB cable. The sound will stop, the light will turn off and you'll see the following message:
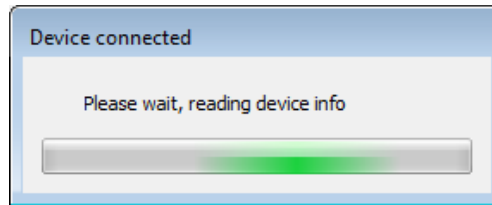
Each time you start the Launcher, on the first connection to Diamond it will read the entire memory content, which can take up to a few minutes. After that a normal reconnect should only take a few seconds, depending on how much of the memory content you changed. It is therefore recommended not to close the Launcher unless you finished working with it: if you want to test your saber, disconnect it but leave the Launcher running, to avoid long waiting times.

Once the connection is established, the Launcher will automatically open the "Diamond Controller" tab. If you wish you can go back to the "Main" tab in order to:

♦ Manually disconnect and reconnect the saber to the computer
♦ Manually reset the saber (normally not required)
♦ Check the serial number and firmware version of you Diamond Controller (those are marked with green on the message area)
♦ Check for connectivity errors (those will be marked with red on the message area)
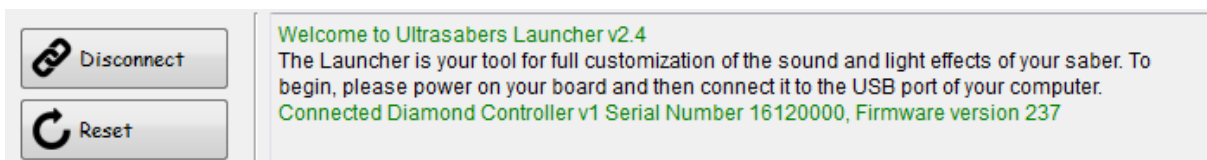
┌─────┐
│ Tips │
└─────┘

♦ If you want to check how your board behaves with updated settings, you don't have to physically disconnect the USB cable: you can use the "Disconnect" button on the "Main" tab. When the board is disconnected, this button will turn into "Connect".

♦ Once you manually disconnected the board, it will not reconnect automatically. You'll have to use the "Connect" button.

Main settings

The main settings are available on the "Diamond Controller" tab of the Launcher.
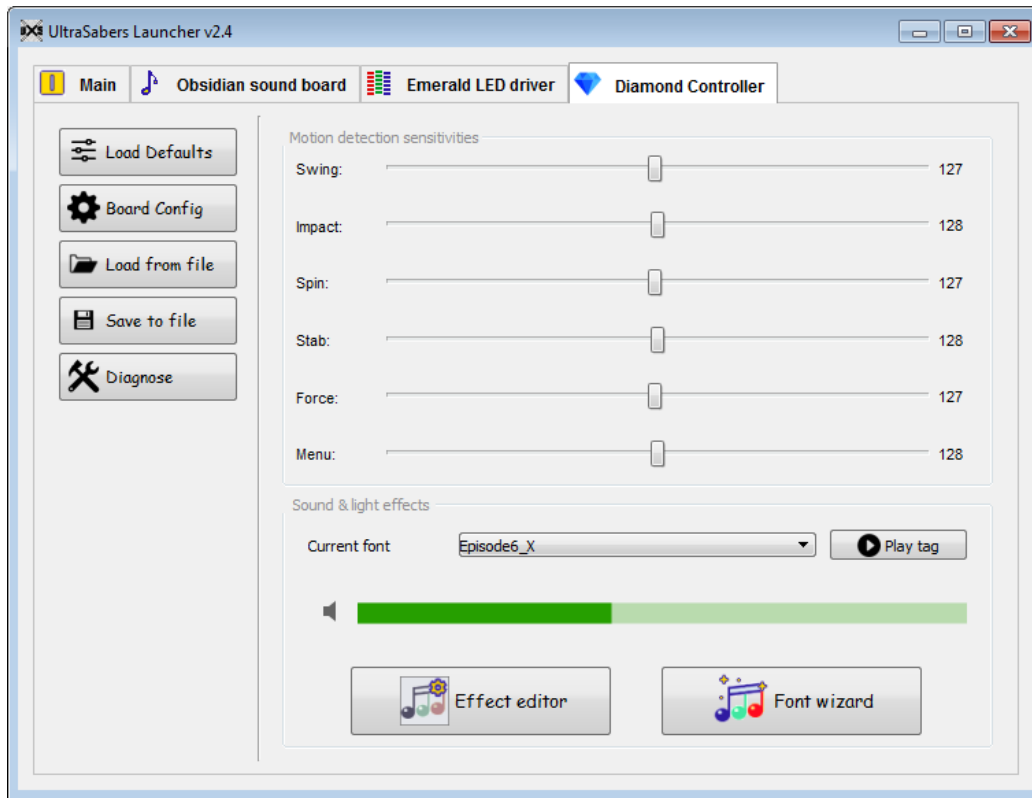
Here you can:

♦ Adjust the detection sensitivity of the basic moves (Swing, Impact, …) and menu rotations, using the corresponding sliders.
♦ Change the current font.
♦ Play the Tag effect of the current font.
♦ Adjust the board volume using the green slider.
♦ Save all the settings in a file or load all the settings from a file.

Tips

♦ All the main settings apply in **real-time**, there's no need to press any "Write" button.

♦ The little speaker on the left of the green volume slider is the "Mute" button.

♦ You can also change the volume and current font from the on-board menu. See *chapter 3* for details.

♦ If you want to revert to the default factory settings, all you need to do is press the "Load Defaults" button. It will overwrite the main settings and board configuration, but leave the fonts and gestures unchanged.
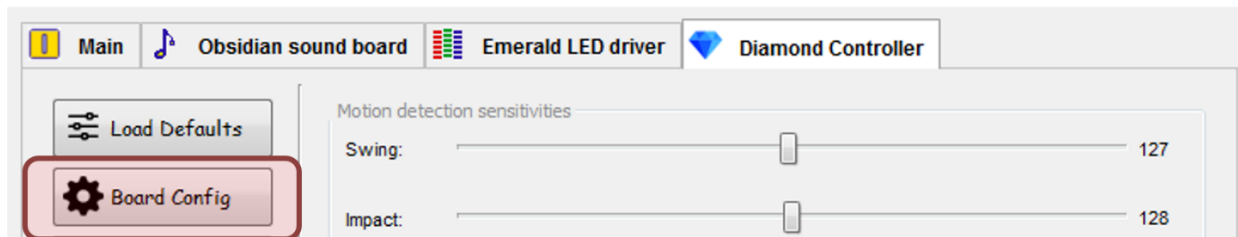
Board configuration

You don't need to change the board configuration unless you wired the board yourself. If you bought a Diamond saber, the board is already wired and configured so you can skip this chapter.

The Diamond Controller can drive up to 8 LEDs. It has 4 power channels for blade illumination, able to drive a RGBW LED at up to 1 A/channel, and 4 accent channels for accessories such as an illuminated switch or a crystal chamber, able to drive independent low-power LEDs at up to 50 mA/channel. Any accent channel can be assigned to the built-in battery monitor, which visually signals the charging state of your batteries. See *chapter 5* for details on LED wiring.

The LED configuration used by your saber has to be programmed on the board **before** wiring the LEDs. Please be very careful: if the board configuration is incorrect, you may damage the board and / or the LEDs. Normally you should receive de board already configured so you don't need to change the configuration unless you change the wiring.

To adjust the board configuration press the "Board Config" button on the "Diamond Controller" tab.

There are three sections related to the board configuration:

Power LEDs
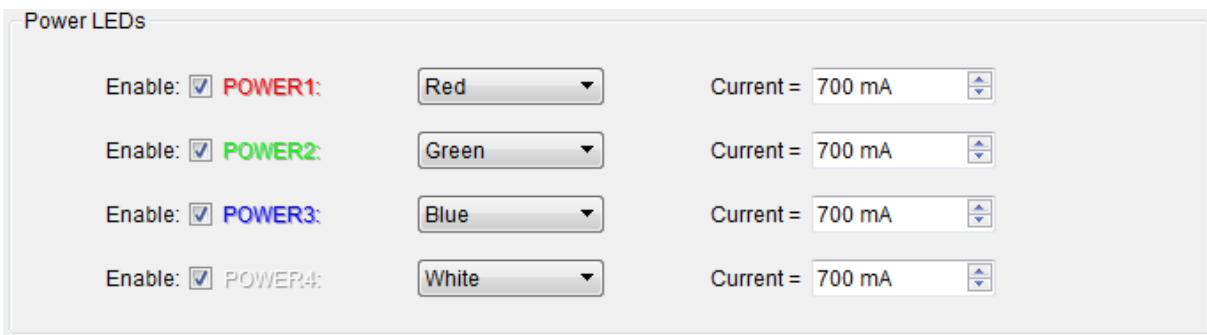
Here you can enable / disable and set the maximum current for each Power LED channel. Please use this setting with caution: if you allow the Diamond Controller to provide a higher current than the LED is able to withstand, it will most likely damage the LED.

The color selection informs the software about the color of the LED wired to each channel. This is used by the Effect Editor to correctly display the color mixing, but otherwise has no impact on the functionality of the Diamond Controller.

Accent LEDs

Here you can enable / disable and set the nominal voltage and current for each accent LED channel. For the correct values, please check the datasheet of the LED you're using.

Accent channels are designed to drive low power LEDs, but with the Onyx LED buck regulator you can use the same accent channels to drive high power LEDs. You can find details about wiring with Onyx in *chapter 5*.

If any accent channel is wired to an Onyx board instead of a low power LED, you should check the corresponding "Onyx LED Buck" checkbox. In this situation there's no need to specify current and voltage: the maximum current is determined by the type of Onyx board used (could be 0.7A or 1A) and the voltage is handled by the Onyx regulator.

Battery Monitor

The battery monitor is a built-in measurement unit that checks the charging level of your batteries. Here you can enable / disable it and, if enabled, choose which accent channel should be used to signal the charging state of the batteries.
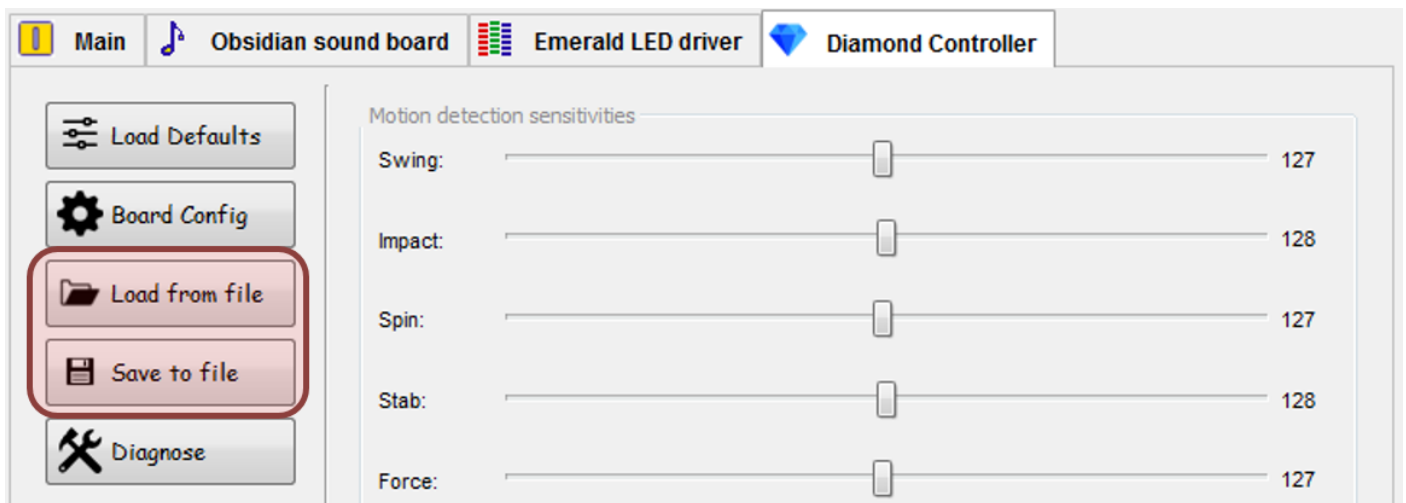

There are two thresholds below which the battery monitor will signal the charging state:

♦ Warning level –below this, the accent LED blinks slowly
♦ Critical level – below this, the accent LED blinks fast

♦ The board configuration is not applied in real-time, you need to press the "Write" button.

♦ The "Read" button reads the configuration from the board. Normally you don't need to use it, reading is done automatically when the board connects to the Launcher.

♦ If you assign an accent LED to the battery monitor, you can no longer use that accent channel for anything else.

♦ The battery monitor is active even if your board is connected to the Launcher, so you can prevent working with discharged batteries.

♦ You can save the board configuration on your computer, in a **.dcfg** file, using the "Save to file" button. This file will contain both the main settings and the board configuration. When you load a .dcfg file, it will instantly program the main settings and the board configuration.

	Main	♪ Obsidian sound board	▤ Emerald LED driver	◆ Diamond Controller

Motion detection sensitivities

Load Defaults		
	Swing:	127
Board Config		
	Impact:	128
Load from file		
	Spin:	127
Save to file		
	Stab:	128
Diagnose		
	Force:	127

♦ If you load the default configuration using the "Load Defaults" button, you will change both the main settings and the board configuration. Just like loading a .dcfg file, the "Load Defaults" button instantly writes to the board.
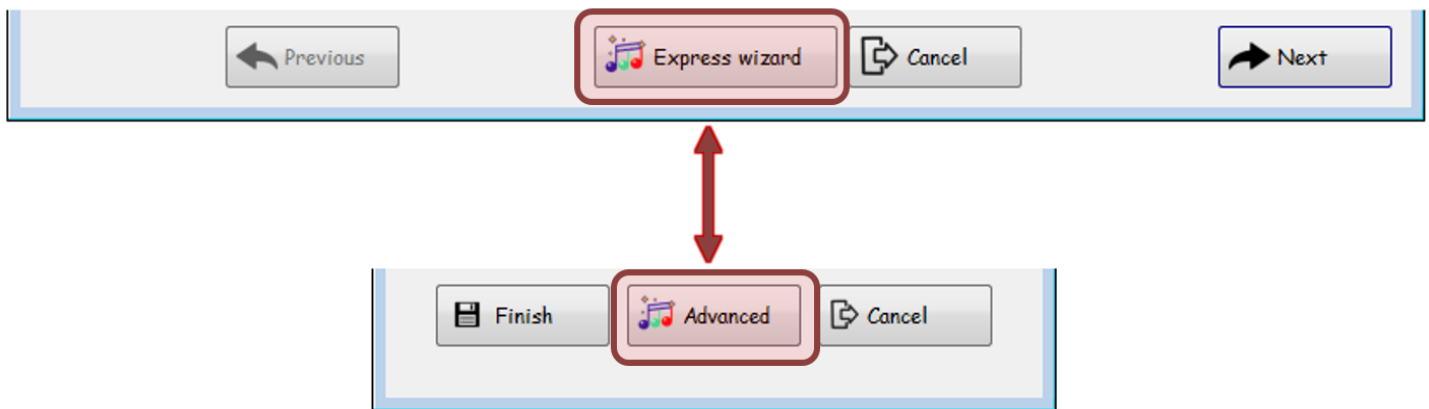
The express font wizard

The font wizard is the software module that allows you to change how your Diamond saber looks and sounds. You can activate it using the "Font wizard" button from the "Diamond Controller" tab.
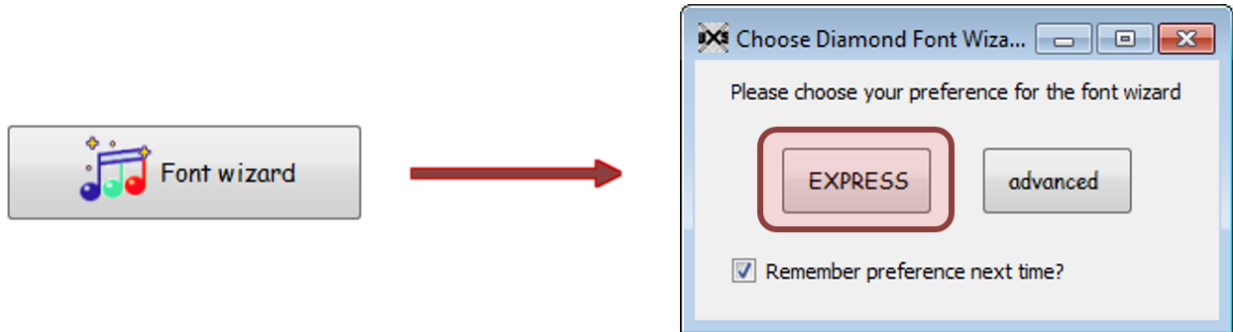
You can run the font wizard in express or advanced mode. The express wizard is faster but offers less choices, while the advanced wizard allows full customization but takes a little more effort to configure.

You can switch between express and advanced wizard any time: if you're in the express wizard press the "Advanced" button and when you're in the advanced wizard press the "Express wizard" button. The software will remember your preference so next time you run the wizard, it will start in the same mode.
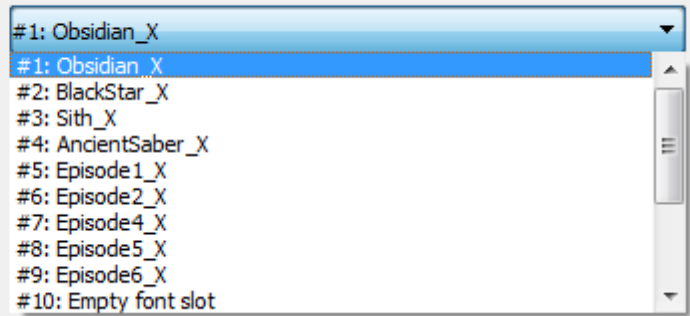
The express font wizard allows you to create and write an entire font in just a few steps:

1. Select slot

The Diamond Controller can store up to 16 fonts in the internal memory, so there are 16 slots to choose from.

If you select a slot that is already used by a font, it will be overwritten.
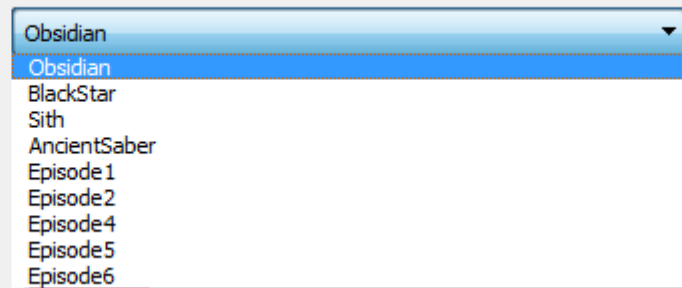
Font Slot to Overwrite:

#1: Obsidian_X

- #1: Obsidian_X
- #2: BlackStar_X
- #3: Sith_X
- #4: AncientSaber_X
- #5: Episode1_X
- #6: Episode2_X
- #7: Episode4_X
- #8: Episode5_X
- #9: Episode6_X
- #10: Empty font slot

2. Select sounds

You can choose any of the 9 font presets which come as default on any Diamond Controller. The preset that you select at this step determines the sounds that your saber will play with this font.

Preset Font:

Obsidian

- Obsidian
- BlackStar
- Sith
- AncientSaber
- Episode1
- Episode2
- Episode4
- Episode5
- Episode6

3. Select colors

While your saber plays the idle hum, it will pulse between the "Blade" and "Pulse To" colors on a predefined pattern.

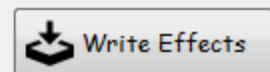When your saber detects an impact and in lockup mode, it will flash with the "FOC" Color.

Click on any color to change or test it.

Blade Color

Pulse-To Color

FOC Color
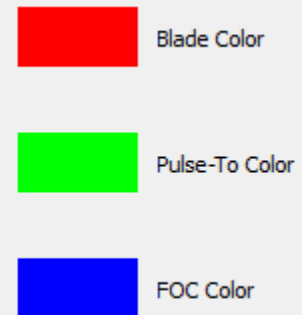
4. Write

Press "Finish". You will see an overview of the font that was created based on your options.

Press "Write Effects". This will write the new font on the board.

Finish

Write Effects

When you're selecting a color, you can do it using the easy or the manual interface. The easy one is a color picker with a few presets; the manual interface allows you to specify the intensity value for each of the red, green and blue channels, either as a color code (0…255) or as a percent of the full intensity. You can switch between the two using the "Easy" and "Manual" buttons.
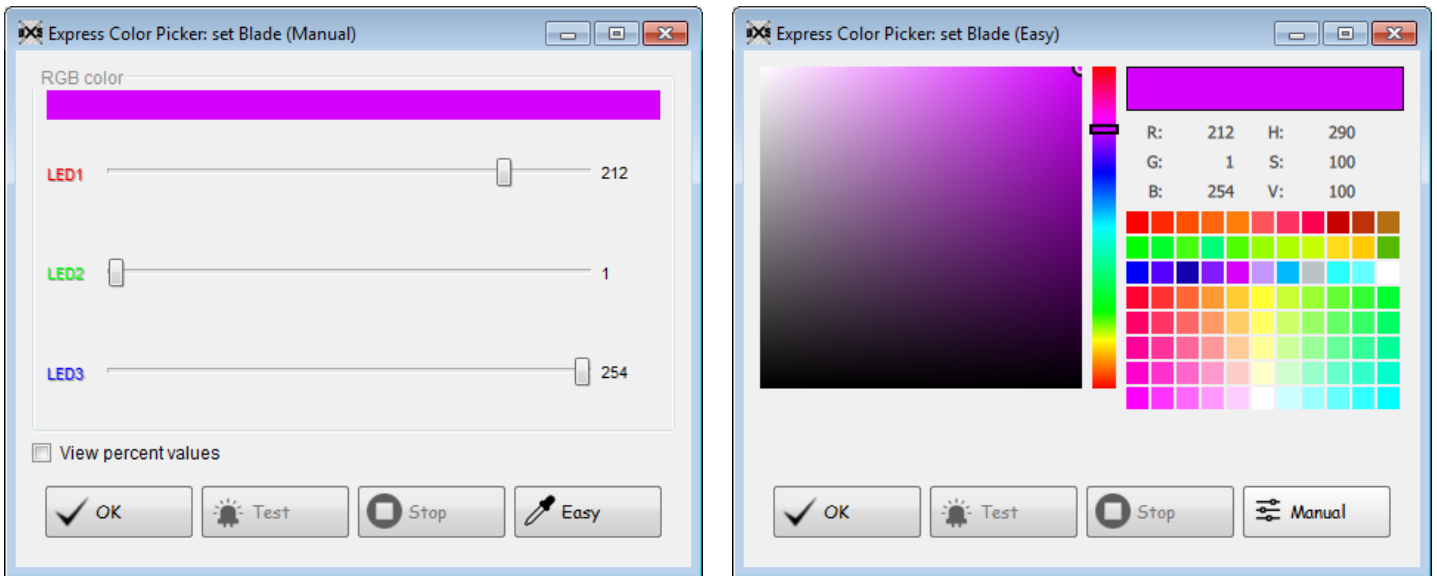
With the "Test" button you can see on your saber how the selected color will look. Use the "Stop" button to end testing and turn off the light – or it will stop automatically when you close the color selector.

That's it! Your new font is now ready to use!

Tips

♦ "FOC" stands for "Flash On Clash", meaning the saber reacts to an impact simultaneously with a sound and a flash of light. The term dates back from the ancient times when this was a big thing. This was before the Diamond Controller era…

♦ The font overview that you'll see when you press "Finish" is actually the last page of the advanced font wizard. Here you can change the name of the font, save it on your hard disk or change any effect. What the express font wizard did is to create a full font based on a preset and your color options. See the remaining of this chapter for details on the more advanced capabilities of the font wizard.

The advanced font wizard

The advanced font wizard is the software module that allows you full customization of how your saber looks and sounds. You can activate it using the "Font wizard" button on the "Diamond Controller" tab.
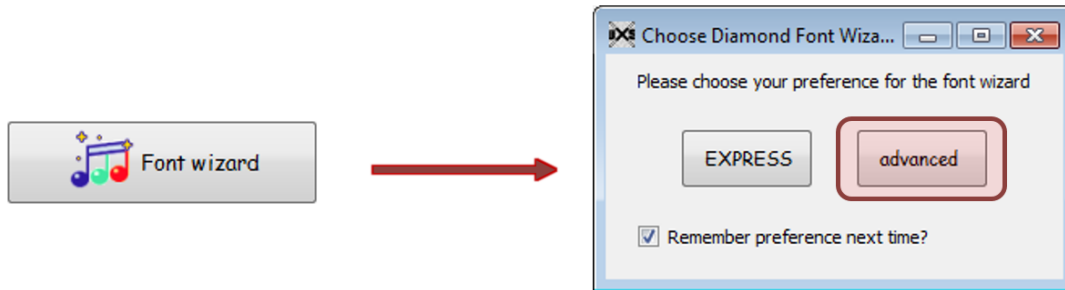
Navigation

The font wizard guides you through all the steps that you need in order to customize and write a font on the board. You can navigate through steps with the "Previous" and "Next" buttons, but also using the navigation panel on the left side of the wizard.

One feature that you might find useful is the ability to save and load an entire font on your computer as a single file. A **.pfnt** file stores everything that defines a font: sounds, light effects and gestures. On the first page of the wizard ("Font Selection") you'll find the "Load" button and on the last page ("Write Font") you'll find the "Save" button.

Please note that "Load" and "Save" are operating with files on your computer, not on the internal memory of the Diamond Controller! In order to write anything on the board, you need to press the "Write" button.

Tip

When creating a new font, it is often easier to start from a template rather than from scratch. What you could do is to start by loading an existing font, one that is close to what you have in mind, and then make changes to it. The Launcher comes with all the default Diamond fonts preinstalled as .pfnt files – just press the "Load Font" button and you'll find them.

Font selection

On the first page of the wizard you'll find a list of all the 16 available slots. The slot that you select here is the one that you'll edit and write. If you select a used slot, you'll edit the font that is already in the Diamond Controller's internal memory. If you select an unused one, you'll start building a new font from scratch.

With "Load Font" you can restore a font previously saved on your computer as a .pfnt file and with "Clear Font" you can erase an entire font from the Diamond Controller's internal memory.

Tips

- When you select another font from this list, the wizard will update its content from the board. Whatever changes you made to the previously selected font, if you did not write it on the board or save it on your computer, **will be lost**!

- You can disable fonts by clicking on the "Enabled" checkbox. When a font is disabled it is still stored in the Diamond Controller's internal memory, but you can no longer use it. Disabling fonts is one way to shorten your on-board font selection menu without spending a lot of time clearing and writing the internal memory.

Effects

The following pages of the font wizard, from "Tag Effect" to "Lockup Effect", have all the same structure. They allow you to assign an effect to each event. See *chapter 2* for details about all the events that you can assign effects to.
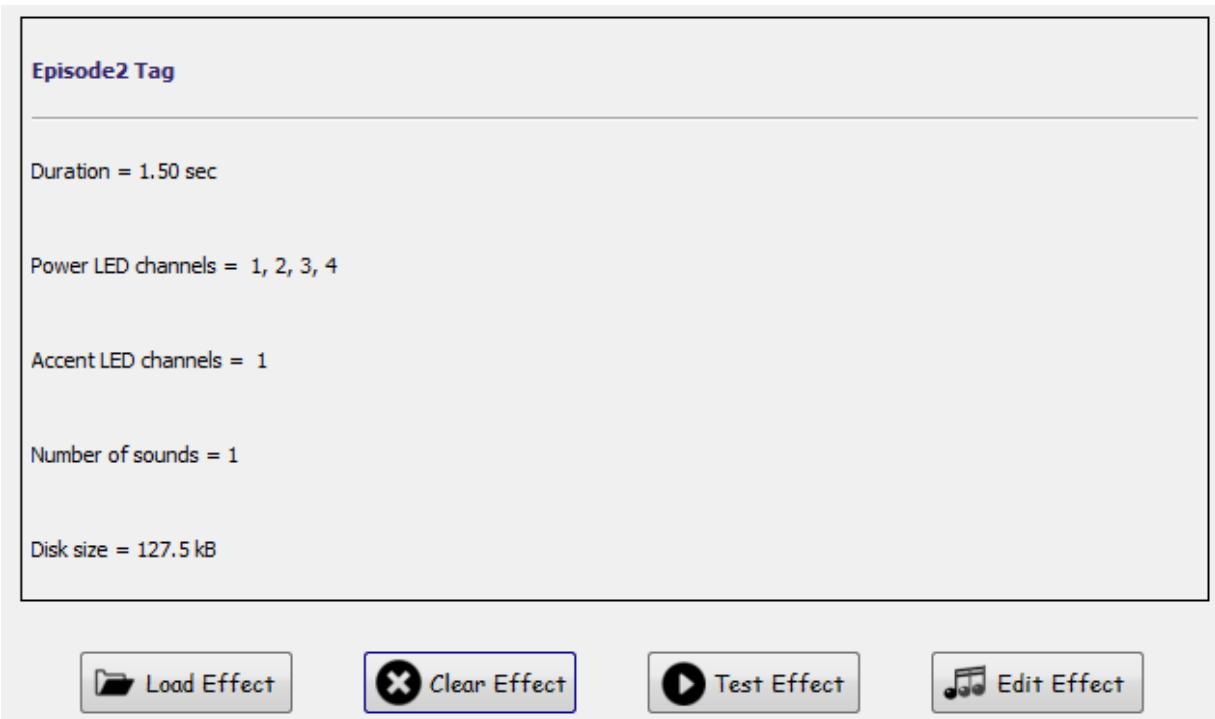
An effect is a collection of sounds and lights, packed together as a single entity. On your computer, effects are stored as **.peff** files, which contain both the light sequence and the sound files. For details about creating and editing effects, see the *following paragraph*.
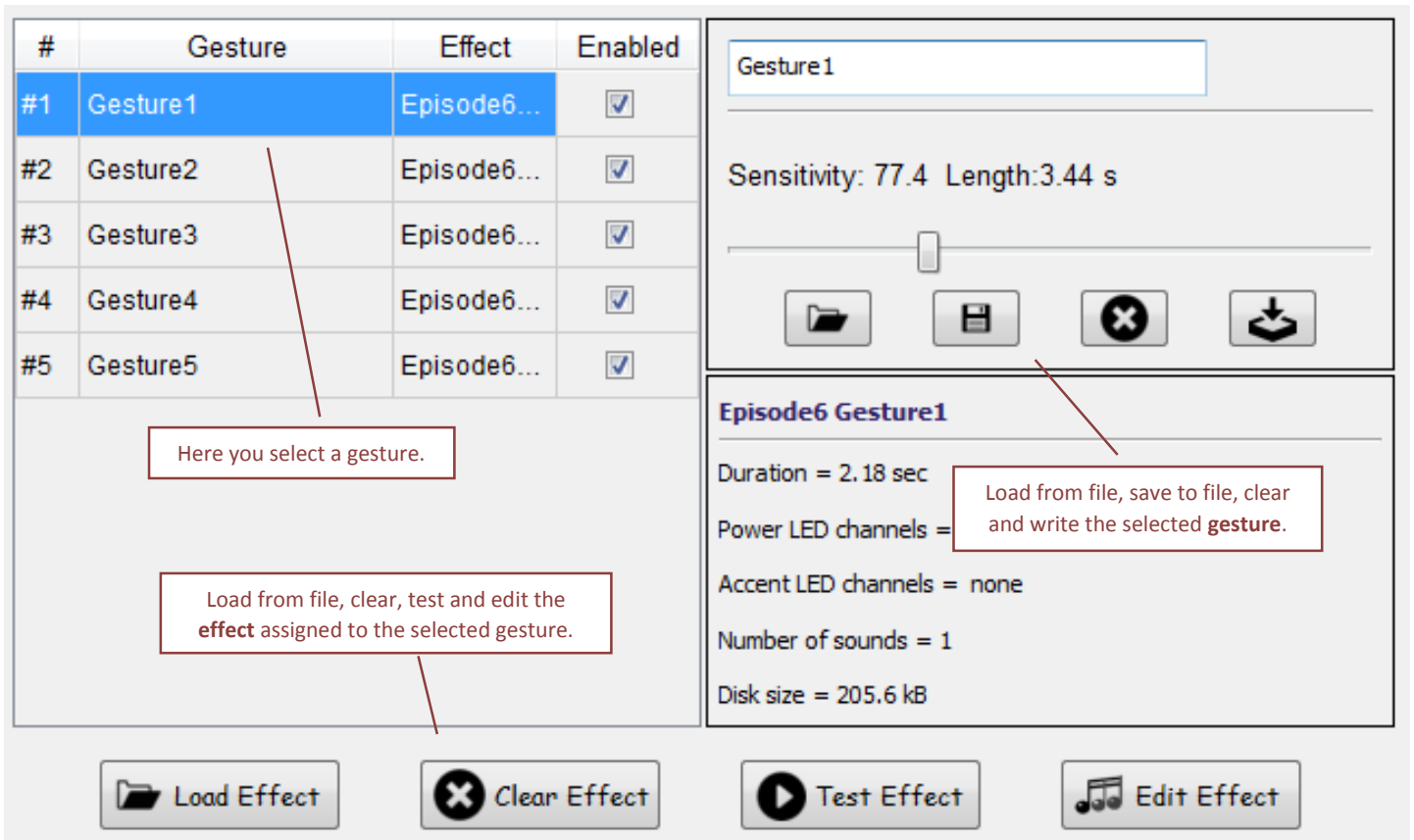
On each effect page you can load an effect from your computer, test it on the saber or edit it using the Effect Editor. With "Clear Effect" you will remove it from the font.

Tips

♦ If you accidentally cleared an effect but did not write yet the font to the board, you can do the following: go to the "Font Selection" page, select another font and then select again the font you were editing. This will restore the font exactly as it is on the board.

♦ If you want to use in your font an effect from another font, you can do the following:
(1) Select the font where the original effect resides.
(2) Go to the effect page and click on "Edit Effect". This will open it in the Effect Editor, where you can use the "Save" button to save it on your computer as a .peff file.
(3) Close the Effect Editor, go back to the wizard and select your font; you can now assign the saved .peff file to any effect: go to the effect page using the navigation panel from the left side of the wizard and press the "Load Effect" button.

Gestures

The "Gestures" page looks different than all the other effect pages of the wizard, because each font can store up to 5 gestures and here you can customize all of them. For details about how gestures are created, see *chapter 3*.

#	Gesture	Effect	Enabled
#1	Gesture1	Episode6...	☑
#2	Gesture2	Episode6...	☑
#3	Gesture3	Episode6...	☑
#4	Gesture4	Episode6...	☑
#5	Gesture5	Episode6...	☑

Gesture1

Sensitivity: 77.4 Length:3.44 s

Here you select a gesture.

Load from file, save to file, clear and write the selected **gesture**.

Episode6 Gesture1

Duration = 2.18 sec

Power LED channels =

Accent LED channels = none

Number of sounds = 1

Disk size = 205.6 kB

Load from file, clear, test and edit the **effect** assigned to the selected gesture.

Load Effect   Clear Effect   Test Effect   Edit Effect

First you have to select a gesture from the list, then you can load, clear, test and edit the effect assigned to that gesture. If you have 5 gestures on your board, you'll have to assign 5 effects on this page, one for each gesture.

Also on this page you can manage gestures: adjust sensitivity, rename, load from computer, save to computer or delete from font. Gestures can be saved on your computer as **.dgst** files, so you can reuse them on another font or even on another saber. Just like when assigning effects, whatever you do on the right side of this page only applies to the gesture selected on the left side. So for instance if you want to delete all the 5 gestures from the font, you need to select the first one, click the ⊗ button and then repeat this for the remaining 4 effects.

- Any change you make to gestures or the effects assigned to gestures will only be applied when you write them to the board. You can write the entire font at once or see the next tip.

- The button is a shortcut that instantly writes the selected gesture to the board (just the gesture, not the effect assigned to it!). It is useful when you loaded a gesture from file, cleared the gesture, renamed it or adjusted the sensitivity, but you don't want to rewrite the entire font to apply this change.

- If you disable a gesture, it will still be stored on the Diamond Controller's internal memory, but it will not be detected anymore. If you change the enabled state, you have to write the gesture (or the entire font) to the board in order to have effect.

Write font

The last page of the font wizard is the one where you review your font and write it to the board. Here you can check that all events have the desired effects assigned, set a name for the font and save it on your computer as a .pfnt file (which is something we strongly advise you to do each time you make your own font, for backup and maybe sharing with the community).

If everything looks good, press the "Write Effects" button.
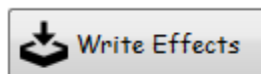
The Launcher will write the entire font to the internal memory of the Diamond Controller (including the gestures!), then it will reset and reconnect automatically.

Your new font is now ready to use!
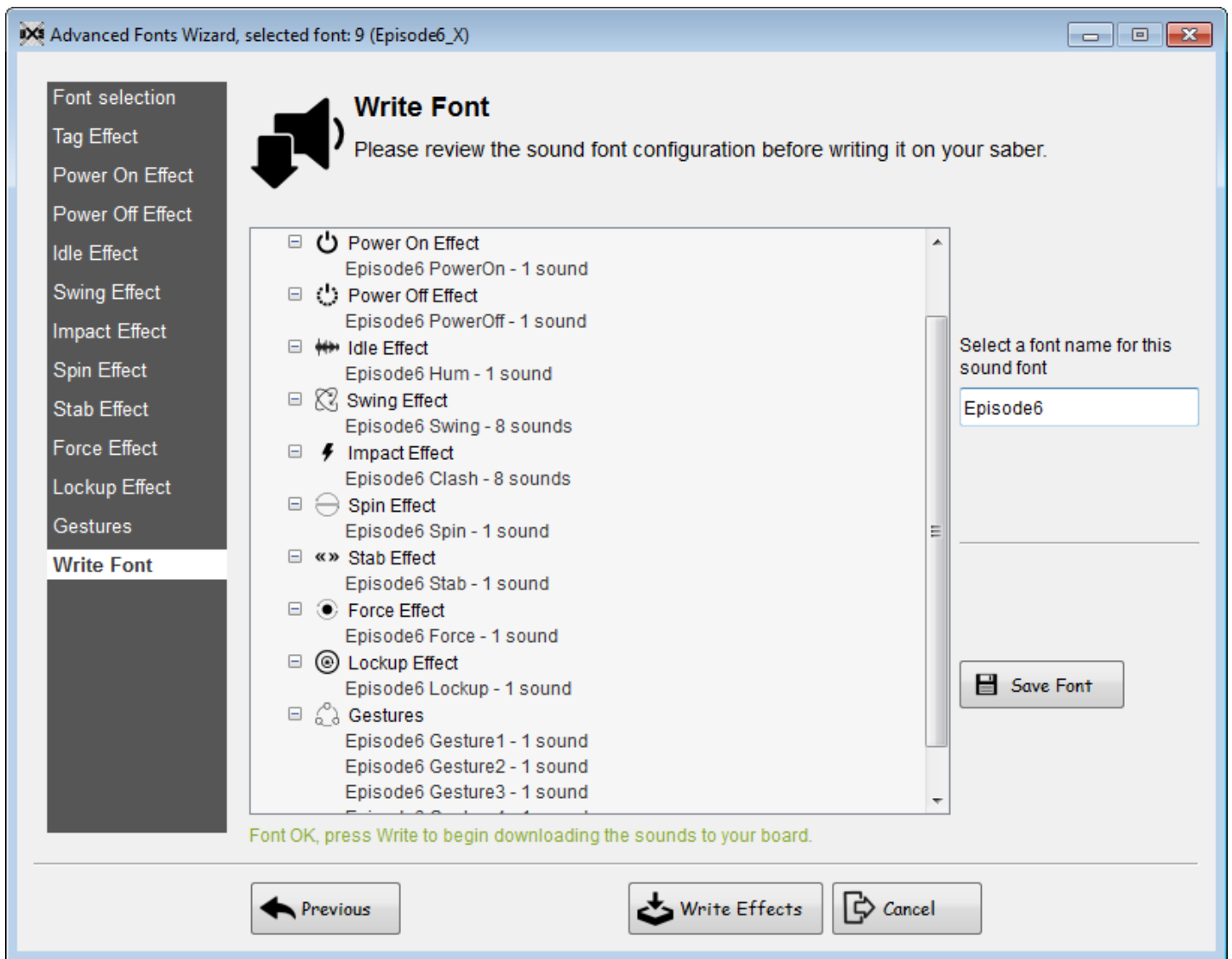
Tips

♦ You can't have multiple fonts with the same name on the board, so please make sure you assigned an appropriate name.

♦ Save the font on your computer before writing it to the board. If something goes wrong, you don't want to lose all your work!
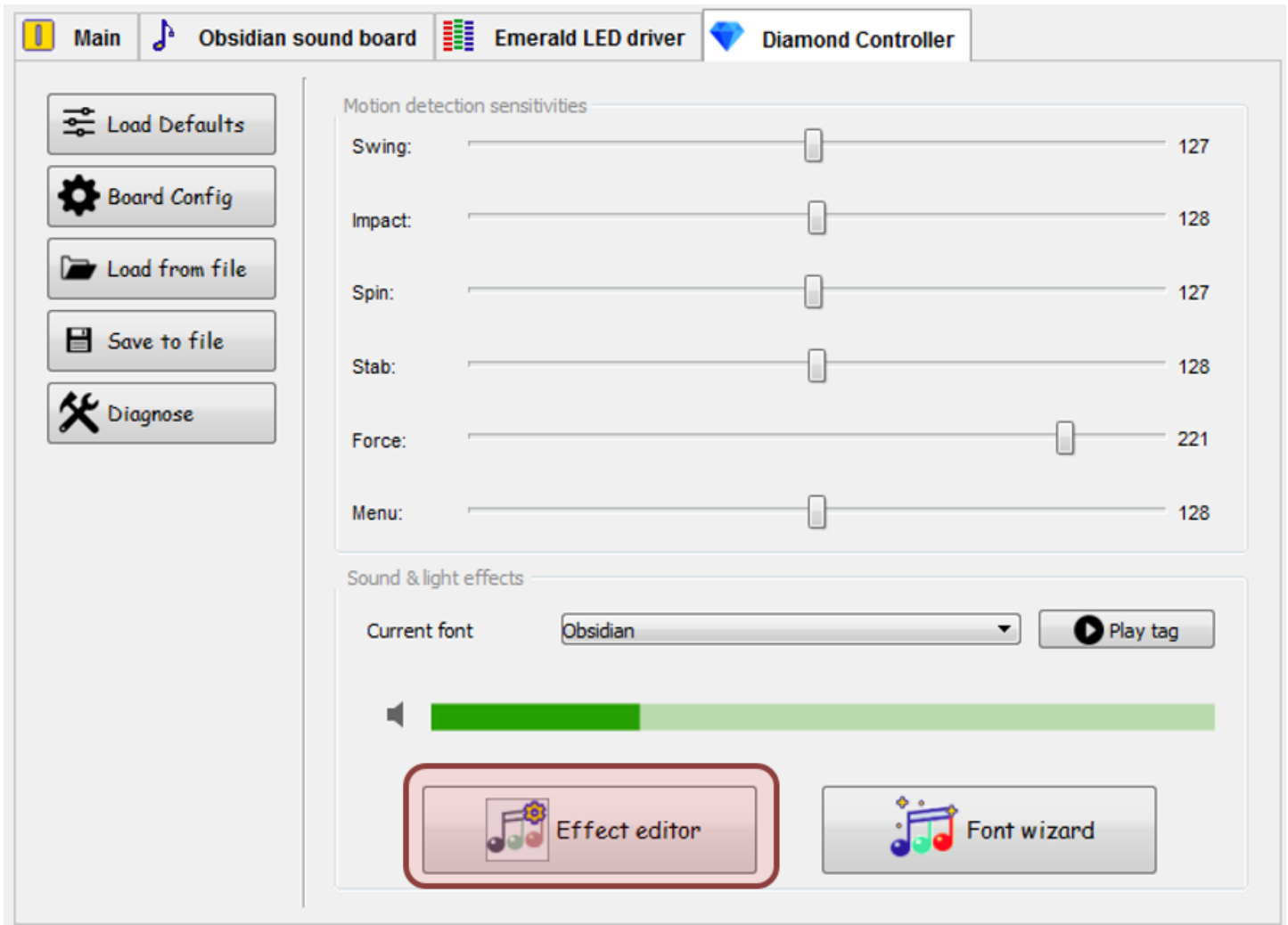
The effect editor

The building block of the light and sound of a Diamond saber is the effect, which packs together a light sequence and one or more sounds. Effects are triggered by events such as power on, swing, lockup… and organized into fonts. The effect editor is the software module of the Launcher which allows you to create and modify effects.

There are two ways to start the editor: standalone or on an effect:

The effect editor starts **standalone** from the "Diamond Controller" tab of the Launcher. It will start with a blank effect. You don't even have to be connected to the saber to use the editor standalone.

In standalone mode there is no association between the effect and the font or the event to which it would be assigned (e.g. Power On, Swing, Lockup), so the only way you can use the edited effect is by saving it on your computer and later loading it to a font. Standalone mode is there mainly for working offline, without the saber connected to the computer.

The second way to start the editor is **on an effect** by pressing the "Edit Effect" button in the Font Wizard, on any effect page. If it starts this way, it will keep the association with the font and the event assigned to, so you can write it directly on the board without the need to save it on your computer.

Font selection	**Tag Effect**
Tag Effect	The tag effect is an identifier of your font. This is the effect that will be played in the font selection menu.
Power On Effect	
Power Off Effect	
Idle Effect	**Obsidian Tag**
Swing Effect	
Impact Effect	Duration = 2.50 sec
Spin Effect	
Stab Effect	Power LED channels = 1, 2, 3, 4
Force Effect	
Lockup Effect	Accent LED channels = 1
Gestures	
Write Font	Number of sounds = 1
	Disk size = 302.8 kB

Load Effect   Clear Effect   Test Effect   **Edit Effect**

19%

Managing effects

On the top of the effect editor window there's a control bar which allows you to, among other things, clear, load from computer, save to computer and rename the current effect. Effects are saved in **.peff** files, which pack together both the light sequence and the sounds.

Clear   Load   Save   Test   Stop   Write to board   Apply to font   **Effect name:**   Obsidian Tag

If the saber is connected to the computer then you can run the effect directly on the Diamond Controller, to make sure it behaves as expected. The "Test" button starts running the effect and the "Stop" button stops it, but the effect won't be saved on the board: it just plays once for test.

The other two buttons on this bar are productivity shortcuts which you might find helpful in specific situations. They deserve some attention:

⬇ Write to board

If the Launcher is connected to your Diamond Controller, you can directly write **to the board** the effect you're editing. You can NOT do this if the editor was started standalone, because the board wouldn't know when to play this effect (on swing, clash, force…)

"Write to board" is useful when you want to quickly change an effect from a font already existing on your board: this way you don't have to rewrite the entire font.

💾 Apply to font

If you intend to modify more than one effect of a font, it might be faster to make all the changes and then write the entire font at once. For such a situation, if you start the editor on an effect, you can use the "Apply to font" button: it will save the effect **in the font** you're editing, so you don't have to save it in a file and then load it to the font. It will NOT write the effect on the board – you'll have to write the entire font.

Lights

The Diamond Controller is able to drive up to 8 LED channels: 4 power channels combined to drive an RGBW LED and 4 independent, low power accent channels. When an effect starts running, it will start executing a timed sequence on each light channel. Those light sequences are defined by the effect editor.

The effect editors presents 5 boxes to define the light sequences, which can be maximized and minimized using the ⊞ and ⊟ buttons:

- One for all the power channels – labeled "Power LED"
- One for each accent channels – labeled "Accent 1" to "Accent 4
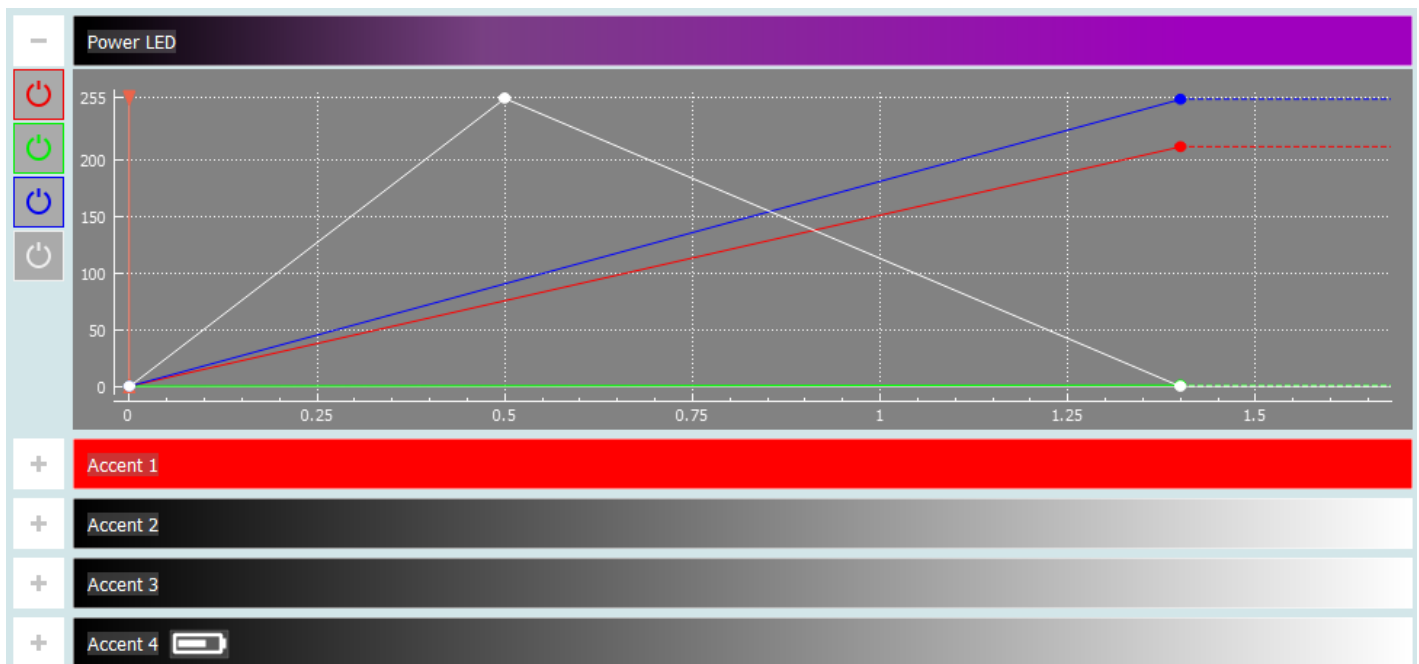
If the battery monitor is enabled, the accent channel to which it is assigned is no longer available for editing and it will be marked with the battery symbol.

Each light sequence is defined by points. Each point has a **time value**, which defines the horizontal position, and an **intensity value**, which defines the vertical position. Light intensities range from 0 (light off) to 255 (full light). Time goes from 0 to 65 seconds, which is the maximum allowed duration of an effect. You can have up to 20 points on each light sequence.

Points can be added, deleted and edited with a right click of the mouse, and moved with a left click (drag and drop).
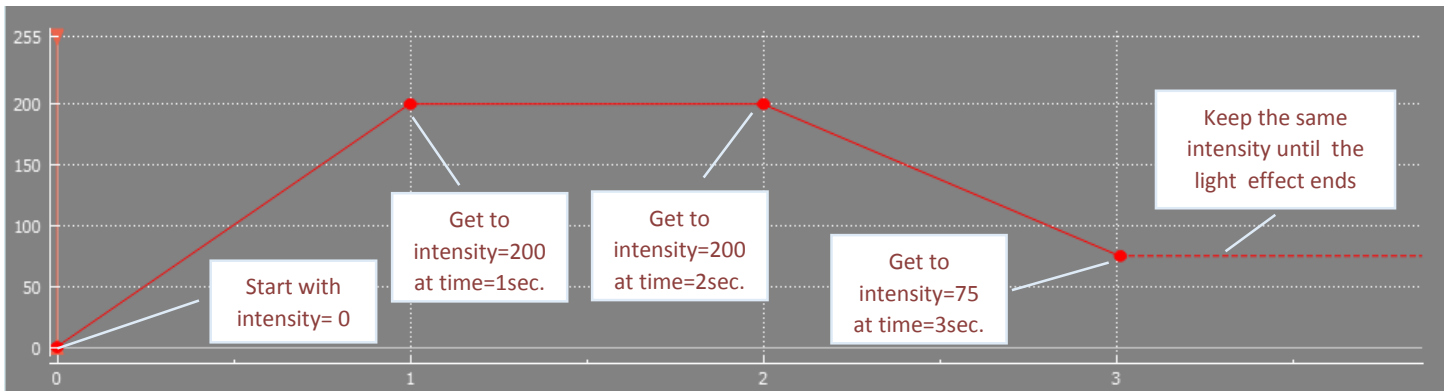
Basically, that's all there is to editing the light sequence of an effect!

But The Force is in the details, so here are some tips…

Tips

♦ When editing a light sequence, you can use the **undo / redo** buttons or the key combinations Ctrl+Z (Cmd+Z on MAC) / Ctrl+Y (Cmd+Shift+Z on MAC) to undo or redo the last operation. This will only affect the light sequence of the effect, but not the sounds assigned to it.

♦ On top of each light editing box there's a colored bar which simulates how the light sequence would look like. This is especially useful for the Power LED, where all 4 channels are mixed into a single color. Please note that the colors will most likely not look identically on a computer screen and on the actual blade!

♦ You can zoom in, zoom out, zoom-to-fit and scroll horizontally the effect, using the controls located on top of the light boxes. This makes it easier to work on details.

♦ The effect can run the light sequence multiple times (up to 100) and you can specify the number of repetitions using the controls located on the left of the zoom buttons. You can use the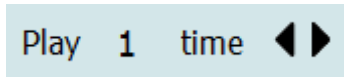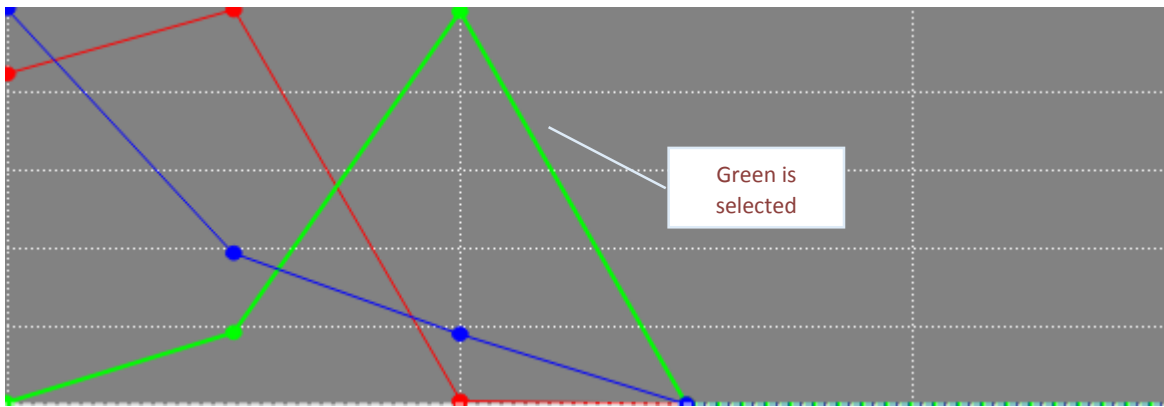 arrow buttons to increase/decrease the number or you can type it directly. Keep in mind that only the light sequence will be repeated, the sound will play a single time!

Play　1　time ◀▶

♦ On the Power LED box you can select which channel you're editing with a single left click on any line of the graph. The selected channel is drawn with a thicker line.

Green is selected

♦ When you right click inside a light editing box (not on a point), you'll find two options:

Add point — Adds a point at the cursor location. For the Power LED, the point will be added on the selected light sequence.

Add point with values — Adds a point at the location specified by time and intensity values. For the Power LED, the point will be added on all 4 channels.

♦ The dotted line means "keep the same intensity until the light effect ends". For instance in the light sequence below, the effect ends at time=1.5 seconds, where the last point is located. Blue is dotted from 0.25 seconds, so it will remain at intensity=255 from 0.25 to 1.5 sec.
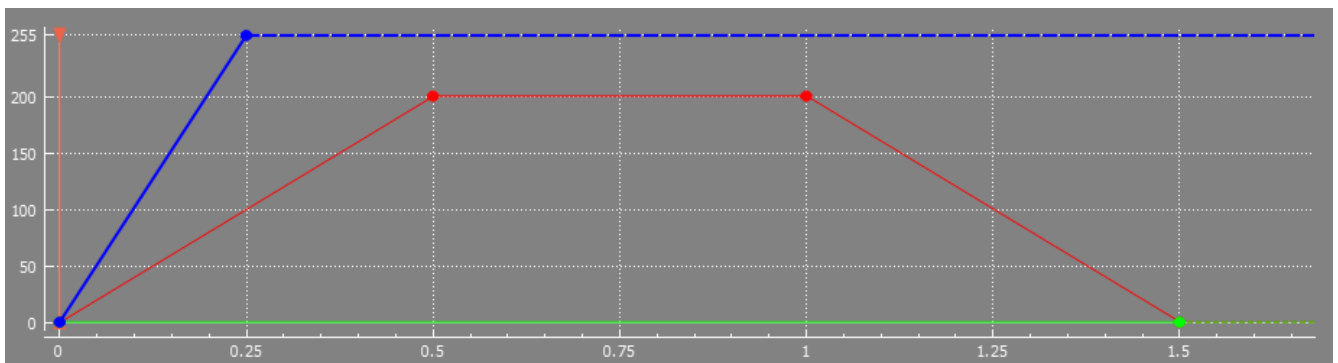
♦ On the left side of each light box, there is an ON/OFF button for each channel. There's a subtle yet important difference between setting a color OFF and setting it to 0 intensity. If it is ON then the effect will take control of that channel and drive it to the intensity defined by the light sequence. If it is OFF, the effect will not take control of that channel and let it run whatever it was running before triggering this effect.

Green stays on 0 intensity for the entire duration of the effect

Green is ON

Green will continue whatever light sequence it was running before triggering this effect.

Green is OFF

This functionality allows you to create special effects such as modulating the color intensity. Let's assume you have an Idle Hum effect that p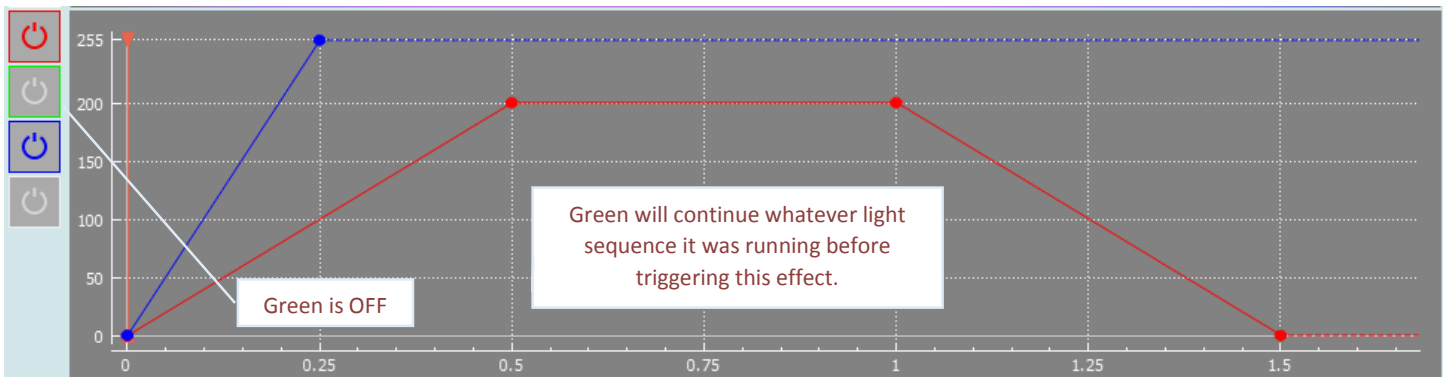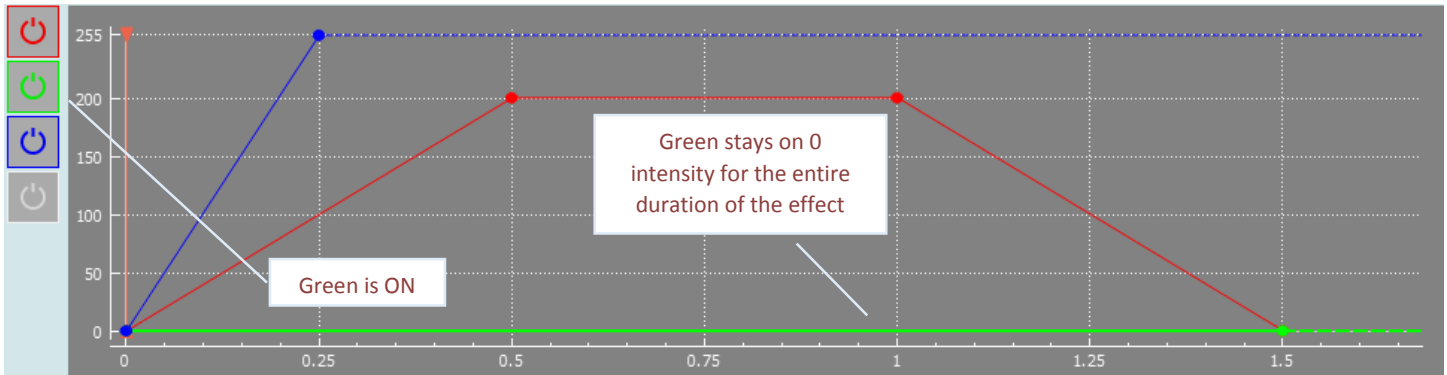ulses between red and blue, and you want to define a Swing effect that only uses the White channel. If the swing effect turns OFF all the channels except White, then when a swing is detected it will leave red and blue pulsing the Idle effect and add only the White, with whatever sequence you defined there. What you'll see is the blade keep pulsing between red and blue, with the added intensity modulation of the swing effect (white = all colors!). On the other hand, if the swing effect turns ON the Red and Blue channels and sets them to 0 intensity, then when a swing is detected the blade will no longer light red and blue, but only white.

This whole effect editing process might seem complicated at first, but really it is not. Just take some time to play a little bit with the editor, test to see yourself what happens and you'll get it.

Mastering the effect editor unleashes the full potential of the Diamond Controller!

Sounds

The sounds of an effect are easier to handle than lights: all you need to do is to add one or more sound files to the effect, using the "Add Sound" button. You can use LSU or WAV files, which will have to be formatted as mono, 16 bit, 48kHz. The green bar sets the sound volume for the effect and the little speaker button on the left is the "Mute" button.
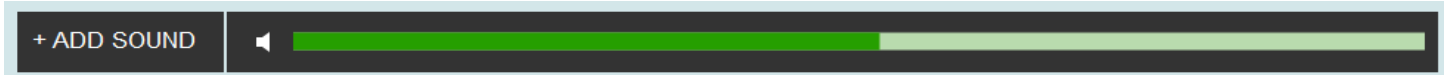
You can add up to 15 sounds to an effect, but only the effects that are assigned to Swing, Clash, Spin or Stab events will use all of them, by randomly selecting a new one each time the effect is triggered. If you're trying to assign an effect with more than one sound to an event that requires a single sound, the font wizard will show you a warning.

For each sound that you're adding to the effect, a sound box will be added to the effect editor, showing you the waveform of the sound and some control buttons. You can maximize and minimize those boxes using the + and − buttons from the left.
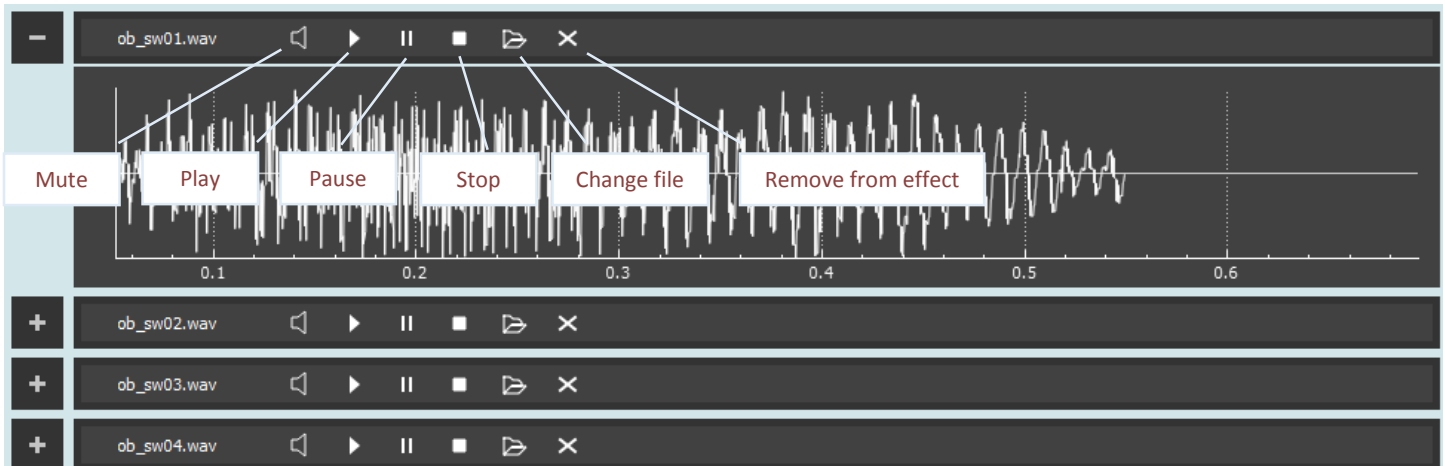
The main reason why the waveform of each sound file is displayed in the effect editor is to make it easier for you to synchronize the sound and light. For that purpose there is a cursor (the orange vertical line) which can be moved with the mouse by keeping the left button pressed (drag and drop). It also moves automatically when you play a sound.

The cursor moves simultaneously on all sound and light boxes, so you can visualize the beat of the sound and synchronize the light sequence with it.
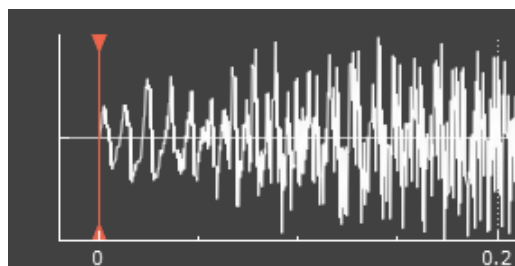
♦ Although not mandatory, it is good practice to end the sound and the light at the same time, because the Diamond Controller drives the sound and light continuously and independently. If they don't end at the same time, you might desynchronize the effects. For instance if the light sequence of the Swing effect lasts longer than the sound, you'll end up with your saber playing the sound of the Idle Hum and the light of the Swing. In most cases you won't even notice such a desynchronization, but sometimes you might.

♦ When loaded into the effect editor, sound files are first normalized, meaning their volume is brought to the maximum possible without introducing distortions. This helps prevent a lot of issues with sounds coming from various sources having different volume settings, which would otherwise require you to use a 3rd party WAV editor to balance their volume. This also mean that you can NOT use a 3rd party WAV editor to control the sound volume, but you don't have to anyway: the effect editor's volume control does exactly that.

♦ You only need to adjust the volume of an effect if you want to adjust the balance of your saber sounds, for instance having the Swing louder than the Idle Hum. If you want to control the volume of the entire font, use the master volume control located on the "Diamond Controller" tab of the Launcher.

Updates

The Diamond Controller is a living product and we're constantly working to improve it, not only by solving known issues but also by adding new functionality. It is therefore in your best interest to keep your Diamond saber up to date. The way to do this is by updating the software and firmware.

Software update

By "software" we mean the Ultrasabers Launcher. Whenever we release a new version, we upload it online and you'll be automatically notified when starting the program.
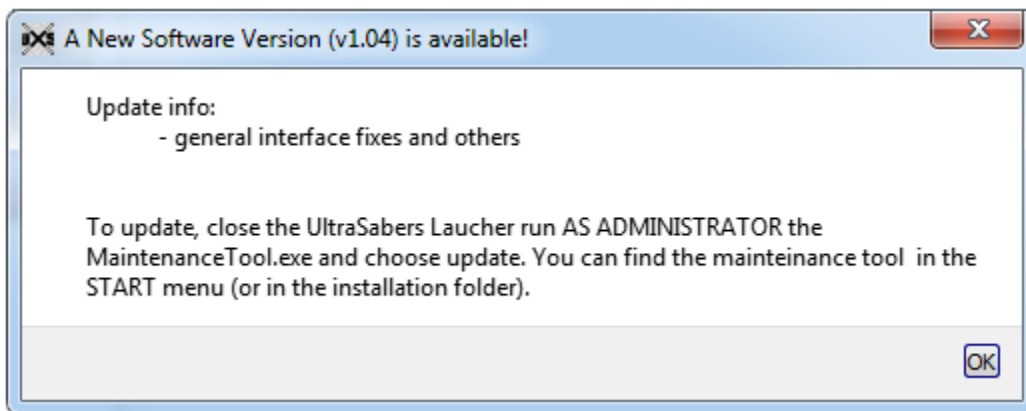
You will have to close the Launcher and run the Maintenance Tool with administrator privileges. You should find the Maintenance Tool installed at the same location as Ultrasabers Launcher.
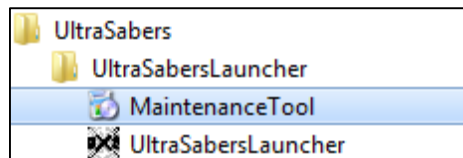
Choose "Update" and follow the instructions from the screen. The Maintenance Tool will download and install the latest version of the software.

Firmware update

The firmware is the program that runs on the Diamond Controller.

When you connect your saber to the Launcher, you will be notified about the firmware version by a system message on the "Main" tab. If there's a new firmware available there will be a red message informing you that you need to update and the Launcher will no longer automatically switch to the "Diamond Controller" tab. It will keep the "Main" tab active to make sure you see the red message.
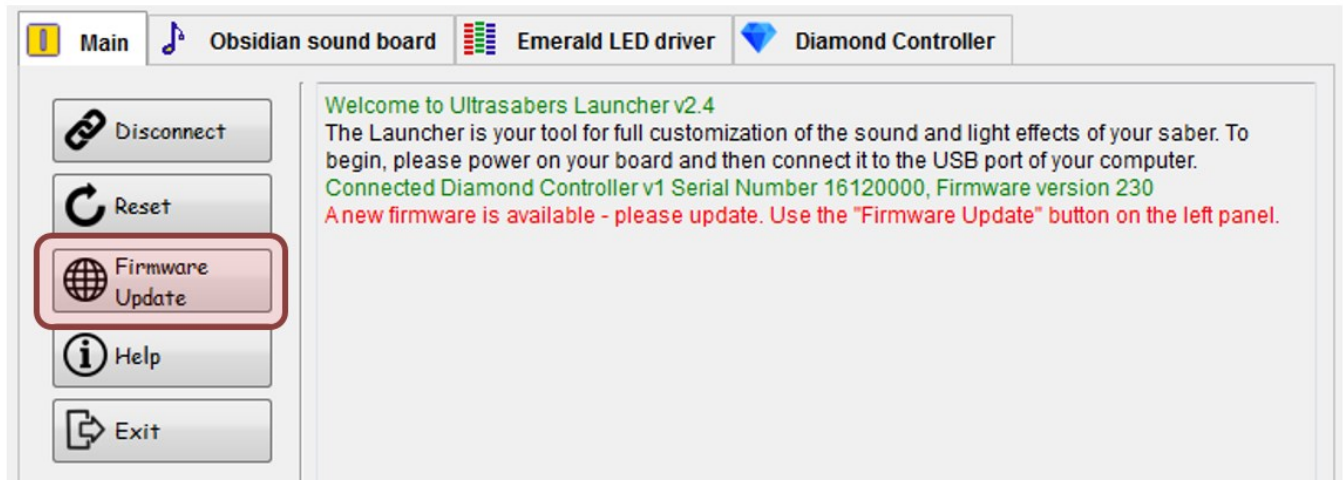
Make sure your batteries are sufficiently charged. If they fail during the firmware update process, your board might be permanently lost. The update takes less than 30 seconds so the risk of failing exactly then is reduced, but even so… be cautious!

Press the "Firmware Update" button and you'll be presented a list of available versions.
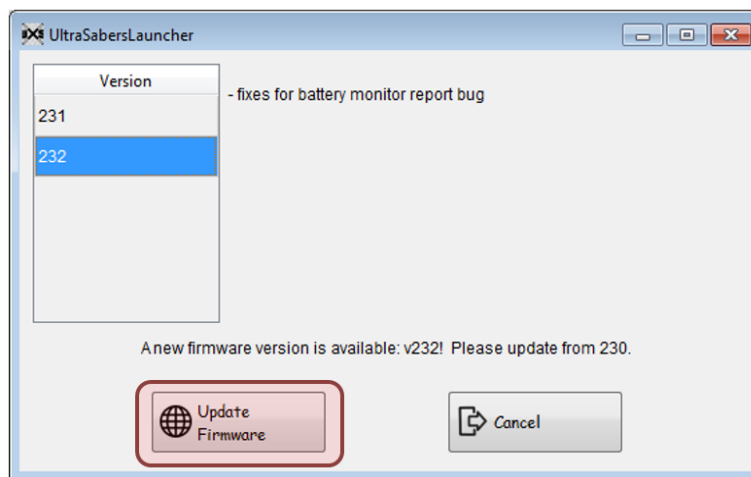
Choose the latest version and press the "Update Firmware" button, then confirm to start the update procedure.

When the update starts, **do nothing!** Especially do not disconnect the batteries! Everything is automated, as soon as the board reconnects you're good to go with the latest firmware!

5. TECHNICALITIES

Wiring

The Diamond Controller is designed to be mounted on a 2 x 14500 battery pack fitted with a speaker. It has a micro USB socket for connecting the board to a computer and a double row, 0.1" pitch, 18 pin connector for wiring the batteries, speaker, switch and LEDs. You can find a suitable mating connector *here* or *here*.
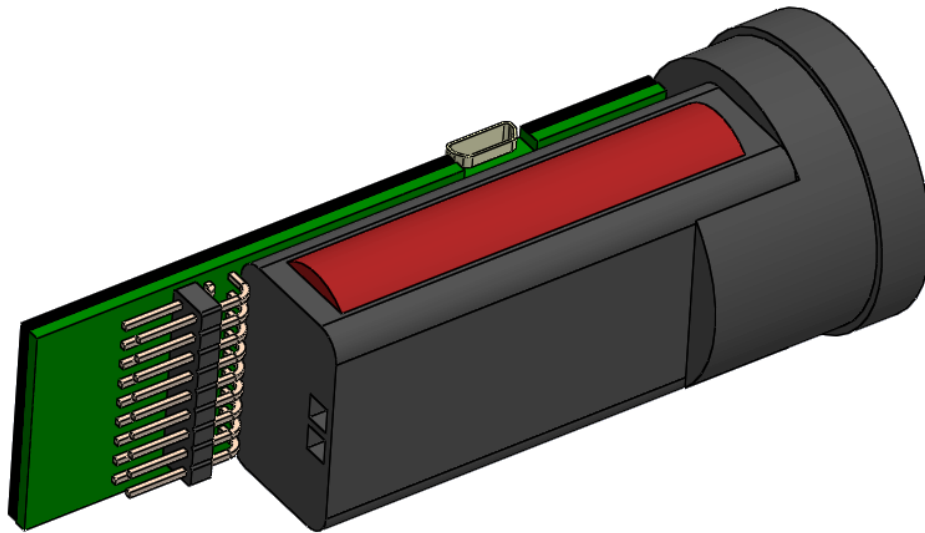
The board is encapsulated in a black polyurethane resin that protects the components and improves heat dissipation.

Although the sensitive parts are not exposed and there's no need to solder anything on the board, **ESD precautions should be observed!** That's electrostatic discharge, a phenomenon by which the static electricity accumulated into your body and clothing can discharge on the board with destructive effects. If you search the web you'll find plenty of informative material about ESD protection, so here are just two basic rules that should keep you safe and require no training or equipment at all:

♦ Do not touch the metallic parts of the board unless absolutely necessary!

♦ Discharge yourself before working with the board by briefly touching a metallic part of a grounded appliance (refrigerator, coffee machine, anything that plugs into a wall socket with 3 pins)!

The safest way to work with an electronic board would be to wear a grounded wrist band.

Below is the main wiring diagram of the Diamond Controller:
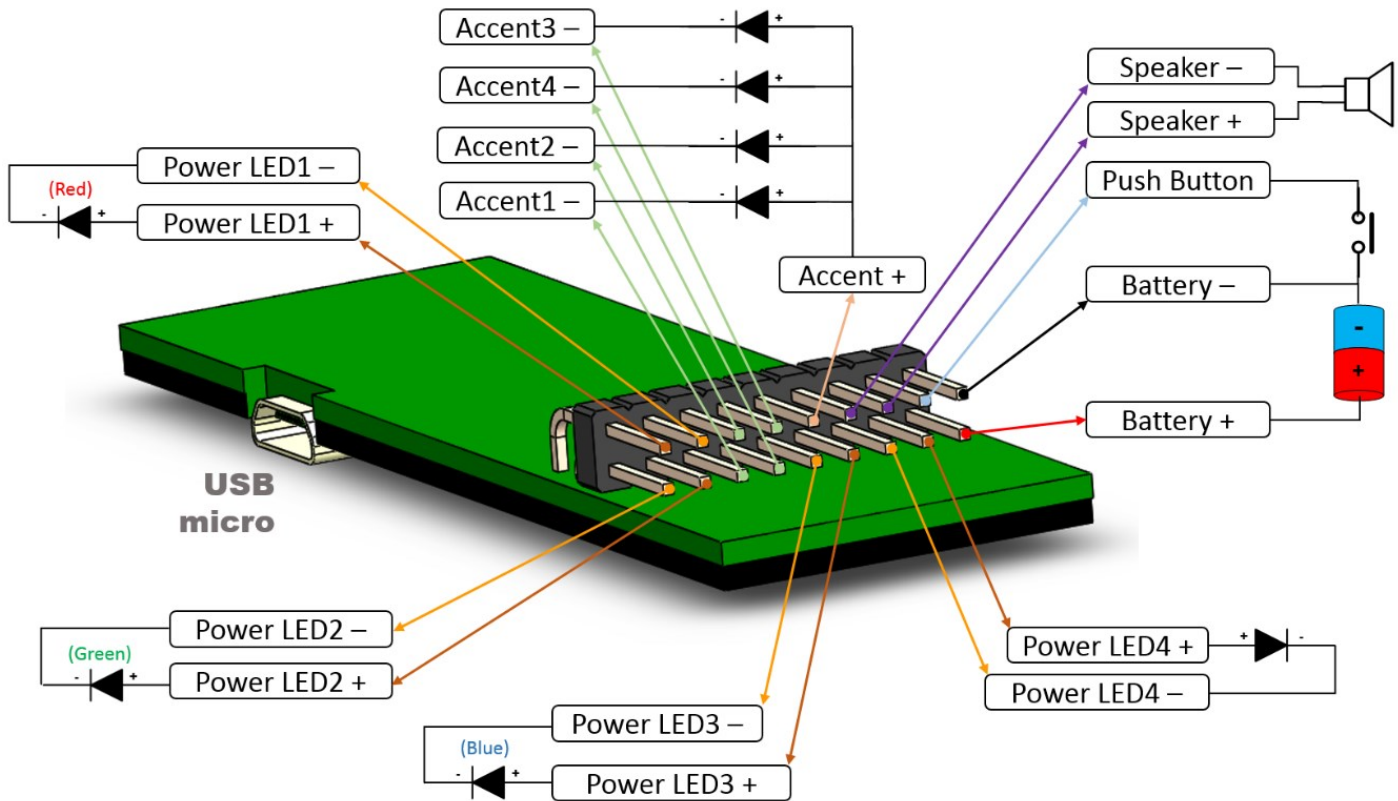
The components that you'll need to wire to a mating 18 pin connector are:

♦ Battery: the preferred setup is to use two 3.7V Li-Ion batteries, size 14500, mounted in a battery holder. The red wire of the battery holder goes to the "Battery+" pin on Diamond and the black one to "Battery-". Keep in mind that black also goes to the switch.

♦ Switch: use a momentary (non latching) switch connected between the "Push Button" and "Battery-" pins of the Diamond Controller.

♦ Speaker: use a 8Ω speaker mounted on the battery holder. The red wire could go to "Speaker+" and the black one to "Speaker-", but that's really not important: mono speakers are oblivious to polarity so it makes no difference. Keep the speaker wires as short as possible as they can pick up noise.

♦ Power LED: wire each die (color) of an RGBW or RGBA LED, following strictly the "+" and "-" markings. Please note that each color is controlled independently by two wires. You cannot use a common anode or common cathode power LED with Diamond! **Under no circumstance, no Power LED wires should be connected together!**

♦ Accent LEDs: the "Accent+" pin of the Diamond Controller goes to all accent LEDs, so you can use either independent or common anode types. Each cathode (-) pin of each accent LED should be wired independently to the corresponding Diamond pin.

Onyx extension

The Diamond's accent channels are designed for low power LEDs, being able to drive up to 50 mA / channel. Their capability can be extended at up to 0.7A / channel or 1.0 A / channel by using the Onyx buck regulator, effectively turning any accent channel into a power channel. This is useful for special configurations such as double-blade or cross-guard sabers.

Onyx is designed specifically to work in conjunction with Diamond so you'll have exactly the same control capability on an accent channel with Onyx as on a power channel. For details about the Onyx buck regulator, you can check the Resources page of the Ultrasabers Launcher software.

Wiring with Onyx is straightforward: each "Accent-" pin of the Diamond Controller goes to the control input of an Onyx board. The "Accent+" pin is not required by Onyx.

Below there's a diagram showing just the alterations to accent wiring required by Onyx extensions. Everything else in the wiring of the Diamond Controller stays the same.
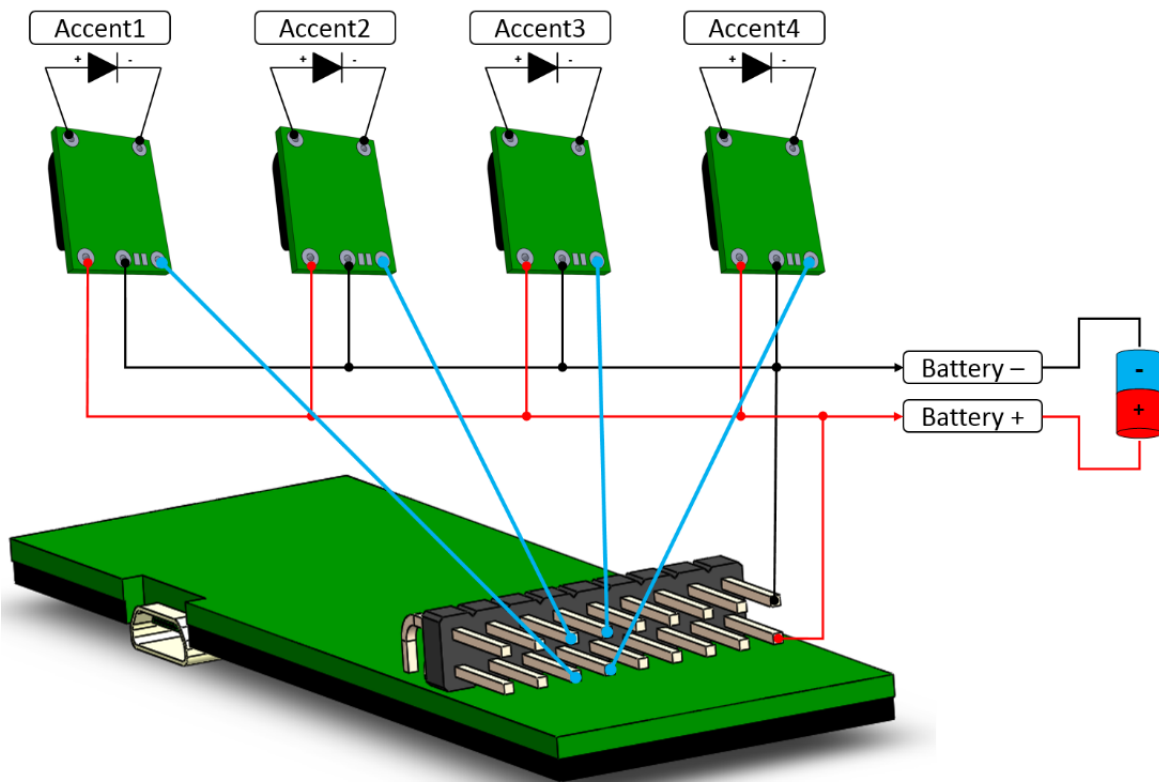
Tips

♦ If you're extending the power capability of an accent LED using an Onyx buck regulator, you have to specify this in the board configuration using the Ultrasabers Launcher software. See *chapter 4* for details.

♦ You can mix low power and Onyx-extended accent channels. For instance you can have Accent1 drive a low power LED and Accent2 drive a high power LED through Onyx.

Specifications

ELECTRICAL	
Operating voltage	5 – 9 Vdc
Recommended battery setup	7.4V (2 x Li-Ion @3.7V)
Audio power	1.25 W @ 8 Ω speakers
Audio quality	16 bit, 48 kHz
Maximum Power LED current	Adjustable: 0.1 – 1 A / channel
Power LED voltage	2 – 5 V
Power LED control	8 bit / channel
Maximum Accent LED current	Adjustable, 10 – 50 mA / channel
Accent LED voltage	Adjustable, 1-4 V
Accent LED control	8 bit / channel
Standby current	2.5 mA
FUNCTIONAL	
Internal memory	256 MB
Number of fonts	1 – 16
Number of effects	Maximum 15 / font
Effect light sequence duration	Maximum 65 seconds
Effect light sequence points	1-20
Effect light sequence repetitions	1-100
Sounds per effect	1 for Tag, Power On, Power Off, Idle, Force, Lockup and gestures
	Maximum 15 for Swing, Impact, Spin and Stab
Number of gestures	Maximum 5 / font
Gesture duration	Maximum 5 seconds
Menu exit time	2 seconds with switch pressed
Menu timeout	30 seconds with no action
Power Off time	2 seconds with switch pressed
Sensitivity adjustment	Swing, Impact, Stab, Spin, Force, Menu rotations and each gesture of each font
Sensitivity range	1 – 255
SOFTWARE	
Operating system	Windows 7, 8, 10 or MAC OS
USB Driver	Virtual COM port. Built-in for Windows 10 and MAC
Hard disk requirements	Minimum 500 MB free space
RAM requirements	Minimum 1 GB
Accepted sound format	LSU or WAV mono, 16 bit, 48 kHz
Native files	.DCFG = Diamond configuration and settings .DGST = Diamond gesture .PEFF = Packed effect .PFNT = Packed font

6. TROUBLESHOOTING

Common issues

When I turn on the saber I get an "Initialization error" message.

This might be a configuration problem or a hardware failure. Connect it to the Launcher, run the diagnose tool and follow the recommendations from the report.

When I turn on the saber I hear some beeps and then nothing else happens.

The beeps means that the board is powered but the memory content is corrupted so it can't even play the initialization error message. Connect it to the Launcher, run the diagnose tool and follow the recommendations from the report. You will probably need to restore factory defaults. If that does not solve it then it is probably a hardware problem, contact Ultrasabers customer support.

When I power the saber, nothing happens.

Make sure the batteries are charged. If they are, there is a hardware problem, either with the wiring or with the board itself. Check the wiring, if everything is good then contact Ultrasabers customer support.

When I powered the saber, smoke was coming out of it.

That was The Force escaping the Diamond Controller. It has no Force anymore. This might have been caused by faulty wiring or a hardware problem with the board itself. Contact Ultrasabers customer support.
[PS: that's not actually a common issue! The Force usually stays in.]

Blade is flickering or sound is very low.

Recharge the batteries.

I just installed Ultrasabers Launcher on Windows but it does not run.

Download and install Visual C++ redistributable from here:
https://www.microsoft.com/en-us/download/details.aspx?id=48145

I cannot find the master volume control in the Ultrasabers Launcher.

Upgrade the firmware and software to the latest version.

I cannot find the "Onyx LED buck" checkbox in the board configuration window of Ultrasabers Launcher.

Upgrade the firmware and software to the latest version.

The board does not connect to the computer or disconnects sporadically.

Make sure the batteries are charged. Disconnect the USB cable and connect it again. Make sure the USB cable is not damaged. Use a shorter USB cable and plug it directly to the computer, not through a hub.

The board is detected by the computer but I get an USB driver error.

Drivers are only required for Windows 7 and 8. They're normally installed with the Ultrasabers Launcher, but if something went wrong you can try to reinstall them manually. You'll find the drivers in the installation folder (normally C:\Program Files (x86)\Ultrasabers\UltraSabers_Launcher) under \Application\Diamond\driver. Run the executable appropriate for your processor.

If you encounter this issue on Windows 10 or MAC, there's a problem with your operating system. It should have the Virtual COM Port driver preinstalled, contact your OS provider.

When the board connects to the computer is freezes while reading or writing to the board.

Make sure the batteries are charged. Make sure the USB cable is not damaged. Use a shorter USB cable and plug it directly to the computer, not through a hub. If the problem persists, contact Ultrasabers customer support and send them the log file from the day you encountered this problem.

The diagnose tool does not open the text report after finalizing the checks.

This might be caused by an improper setting of the operating system, which is unable to find the default text editor. You should try to manually search and open the file **diamond_diagnose.txt**. On Windows it is located in **%home%/UltraSabers_Launcher/logs/** On MAC you'll find it on **$HOME/UltraSabers_Launcher/logs/** Just copy and paste the bolded path in a file explorer and the operating system will know how to decode it.

Running a diagnose

When you turn on the Diamond Controller it will first check the internal configuration and memory content. If it finds a problem it will play an audio message reporting an initialization error. Such errors might not be critical, the Diamond Controller will try to disable the corrupted functionality so, after the error message, the board might seem to behave normally. Depending on the severity of the error, you might get full, partial or no functionality at all.

Whenever there's an initialization error reported, you should run the diagnose tool in order to investigate the problem. Connect your saber to the computer, run the Ultrasabers Launcher and press the "Diagnose" button located on the "Diamond Controller" tab.
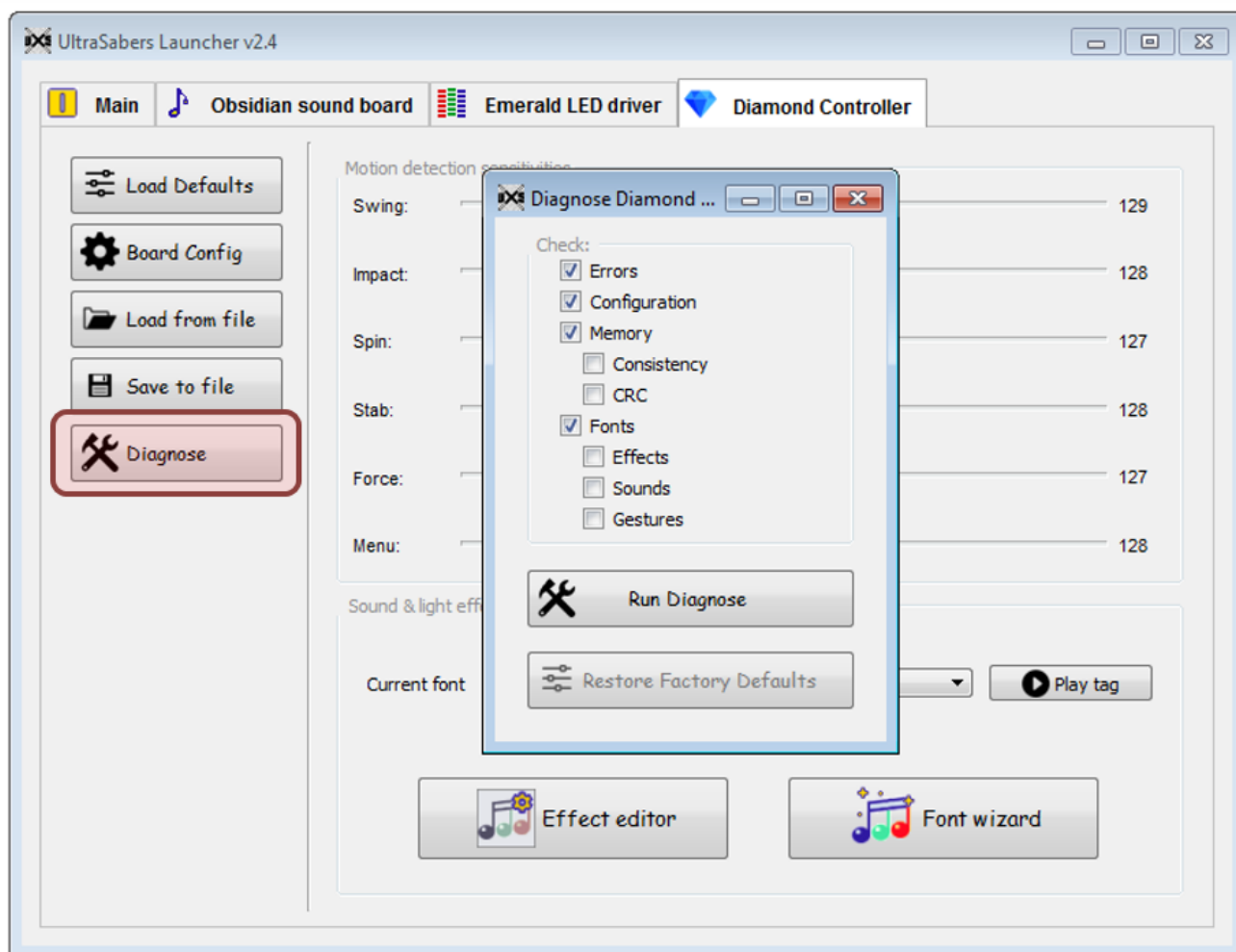
You'll be presented with a list of checks. For the first diagnose run you should leave everything as it is. If the error persists and is not reported then you should run the diagnose again with all the checks enabled; it will take longer but it will check everything.

When you press the "Run Diagnose" button, the Diamond Controller will start to run some internal checks.

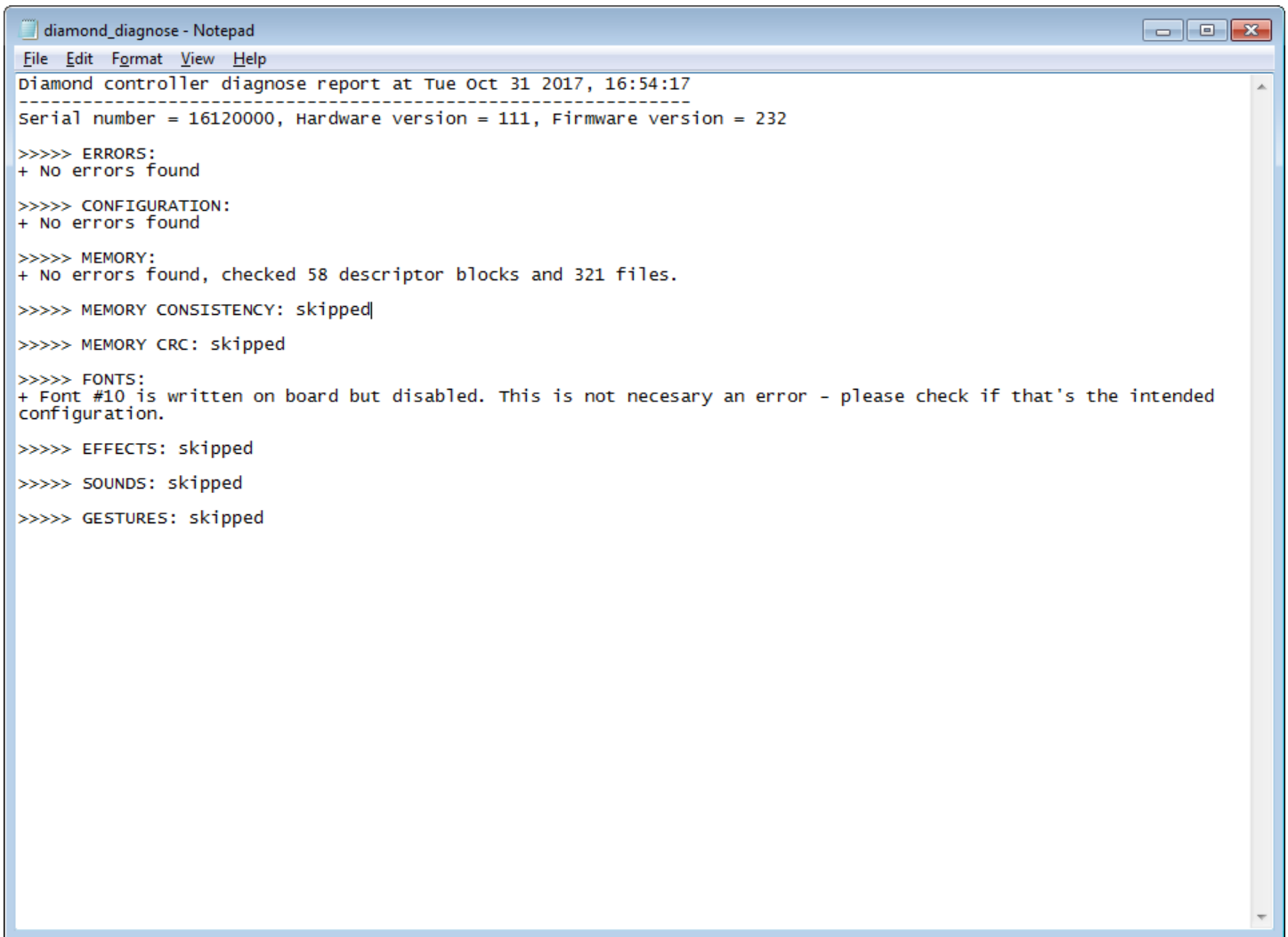The current status of the diagnose will be reported in a progress window. Let it work, do not disconnect the USB cable and do not remove the batteries.
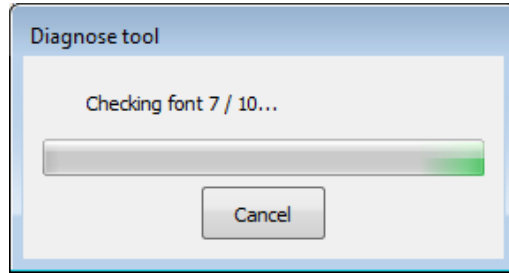
When the diagnose is complete it will open a text report, detailing the results of the checks. This is a human readable report and contains suggestions on how to fix the problems found. Try following the suggestions and save the file to a known location. If you'll need to contact customer support, you will be asked to provide this diagnose report.


```
Diamond controller diagnose report at Tue Oct 31 2017, 16:54:17
----------------------------------------------------------------
Serial number = 16120000, Hardware version = 111, Firmware version = 232

>>>>> ERRORS:
+ No errors found

>>>>> CONFIGURATION:
+ No errors found

>>>>> MEMORY:
+ No errors found, checked 58 descriptor blocks and 321 files.

>>>>> MEMORY CONSISTENCY: skipped

>>>>> MEMORY CRC: skipped

>>>>> FONTS:
+ Font #10 is written on board but disabled. This is not necesary an error – please check if that's the intended
configuration.

>>>>> EFFECTS: skipped

>>>>> SOUNDS: skipped

>>>>> GESTURES: skipped
```

Restoring factory defaults

If the Diamond Controller is reporting errors and you're unable to fix them following the recommendations of the diagnose tool, the last resort is to try to restore the factory defaults. This procedure will rewrite the entire content of the internal memory, including fonts, gestures and settings, to the default state.

Please note that restoring factory defaults will not necessary restore the board to the same state you received it in. Depending on your purchasing options, it is possible that the particular board that you received was customized to your preferences, so restoring factory defaults will lose that customization.

The recommended procedure when restoring factory defaults is the following:

1) Make sure that the batteries are fully charged. Restoring factory defaults can take some time and if the batteries fail during this process you'll end up with a corrupted memory.

2) Save each font from your saber on your computer. See *chapter 4* for details about saving and loading fonts.

3) Run the diagnose tool. The "Restore Factory Defaults" option will not be enabled until you run the diagnose at least once.

4) Press the "Restore Factory Defaults" button. The process will take several minutes as the entire memory has to be rewritten, please be patient and do not interrupt the process.
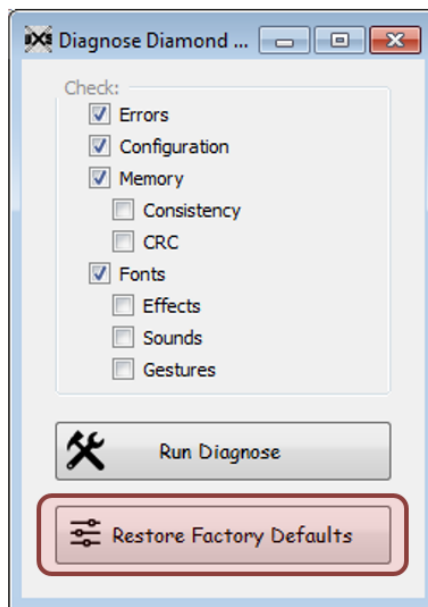
5) Write the fonts that you saved on your computer back to the board.

Reporting errors

If you followed all the guidelines of the troubleshooting section of this manual and the problem persists, you should contact Ultrasabers customer support. You will probably be asked to provide the following files:

♦ If your problem is related to the behavior of the Diamond Controller: **the diagnose report**. Please see previous paragraph on how to get the diagnose report.

♦ If your problem is related to the communication of the Diamond Controller with the Ultrasabers Launcher software: **the log files**. Those can be found at **%home%/UltraSabers_Launcher/logs/** on Windows systems and at **$HOME/UltraSabers_Launcher/logs/** on MAC systems. Just copy and paste the bolded path into a file explorer and the operating system will know how to decode it.

The log files are named **<date_of_usage>.lgs**. You should only provide the log files from the day(s) when you encountered problems. The log files are not human readable so don't try to make sense of their content, just send them to customer support.

*Diamond Controller and Ultrasabers Launcher are developed and manufactured by
RSX Engineering, exclusively for Ultrasabers.*

*RSX Engineering LLC
11th Apateu St, Timisoara, 300543, Romania
+40 771 279 017
ultrasabers@rsxengineering.com*