e-ther

https://peacockmedia.software/e-ther

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 configuration utility

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.

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 **Configuration**.

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 'expression' by default.

Note that if set to 'expression', 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.

Both sensors have a useful range of around 10" / 25cm.

Rotary control

The rotary control at the side controls the frequency range, or 'spread'. At one extreme, the pitch control will appear to do nothing. At the other extreme, the pitch control should give a range of two octaves with a C approximately in the centre.

If using MIDI output, e-ther sends RPN 0 (Pitch Bend Sensitivity) messages, so your host must respond correctly to these if this control is to be effective. (I believe that Garage Band does not).

Note that this control won't appear to change anything if a note is already sounding. Move clear of both sensors, and then play a new note to hear the new setting.

Octave buttons

These two buttons are easy to tap while playing. With audio output, the change will be heard immediately but with MIDI output, you won't hear the change until a new note is started.
7 octaves are possible, the frontmost button raising the output by an octave, the other lowering it.

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 'bootsel' 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

This is now built into e-ther. If you have an e-ther 1, there is an earlier version of the manual which describes the optional DAC.

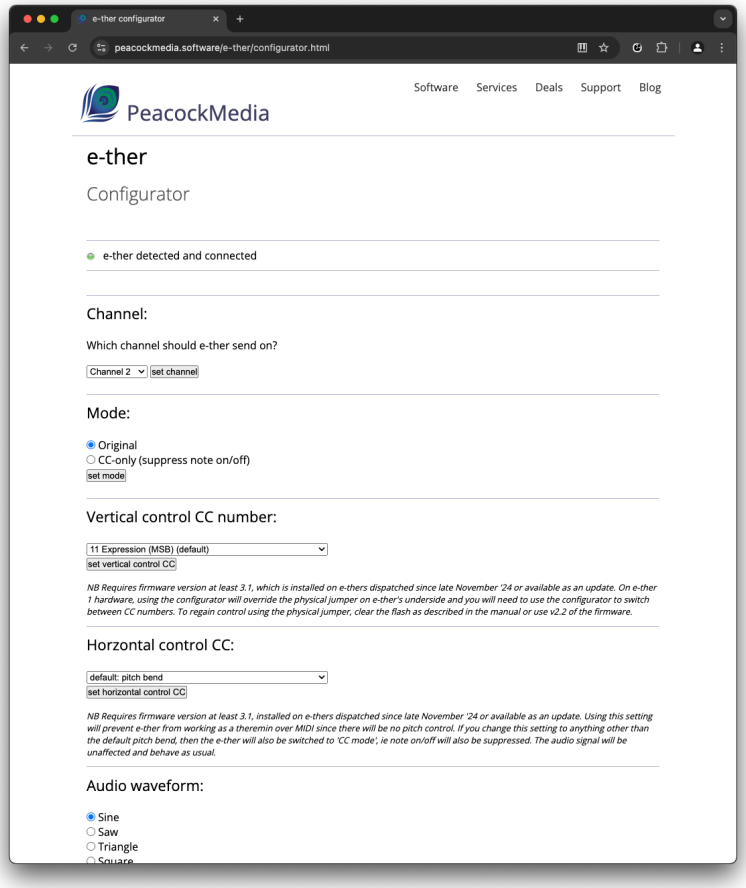
The audio jack is on the left-hand side and is marked 'Audio out (stereo)'

You don't need to configure or switch anything on. Audio will be present at this jack. If you find the audio level too high or too low, then there is a setting in the **configurator**.

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 are unlikely to be 'in tune' and are not meant to be. You could use both for a ghostly (possibly unpleasant) effect, but it's intended that you use one or the other.

Configuration

Visit https://peacockmedia.software/e-ther/configurator.html to find the configuration utility.



For information about using the utility scroll down the configurator's page and find **Getting started**. There are some caveats about which browsers work best. You may need to allow a plugin to be installed.

Note that The configurator depends on WebMIDI which isn't universally supported in browsers. Desktop support is good. It appears to have good support on Android devices but there are no options for iOS.

After plugging e-ther into your computer, the configurator should detect it.

A video showing the configurator being used is here: https://youtu.be/xEWzqqkwKU4

Note that the configurator may show default values, not the actual settings on e-ther. This is because communication used to be one-way - from configurator to e-ther. Since May '25 this has been improved; the configurator will read e-ther and display the actual values. This requires at least v4 of the firmware. Contact support if you need this update.

Channel

Simply choose another channel and press 'set channel' to change the channel that e-ther uses to send MIDI.

Mode

This allows you to change the mode. The CC-only option allows you to use e-thers sensors as a MIDI CC controller without sending note on/off messages.

Vertical control CC number

By default, expression messages - CC 11 - will be sent. (This was chosen for the default because this tends to be used to control the volume of a patch.)

Alternatively, modulation wheel messages - CC 1 - or any other CC number can be sent. You can most likely choose the function of the modwheel on the host device. By default it's usually used for an effect such as vibrato, but could also be set to control other expressions such as filter cutoff.

Horizontal control CC number

By default this is set to pitch bend (in conjunction with note on/off and RPN0) for a theremin-like experience. If you'd like e-ther to be more of a CC controller then you may want to switch the horizontal control to another CC number.

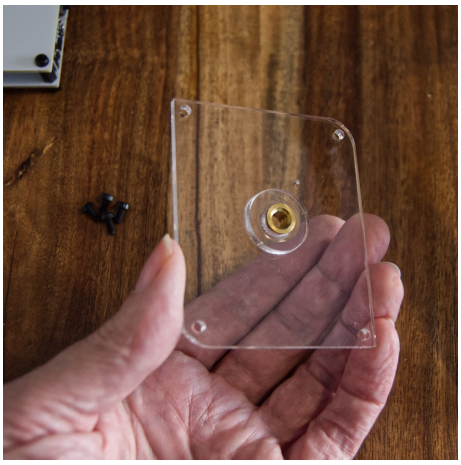
Full Horizontal and Vertical CC configuration requires firmware at least 3.1.1

Flip horizontal and vertical controls

For some use cases (particularly with CC-only mode) it may be preferable to have pitch bend on the left hand / vertical control and expression on the right hand / horizontal control.

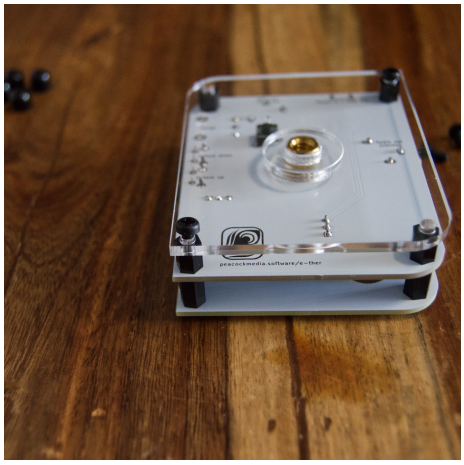
Fitting the tripod mount

A tripod mount is now available with a standard tripod thread (1/4" x 20). Here is the procedure for fitting it.

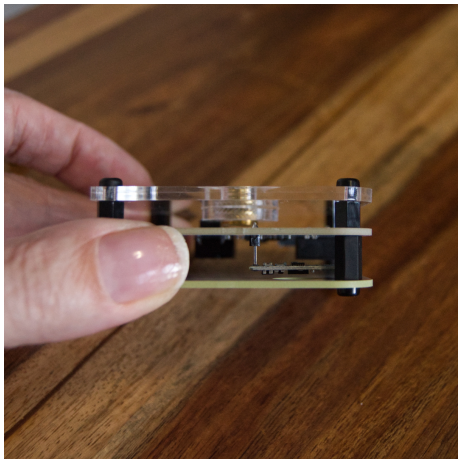


1. Your tripod mount is probably supplied with the protective film still on, so that you can enjoy peeling it yourself. Beneath should be pristine crystal clear perspex.

2. Pull off e-ther's rubber feet to reveal the stand-offs within.



3. Use the provided screws to screw the tripod mount in place



4. Note that the reinforcing ring should be towards your e-ther and the screws now serve as your feet. If it won't always be on the tripod and you find that it slips around, you may like to fit clear self-adhesive feet.

Using e-ther with MIDISID

If using e-ther with MIDISID, configure e-ther to use mod wheel on the vertical control (see **Configuration**) 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.

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.

The answer to this problem 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.

There doesn't seem to be an official maximum rate for midi messages (other than the baud rate of real MIDI) but the host has to be able to buffer and handle the incoming stream of data. By default, e-ther doesn't limit this and sends a very fast stream of expression and pitch bend messages, for the smoothest result. The configurator now allows you to 'rate limit' the midi messages to four levels. If you know that the rate is a problem or suspect it might be, then you can experiment with this setting.You want to have it set to the fastest (the lowest level of limitation) that works for you.

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 **configurator**). Expression (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 2.0 : Oct 2023 first public version of this document for e-ther2
Version 2.1 : May 2024 added some notes about using the configurator following user feedback.
Version 2.2 : November 2024 - Updates some images such as the configurator.
Version 3 : November 2024 - some changes relating to the change from micro USB to USB-C (known as e-ther3). Removes the information about the plug-in DAC and other things relevant to early e-thers (e-ther1).
Version 3.0.1 : May 2025 - minor update relating to configurator and firmware 4.0

Circuit boards

Version 1.0 : First public version.
Version 2.0 : First version with microcontroller and DAC incorporated onto main board
Version 3.0 : Changes the micro USB socket for USB-C, some repositioning of components to accommodate the larger socket but circuit and positions of sockets / buttons unchanged.

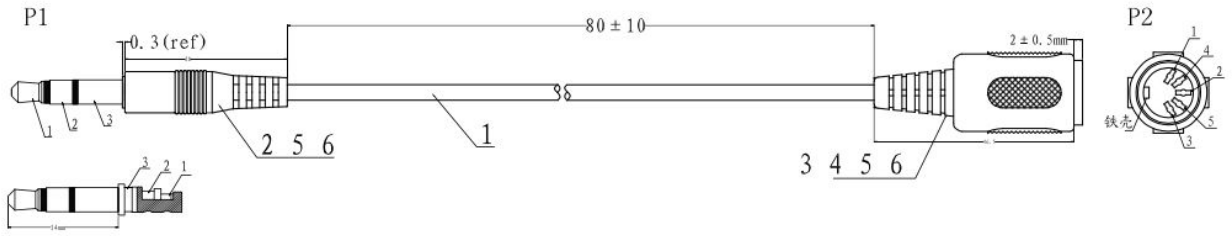
Firmware ('e-ther OS')

Nov 2023 : release of major new version to coincide with e-ther2, confusingly numbered v3.0.x Compatible with all e-thers.
Feb 2024 v3.0.3 : Fixes a bug that caused breath control messages to be sent on the TRS MIDI output rather than expression. This may or may not have worked but is not as intended.
Allows rate limiting. Some hardware / software may find the rate that e-ther sends MIDI messages too fast. I'm not aware that the MIDI standard specifies a maximum, but the host must be able to buffer and deal with the data quickly enough. If you know or suspect that this is causing you a problem, then the configurator allows you to 'rate limit' with three levels. Even at the most severe limiting, the pitch and expression changes should still sound smooth.
Nov 2024 v3.1.1 : Adds ability to configure both controls to any sensible CC number. (configuring the right-hand control to anything other than the default pitch bend, automatically switches to 'CC mode' which suppresses note on/off). This goes with a new version of the configurator page. Also adds a 'factory reset' to the configurator and firmware which resets all configurable settings to default. Current firmware and configurator will work on all versions of e-ther
May 2025 v4.0 : Several changes / improvements relating to MIDI output: removes automatic switching to CC mode if the horizontal control isn't set to pitch bend. Direction of the values on the right hand reversed, where not set to pitch bend, so that highest value is given when hand is closest to the device, 0 when furthest away or out of range. This makes it consistent with the left hand and also with people's expectations. Values should now run from zero to 127 rather than falling short. When in CC mode and right hand is pitch bend, the value 'centres' when hand is out of range. Communication with the configurator is now two-way, ie the configurator now receives the actual values on the device and displays them rather than showing defaults, which was confusing.

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

To add 'range' options for the custom CC controls. Currently each control produces values 0-127. Maybe you want to use the full range but not actually go all the way down to zero. Or to have the full distance of the sensor limited to a certain range of values.