

WARBL User Manual

Software version 6.2

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1. Introduction

WARBL is a plug-and-play USB-MIDI wind instrument, designed to simulate traditional open-tone-hole instruments like tin whistles, flutes, and bagpipes. WARBL has eight optical tone-hole sensors, a pressure sensor, three buttons, and an LED indicator. The buttons are numbered 1, 2, and 3 from the top (mouthpiece) end of the instrument.

There is also a programming button under the hole in the enclosure where the LED is visible. This is used for entering programming mode under certain circumstances, but will not be used in normal operation. To reset the device, simply unplug it and plug it in again.

2. Optical sensors

The infrared optical sensors detect the distance of your fingers from the tone holes. The device uses this information to send MIDI pitch-bend messages, and to determine whether each hole is covered. The sensors may require occasional cleaning (see section

11) and calibration (see section 10). Although the device has been calibrated once when new, you will likely need to calibrate it to your own fingers.

Because they use infrared light, the sensors work well in most lighting conditions (including complete darkness), but may have slightly different sensitivity outdoors in direct sunlight. For best results, please ensure that your hands are clean and dry.

3. Pressure sensor and mouthpiece options

The pressure sensor measures the pressure from your breath or a bagpipe bag. The sensor is compensated for temperature and is quite precise. It can detect a maximum pressure of 6 kPa (about 24 inches of water).

The standard mouthpiece is a closed plastic tube. To install it, insert it by twisting it roughly 1/2" into the rubber stopper. It can be removed by twisting and pulling. The mouthpiece is a closed system, meaning that no air can escape. This means that you never have to take a breath or refill a bagpipe bag. While this generally makes playing easier, it also changes the way that breath can be used for

articulation, for example it is not possible to “tongue” notes. If preferred, the mouthpiece with a small hole on the side can be used to let air escape and more closely approximate a real instrument. The hole should be positioned pointing downward so that moisture can drain out.

The rubber stopper for the mouthpiece can also be removed by twisting while pulling. This exposes a small chamber that is designed to trap any moisture. Under normal operation with a closed mouthpiece tube, there probably won't be any liquid moisture that accumulates in the trap, because no air is passing into the instrument. If there is accumulated moisture, a bit of cotton can be inserted to absorb moisture, then removed to dry after playing.

If it is necessary to remove the rubber stopper frequently, it should be lubricated with a small amount of lithium grease, non-petroleum-based lip balm, or similar lubricant. It should then be reasonably easy to twist and remove.

See section 10 for using a bagpipe bag instead of a mouthpiece tube.

4. MIDI app options and setup

Most mobile device and computers can be used as MIDI host devices. IOS devices work especially well because they have low latency and there are many low-cost MIDI app options. Plugging WARBL into an iOS device requires the [Apple Lightning to USB Camera Adapter](#) or a similar adapter. There are less expensive non-Apple brand adapters [available](#), but please note that I have not yet tested these. Plugging into an Android device requires USB On-the-Go support and a USB On-the-Go adapter. WARBL uses only 20 mA of current to be compatible with most devices and have a minimal effect on battery life.

Some recommended iOS apps are [Roland Sound Canvas](#), Appcordians [Celtic Sounds](#) (or [other Appcordians MIDI apps](#)), [Universal Piper](#) (also available for Windows and Mac), and [Thumbjam](#). If the app allows control over the maximum pitch bend, it should be set to two semitones. This is the default for many apps. Some apps allow “background play”, meaning that the app will continue to play after it is closed. This allows using multiple apps simultaneously, producing the sound of multiple instruments at once.

Note: MIDI apps that are open “in the background” continue to use battery life, so it’s a good idea to force them to close after you are done playing (on iOS, double-click the home button and then swipe the app upward).

5. Instruments

WARBL stores settings for three “instruments”, each of which consists of a fingering pattern and an associated group of controls. For example, one instrument might use the tin whistle fingering pattern and settings for pitch bend, pressure sensing, and button configurations that work well for tin whistle sounds within a given app. Another mode could be set up with uilleann pipe fingering using a bagpipe bag and buttons configured for controlling drones and regulators with a different app.

By default, the three instruments use tin whistle/flute, uilleann pipe, and great highland/Scottish smallpipe fingering, respectively. See section 9 for more information on changing settings for the three instruments.

The tin whistle/flute fingering pattern is meant to be a “universal” pattern, and includes the ability to flatten any note a half step by covering the R4 (right-hand “pinky”) hole. This gives you a fully chromatic two-octave range. The fingering pattern is also known as the “simple-system” pattern and will be familiar to players of many types of wind instruments.

6. Pitch-bend modes

WARBL mimics open-tone hole instruments by sensing the distance of your fingers from the holes and using this information to bend notes downward.

There are three pitch-bend modes. In **mode 1 (slide and vibrato)**, lowering the finger over the highest uncovered hole will gradually flatten the current note down to the next lower note on the scale, much like on a real instrument. Lowering fingers over any other open holes will flatten the note to a lesser extent, which is useful for vibrato. If a finger over a "vibrato" hole is lowered all the way but the new fingering pattern doesn't change the current note, the pitch bend is reset to zero. The pitch bend contributed by each hole is cumulative, meaning that lowering fingers over multiple holes

simultaneously will flatten the note more than lowering just one finger.

In **mode 2 (vibrato only)**, the highest uncovered hole is treated the same as the rest, so lowering a finger over it will flatten the note somewhat, but not enough to slide all the way down to the next note on the scale. With some apps, this gives a cleaner sound than mode 1, especially when playing fast passages. You can still flatten the current note more by lowering multiple fingers over open holes if you'd like.

In **mode 3 (no pitch bend)**, no pitch-bend information is sent. This is best for very clean fast passages, or for mimicking other instruments like accordions where note bending sounds unnatural.

Because of the nature of MIDI, slides from one note to another will never be completely clean because there will be slight break when the new note is triggered. However, this is not very noticeable in most instances. Some apps and instrument sounds give better slide results than others.

7. Pressure modes

The pressure modes control the way that WARBL responds to air pressure. There are four pressure modes.

In **mode 1**, it is possible to use the breath to play two full octaves, “overblowing” to reach the second octave, like on a tin whistle or flute.

Mode 2 similarly allows you to play two octaves, but the settings are optimized for using a bagpipe bag, similar to playing uilleann bagpipes.

Mode 3 is used for playing a single octave only, like on a great highland practice chanter (or using a bag for one octave only).

In **mode 4**, the pressure sensor is ignored entirely. Instead, a button is configured to turn the sound off and on (see section 9 for programming the buttons).

8. Default button configuration

Note: The button configuration can be changed using the WARBL Configuration Tool.

By default, clicking (and releasing) button 1 changes the pitch-bend mode, clicking button 2 changes the pressure mode, and clicking button 3 changes the instrument. When changing any of these modes, the LED blinks to indicate the number of the selected mode or instrument.

Holding button 2 and clicking (and releasing) button 1 will shift upward one octave. Holding button and clicking button 3 will shift downward one octave. The maximum shift in either direction is 4 octaves. The selected octave shift (either up or down from the default octave) will be indicated by the LED. The LED will not blink if the default octave is selected.

There are also some “secret” button actions, that involve covering certain tone holes while pressing a button. These allow access to certain functions if you have reassigned the normal button clicks to other functions. To enable these, you must turn on the “secret” button command switch for current mode in the WARBL Configuration Tool.

The “secret” commands are as follows:

Covering only hole L3 while pressing button 1 will change the pitch-bend mode, and covering only R3 while pressing button 1 will change the instrument.

Covering only the R1 hole while pressing button 1 will turn on and turn off the Lynch Drones in the Appcordians Celtic Sounds Module app. Similarly, covering the R2 hole while pressing button 1 will turn on/off the Crowley drones. Either of these combinations can also be used to control drones in the Universal Piper app by using the “learn” capability under MIDI settings.

9. Customization with The WARBL Configuration Tool

The Configuration Tool is a web app designed to give you full control over the device with an easy-to-use interface. It connects to WARBL using MIDI protocol. It is necessary to use a browser that supports Web MIDI, which currently includes Chrome and Opera on Windows, Mac, Linux, Chromebook, or Android. Firefox can also be used after installing the free [WEB MIDI extension](#).

Safari unfortunately does not yet support Web MIDI. However, on iOS devices you can use the free [Web MIDI app](#) (highly recommended). Simply navigate to the Configuration Tool within the app and select "Enable SYSEX" in the settings. You may also want to bookmark the page for later use.

The Configuration Tool allows you to change the settings for each of the three instruments, as well as calibrating the optical sensors. Click on the “info” buttons within the tool for more information about all of the controls.

10. Using bagpipe bags and the optional bell sensor

The optional bagpipe kit includes a simple collapsible plastic bottle that can be used as a bagpipe bag. Simply inflate the bag to the desired amount and plug the tube into the rubber stopper in place of the mouthpiece tube.

Note: The pressure sensor is always calibrated when WARBL is turned on, so when you’re using a bag, put a small amount of pressure on the bag while you plug WARBL in. This will “tell” it how much pressure you’d like to use to begin making sound. If you have too much pressure on the bag when you plug in the device, there’s a chance that the pressure sensor won’t be able to respond to a large enough range of pressure, and you won’t be able to play the highest notes (when using the sensor to “overblow” to play a second octave).

If you can't reach the highest notes, either the sensor was calibrated too high when you plugged in the device, or you have the Octave Threshold set too high in the Configuration Tool (or a combination of both).

When using a bag, it is suggested that you use pressure mode 2 (for two octaves, with overblowing) or 3 (for one octave).

It is also possible to use real bagpipe bags, though the method of attachment will vary. Please feel free to contact me for ideas about connecting other bags.

The bell sensor is designed to allow closed piping, as with uilleann pipes. It is the same type of sensor as the tone-hole sensors, but plugs into the jack at the end of the device to sense when the instrument is "on the knee" or "off the knee". If you're using the uilleann fingering pattern and the bell sensor is plugged in, no note will be sounded if all the tone holes and the bell sensor are covered. This simulates an uilleann chanter that is completely closed off. The sensor can also be used for sliding and vibrato.

The bell sensor should be used only with the included USB cord with a slim right-angle plug. Using other cords may put too much pressure on the sensor and USB connector. The bell sensor can be calibrated in the same manner as the other sensors (see section 9), and may

need to be recalibrated depending on the type of pants that you're wearing. Most types of cloth (including dark-colored cloth like bluejeans) are quite reflective in the infrared range and work well with the sensor.

11. Care and maintenance

The only maintenance required is occasional cleaning. A soft cotton cloth can be used for cleaning the outside of the enclosure, and a cotton swab works well for cleaning the toneholes and optical sensors. You can dampen the swab with rubbing alcohol if necessary. A compressed air can like those used for cleaning computers can be used to blow any dust out of the interior. You can blow air into the tone holes or the bell-sensor jack.

12. Updating the software

The easiest way to update the software is on a PC. Download the WARBL Software Installer from the [Documentation](#) page, and unzip the folder to a location on your hard drive where you have

administrative privileges, for example your Documents folder. Also download the latest software version and save it the same folder or anywhere that you have administrative privileges. **Note:** none of the folders in the file tree can contain spaces in their names.

Next, open the WARBL_Installer folder and double-click the HexUploader.exe file to run it (you may have to give permission the first time you run it). Click the “...” button to open the software hex file that you saved. Plug in WARBL, click “Device in Serial Mode”, select the serial port from the menu (it’s likely the only one listed) and click “Upload”. You should see a prompt window open briefly while the software uploads, and then it will close. The next time you connect to the WARBL Configuration Tool, the new software version should appear in the upper right-hand corner.

If uploading in serial mode doesn’t work for some reason, you can select “Device in HID Mode” instead. Then, after clicking “Upload” you must double-click the programming button inside the WARBL enclosure using a toothpick. The LED should pulse and the software should upload. Please contact me if you have trouble with this process.

It is also possible to upload the software using the Arduino IDE software (Windows, Mac, or Linux). This is more involved, but contact me if you’d like more information about the process.

Tin Whistle/Flute Fingering Chart

left thumb	●	●	●	●	●	●	●	●	●	●
L1	●	●	●	●	●	○	○	○	○	○
L2	●	●	●	●	●	○	●	○	○	●
L3	●	●	●	●	○	●	●	○	○	●
R1	●	●	●	○	●	●	●	○	●	●
R2	●	●	○	●	●	●	●	○	●	●
R3	●	○	●	●	●	●	●	○	●	●
R4	⦿	⦿	⦿	⦿	⦿	⦿	⦿	⦿	⦿	⦿
bell sensor	●	●	●	●	●	●	●	●	●	●
	D	E	F#	G	A	B	C	C#	C#	D

- uncovered
- covered
- no effect on note
- ⦿ flattens the note by a half step

Uilleann Pipes Fingering Chart

left thumb	●	●	●	●	●	●	●	●	●	●	●	○
L1	●	●	●	●	●	●	●	○	○	○	○	●
L2	●	●	●	●	●	●	●	○	●	●	○	●
L3	●	●	●	●	●	●	○	●	●	●	○	●
R1	●	●	●	●	●	○	●	●	●	○	○	●
R2	●	●	●	●	○	●	●	●	○	○	○	●
R3	●	●	●	○	●	●	●	●	●	○	○	●
R4	●	●	○	●	●	●	●	●	●	○	○	●
bell sensor	●	○	●	●	●	●	●	●	●	●	●	●
	no sound	D	Eb	E	F#	G	A	B	C	C	C#	D

- uncovered
- covered
- no effect on note

Great Highland Bagpipes/Scottish Smallpipes Fingering Chart

left thumb	●	●	●	●	●	●	●	●	●
L1	●	●	●	●	●	●	●	●	●
L2	●	●	●	●	●	●	●	●	●
L3	●	●	●	●	●	●	●	○	○
R1	●	●	●	●	●	●	○	●	●
R2	●	●	●	●	○	○	○	○	●
R3	●	●	○	○	●	○	○	●	●
R4	●	○	●	○	○	●	●	○	○
bell sensor	●	●	●	●	●	●	●	●	●
	G	A	Bb	B	C	C#	D	Eb	E

left thumb	●	●	●	●	●	○	○	○	○
L1	●	●	●	●	○	●	○	○	●
L2	○	○	○	○	○	●	○	●	●
L3	●	●	●	○	○	○	●	○	●
R1	●	●	●	●	●	●	●	●	●
R2	●	○	○	●	●	●	●	●	●
R3	●	●	●	●	●	●	●	●	●
R4	○	○	●	○	○	○	○	○	○
bell sensor	●	●	●	●	●	●	●	●	●
	F	F	F	F#	G	G#	A	A	A

- uncovered
- covered
- no effect on note

Northumbrian Bagpipes Fingering Chart

left thumb	●	●	●	●	●	●	●	●	●
L1	●	●	●	●	●	●	●	○	●
L2	●	●	●	●	●	●	○	●	●
L3	●	●	●	●	●	○	●	●	●
R1	●	●	●	●	○	●	●	●	●
R2	●	●	●	○	●	●	●	●	●
R3	●	●	○	●	●	●	●	●	●
R4	●	○	●	●	●	●	●	●	●
bell sensor	●	●	●	●	●	●	●	●	●
	no sound	G	A	B	C	D	E	F#	G

- uncovered
- covered
- no effect on note

Note: music is generally written in key of G, but scale actually sounds in key of F (can be changed with the Configuration Tool)

Warranty

WARBL is guaranteed for a period of one year from the date of purchase. The warranty does not cover damage to misuse. The customer is responsible for the cost of shipping for warranty repairs.

Please contact me for warranty service at info@warbl.xyz.

WARBL is RoHS compliant.

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