

e-ther

ADVANCE



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Introduction

Thank you for your interest in e-ther. As its name suggests, it's played with gestures in the air like a theremin and can output:

- MIDI over USB
- MIDI over TRS (a lead with the right pinout gives MIDI over 5-pin DIN, see Appendix B)
- audio at line level with a 'gain' control via menu

The theremin was invented in 1920 by a Russian physicist named Leon Theremin. It works by detecting changes in capacitance, so it responds to proximity of the player's body.

Today, cheaper theremin-like instruments use optical sensors.

e-ther's sensors don't use visible light and therefore aren't affected by changes in ambient light. They measure distance very accurately (invisible, eye-safe) making e-ther very predictable and consistent.

e-ther advance takes this further by adding quantisation - it can 'settle' onto the musical notes of your choice (chromatic or a chosen scale) with configurable portamento. It also allows settings to be changed on the device, and can show a 'live display' of the current note or target note while playing.

If you don't find the information you're looking for in this manual, I'll be very glad to discuss any aspect.

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~ Shiela

Powering e-ther

Power e-ther via its USB-C port. Using MIDI over USB is the most convenient way to use e-ther as you only need to plug in a single lead.

Inputs, outputs and controls

USB-C

This is the most convenient way to use e-ther as you only need to connect one lead. e-ther can take power from here as well as send MIDI. When plugged into a computer or other MIDI host with a USB-C cable, e-ther should power up and appear as 'e-ther'. If you want to use MIDI over USB then your cable will need to be one that carries data rather than a 'charge only' lead. This socket is also used for updating the firmware. (see **Updating the firmware.**)

MIDI output socket

A 3.5mm jack socket for 'MIDI over TRS', using the 'Korg' or 'type A' configuration. For connecting to a device with 5-pin DIN, you can buy or make a lead following this standard (pinout in Appendix B).

Note that MIDI messages are sent by default on **channel 2** but this can be changed to any of the 16 channels, see [MIDI](#).

Vertical sensor

The vertically-facing sensor corresponds to a traditional theremin's volume antenna. When using the audio output, the vertical sensor will control the volume. When using MIDI output, it can be set to any CC number but 'channel volume' by default.

Note that if set to 'channel volume', the vertical sensor reading has a curve applied so that the volume change feels more natural. Modwheel and other CC changes are linear.

This control deliberately operates in the opposite way to a classic theremin, ie maximum volume or expression is closest to the device, while moving higher or out of range is zero volume or expression. After much experimentation, this way seemed more natural.

You can interrupt the vertical sensor's beam for a sharper attack, or bring your hand down slowly and vertically from outside the beam's range for a 'niente' or crescendo from nothing.

If using a MIDI sound patch without sustain and short attack (like a stringed instrument) then you can use a plucking motion to 'pluck' the note.

Horizontal sensor

The horizontally-facing sensor corresponds to a traditional theremin's pitch antenna. It controls pitch / frequency and has a very linear operation.

The vertical sensor has a useful range of around 10" / 25cm. The horizontal one has a slightly longer useful range of around 15" / 40cm.

Nudge control

Push this up and down to navigate the menus. It also has a push button (push directly towards the device) which switches from the menu system to the playing display (displays the current note or nearest note.)

Octave buttons

When viewing the menus, these two buttons increase or decrease the value of the selected menu item. When using the playing display, they'll switch the octave up or down.

With audio output, an octave change will be heard immediately but with MIDI output, you won't hear the change until a new note is started.

Stereo / mono output

If using the audio output, a similar waveform will be given on both channels. If using MIDI, obviously it's up to the host whether the audio it generates from the MIDI is mono or stereo.

Reset button

The main reason for including a reset button is so that you can update the firmware. It's easier to access than the 'boot' or 'bootse1' button. (See **Updating the firmware.**)

If e-ther doesn't appear as a MIDI device over USB after a few seconds from power-up, try the reset button.

Audio output

The audio jack is on the left-hand side and is marked 'Audio out (stereo)'

You don't need to configure or switch anything on. Audio will be present at this jack. You can use headphones / earbuds or connect to anything expecting line-level audio. If you find the audio level too high or too low, then there is a setting in the menu.

MIDI will also be sent to the USB-C and TRS MIDI sockets at the same time, but note that the audio output and midi output may not be exactly 'in tune'. You could use both for a ghostly (possibly unpleasant) effect, but it's intended that you use one or the other.

The menus

Root note and octave

This is the starting note of the scale or mode that you're in, and should be the note that you hear when your right hand is closest to e-ther's horizontal sensor.

If you're viewing the playing display, you can change the octave using the two buttons while playing.

Scale or mode

If set to 'continuous', e-ther will behave like the classic e-ther and a real theremin - the pitch is continuously variable, meaning that practice and a good ear are required for in-tune melodic playing.

When set to chromatic or any of the other scales / modes, e-ther will quantise the output - it'll 'settle' exactly on specific notes.

Glide (Gld:)

When set to chromatic or any of the other scales / modes, this controls how much glide or portamento is applied. With none, you'll hear the steps between the notes, like a stylophone. With a middling value, notes will transition smoothly, giving a theremin-like sound

Range (Rng:)

The right-hand sensor has a working range of around 15"/40cm. With your hand closest to the device you should hear the note displayed at the top of the menu system. You can choose whether the full physical range plays one octave (12 semitones, actually 13 notes including the starting note and octave), an octave and a half (18 semitones) or two octaves (24 semitones).

Vibrato / Vibrato speed (Vib: / Spd:)

With quantisation, it's difficult to add vibrato manually as you might naturally want to. But like a stylophone, e-ther can artificially vary the pitch using a sinewave LFO. Here you can set the amount of vibrato and the speed, each on a scale of 0-5.

With the MIDI output, this is currently added by sending a modwheel message using the Vib: value. Modwheel often controls the amount of vibrato with a software instrument, or you can set it to do so. A possible future enhancement is to apply a sine LFO as pitch bend messages.

Audio

Here you can set the output volume (3 levels) and the waveform (sine, saw, square, sine with harmonics, noise)

MIDI

Here you can set the MIDI mode. OG means 'classic' mode, intended to closely works like a theremin - note on/off and volume on the left hand (vertical control), pitch on the right (horizontal control).

CC mode allows you to use e-ther's sensors as a MIDI CC controller without sending note on/off messages. (Continuous control or control change, take your pick).

You can also set the MIDI channel here.

Vertical CC number and horizontal CC number (VCC: and HCC:)

Whichever mode you're in, you can still choose the MIDI CC number that is sent by each sensor. The default for vertical is CC7, channel volume. Alternatively, modulation wheel messages - CC1 - or any other CC number can be sent. You can most likely choose the function of the modwheel on the host device.

The default for horizontal is pitch bend (technically not a CC but is included here as CC0).

Calibration

It shouldn't normally be necessary to use this tool but if you find that you're not able to reach the root note with your hand as close as possible to the device, or if it seems a long way from the root note to the next, then recalibration should fix it (these sensors can vary a little with extremes of temperature and other factors).

To open the calibration tool, scroll down through the menus as far as you can. Then pull the menu switch down and hold it for a good 3 seconds before releasing it. You'll then see the current calibration values beside the current 'raw' sensor readings, for the vertical and horizontal sensors.

If you move your hand as close as possible to each sensor a couple of times and hold it there, you'll see the approximate value. it'll dance around (it's smoothed during use). Try to get an idea of the 'middling' value it's dancing around. (it may be as low as 20, or as high as 55). Then use the up and down button to adjust the calibration value to match. Then scroll back up out of the calibration tool. These calibration values will be saved and recalled on startup.

Using e-ther with MIDISID

If using e-ther with MIDISID, configure e-ther to use mod wheel on the vertical control (see [Vertical CC number](#)) and then you'll be able to choose pulse width, vibrato strength or filter cutoff for modwheel (e-ther's vertical sensor).

The SID chip doesn't really allow for on-the-fly changes in volume (other than master volume, which is coarsely stepped and isn't suitable for this situation, and sustain level which can't be changed while playing the note). So with the jumper in the default position, you'll only get note on/note off.

For traditional theremin sound, use one of the organ sounds, or set ADSR to maximum sustain with gentle attack and release.

Sounds with an attack and decay (such as the string instruments; guitar, bass, harp) can sound very effective. The vertical beam can be interrupted, like plucking a string and will trigger the envelope.

Updating the firmware

When updates are available, it's easy to update the firmware.

With e-ther powered up, give a double-click on the reset button. This should put the device into boot mode. (The double-click may be a little slower than you think. If you tap too slowly, it'll simply reset the device twice. Too fast won't work either.)

Alternatively, with e-ther dismantled, keep the BOOTSEL or BOOT button pressed while plugging in the USB cable, or while single-tapping the reset button if already powered up.

Then you should see the device on your computer as a drive with a name like "RPI-RP2". Simply drag the new firmware (.uf2 file) onto the new drive's icon. If successful, it should then unmount itself from your computer and the new firmware should start.

Troubleshooting

No MIDI output

Note that e-ther sends on **channel 2** by default.

Check that e-ther isn't set to CC mode (below MIDI in the menu). In CC mode, pitch bend and channel volume messages should be sent but no note on/note off. VCC should be 7 by default and HCC should be pitch bend.

The answer to no midi output at all over USB is almost always a bad or wrong USB lead. Note that some USB leads carry power but not data, ie they're made for charging. It's not unknown for USB leads to go bad or not to make good connections. Please try other leads.

If this doesn't solve the problem, then do you have any software or device that can display the MIDI? (eg MIDI Monitor on a Mac). The horizontal control should produce pitch bend messages and the vertical control should initially produce a note on, then a series of expression messages (or other CC if you've reconfigured) and finally a note off.

e-ther doesn't appear as a MIDI device or instrument

When e-ther appears, it'll be as 'e-ther' (or 'TinyUSB device' for early firmware). Power e-ther with the USB cable and if nothing happens after a few seconds, tap the reset button once (on the underside). Tapping it twice has a different purpose. Make sure to tap it once only and wait. then try again.

See the comments just above about charge-only USB leads.

If using a Mac, open the utility Audio MIDI Setup which will already be on your Mac. Go to Window>MIDI Studio (cmd-2) and see whether 'e-ther' or 'TinyUSB device' has an icon there. If it does, then the computer has connected with it at some point. If it's greyed out, then it's not currently connected and when it does connect, the icon will light up.

MIDI output produces a single note / the range control doesn't appear to work

e-ther relies heavily on 14-bit pitch bend messages, along with RPN0 (pitch bend sensitivity). If your host or software doesn't support these messages, or only supports 7-bit pitch bend then the horizontal control won't appear to work, or the range will be fixed and limited.

Horizontal control works, but vertical control just produces a note on / off

Try different instruments. It's down to the software you're using to handle the expression messages from the vertical control. In real life, instruments such as organs have no control over level; notes are just on or off, so a software version of the instrument is likely to do the same. Some instruments have an attack and decay with no sustain or release, like a guitar or bass. So again, a software version is unlikely to modify the envelope of that note, only the pitch.

Note that you can configure e-ther to produce different CC messages with the vertical control (see [Vertical CC number](#)). Channel volume (the default) is the most likely to work, but there's a good chance that you can tell your software what parameters to change for particular CC messages.

If your issue still isn't answered, please contact me, shiela@peacockmedia.co.uk

Appendices

Appendix A

Version control

This document

Version 3.0 : Oct 2025 first public version of this document for e-ther Advance

Version 3.0.1 : Dec 2025. Cleans up a couple of mentions of the configurator, relevant to the classic e-ther but not the Advance.

Circuit boards

Version 4.0 : First public version of 'Advance', includes OLED screen and jog-wheel for menu instead of range thumbwheel. An early version of the board had the vertical sensor in a slightly different position, these were used for beta testing with a brushed black acrylic face plate.

Firmware ('e-ther OS')

Oct 2025 : release of major new version for e-ther Advance. Due to a change of sensor, not compatible with earlier e-thers, which continue to be sold, updated and supported as 'e-ther Classic'.

Version 5.0.1 : rewritten calibration method, note spacing is now equal regardless of the number of notes in the scale or their intervals, lower reverb levels.

Version 5.0.2 : No longer beta, this is the initial release version. A further mod to the reverb level. It also drops the audio frequency by an octave to more closely match the MIDI output.

Version 5.0.3 : now sends MIDI RPN0 (sensitivity) with every note on. This has proved useful because the host being sent to may have changed since e-ther powered up or range last changed

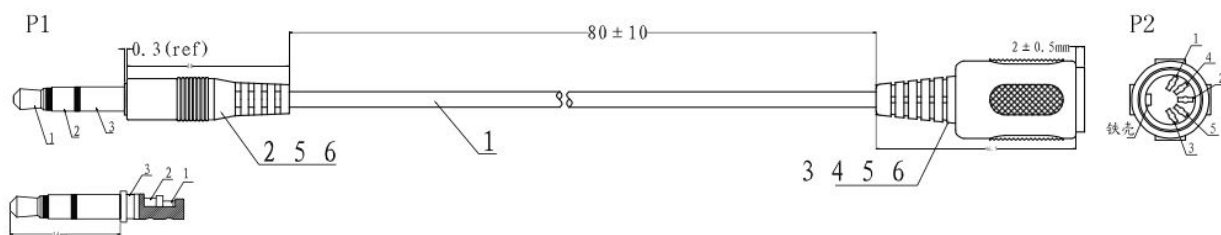
Version 5.0.4 : fixes a memory leak which would cause a hang after prolonged playing while using the live note display

Version 5.0.5 : cures an occasional glitch (click) in the audio output every so often.

Appendix B

MIDI over TRS

The 3.5mm jack used for MIDI out follows the most official standard for MIDI over TRS. If buying a lead, it may also known as 'Type A' and used by Akai Pro, IK Multimedia, Korg, Line 6, littleBits, Make Noise. (diagram from midi.org)



PIN OUT:

P1	P2
1-----	5
2-----	4
3-----	2

Note that it's very easy to mix up pins 4 and 5. The diagram above is looking at the user end of a *socket*. If looking at the pins of a *plug*, or when looking at the inside/solder side of a socket, the pins will be mirrored. If you're making a lead and it doesn't work right away, then it's likely that you've reversed 4 and 5. (This shouldn't cause any harm.)

<https://www.midi.org/midi-articles/updated-how-to-make-your-own-3-5mm-mini-stereo-trs-to-midi-5-pin-din-cables>

Appendix Z

Planned features

Optional curves for MIDI CC values which are currently linear

For the MIDI output, the Vib: settings currently send a modwheel value, which is likely to add vib to a software instrument, or can be made to do so. It may be better to apply a sine LFO as pitch bend messages.

receive MIDI over USB and output audio using the current settings (waveform, amount of port, vib etc)