

PHON

Software monitor controller for macOS

User Manual

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Neutral & Natural Audio

neutralandnaturalaudio.com

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Foreword

After twenty years of designing studios and calibrating monitoring systems, I have seen the same problem in every facility I have worked in: engineers making different mix decisions at different monitoring levels, then wondering why the results do not translate.

The cause is well documented. Fletcher and Munson published their curves in 1933. ISO standardised them. Every audio engineering textbook mentions them. And yet very few tools address the problem in a practical way.

PHON was born from a simple observation: if we know how hearing changes with level, and we know the level at the listening position, we can correct for it. Not approximately, and not with a fixed bass boost: with the difference between two equal-loudness contours, applied on the one device that knows both numbers, the monitor controller.

This manual explains the theory, the implementation and the practical workflow. Take the time to calibrate. It is the foundation everything else rests on.

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Note. This manual describes PHON 1.0.3 for macOS. Screenshots show the Dark theme; the layout is the same in every theme.

1. What PHON does

1.1 A monitor controller in software

A monitor controller sits between your sources and your speakers. It selects what you listen to, sets how loud, switches between speaker pairs and headphones, and protects them. PHON puts that stage in software, on your Mac, before the converter. Your DAW's master fader stays at 0 dB and your session is untouched: PHON is not a plugin, and it adds nothing to the project.

Because it runs on the computer, PHON knows two things an analogue box cannot: which application is playing, and how loud you are actually listening once you have calibrated it. From these two facts it does what hardware cannot:

- **Reference comparison with nothing to import.** Source B is whatever plays in Spotify, Apple Music, a browser or any other application, captured per application and trimmed to the level of your mix.
- **Loudness compensation tied to the calibrated level.** At the reference nothing is applied. Below it, PHON applies the ISO 226 difference between the reference and where the fader sits, so the low end you hear at 65 dB is the one you would hear at 80.
- **Three calibrated, protected outputs.** Speakers, an alternate pair and headphones, each on any device and channel pair, each with its own trim, low cut and limiter.
- **Metering where it means something.** Loudness and true peak are measured before the volume, so the numbers describe the material, not how loud you are playing it.

1.2 The signal path

Every stage below runs in 64-bit floating point. Only one source and one output are active at a time; the switches are crossfaded so they never click.

Stage	What happens
Sources A and B	Source A is normally your DAW, source B the reference. Each is an application captured live, a virtual device or a hardware input, with its own name and channel pair.
Input trim and MATCH	One trim per source and per output, ± 12 dB. MATCH measures both sources and sets the trim of the one you are not listening to, so the comparison is at the same loudness.
Loudness compensation	One low shelf whose gain follows the volume below the reference, scaled by a dosage in percent, separate for A and B (chapter 6).
Low cut	The three presets of the LOW CUT row, to hear what a small speaker or a phone keeps of your low end.
Safety low cut	A Linkwitz-Riley high-pass at 12, 24 or 48 dB/oct to keep sub-bass away from small woofers (chapter 9).
Volume, trim, pan	The monitor fader, -35 to $+15$ dB from the reference, with DIM and MUTE.
Routing	Stereo, swapped, left, right, mid or side, with a correlation meter.
Limiter	A brick-wall limiter with 1 ms lookahead on every output, after the volume, so nothing above the threshold reaches the speakers.
Outputs A, B, C	Any Core Audio device and channel pair per output, switched with a 40 ms crossfade.

1.3 Requirements

- macOS 13 or later, on Apple Silicon or Intel (one universal application).
- Per-application capture requires macOS 14.2 or later. On macOS 13, use a virtual device or a hardware input as a source.
- An audio output: an audio interface, the built-in output, or a virtual device.
- An SPL meter for calibration, with C weighting and slow integration. A phone application will do for a home studio; a class 2 meter is better.
- Optional: a MIDI controller for a physical knob, and a phone or tablet on the same network for the web remote.

2. Installation and first launch

2.1 Installing

Download the installer from neutralandnaturalaudio.com/download.html, open the package and follow the steps. PHON is installed in your Applications folder. The same build serves the trial and the licensed version: activating a licence does not require a new download.

PHON installs no audio driver, no kernel extension and no virtual device. Nothing changes in your DAW.

2.2 Permissions

On the first launch macOS asks for two permissions. PHON keeps running while a permission is missing, and the corresponding source starts by itself once access is granted.

Permission	Needed for	Where to grant it later
Screen & System Audio Recording	Capturing the audio of another application (a source set to an app). PHON uses it for audio only.	System Settings > Privacy & Security > Screen & System Audio Recording
Microphone	Reading a hardware input or a virtual device as a source.	System Settings > Privacy & Security > Microphone

2.3 First launch

PHON opens as a narrow column, sized for the strip of screen beside your arrangement. The bottom left of the window shows the licence state, the bottom centre the current sample rate and latency.

Before anything plays, open **Settings > Audio Settings** (Cmd+,) to choose your sources and outputs (chapter 4), then calibrate (chapter 5). Both take a few minutes and are done once.

2.4 Trial and licence

Trial. The trial lasts 14 days and includes every feature. No card is needed. The trial is registered with the licence server on the first launch, so an internet connection is required that first time; after that PHON can run offline for the rest of the trial.

Activation. Buy PHON at neutralandnaturalaudio.com/phon.html. The licence key arrives by email. Click the licence label at the bottom left of the window, or choose **Settings > License...**, enter the email address and the key from your purchase, accept the data notice and click **Activate License**. PHON sends your email address and an identifier of the machine to the licence server to validate the key; nothing else is collected.

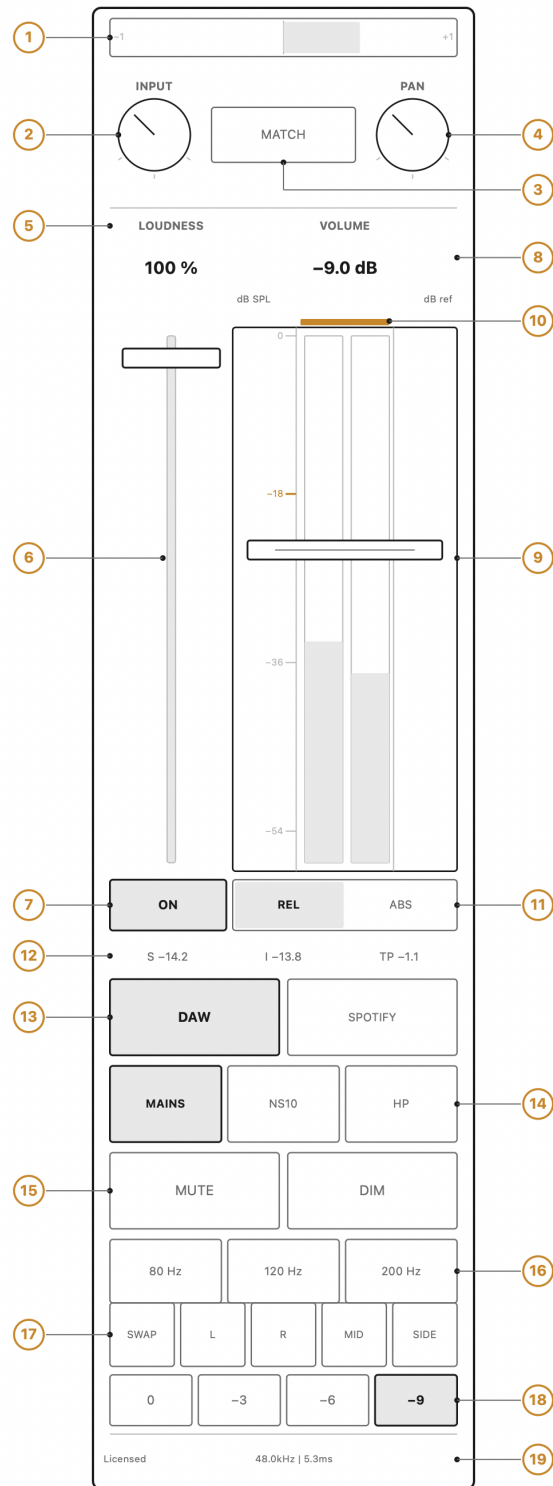
Machines. One licence activates PHON on up to two machines. **Manage Licenses** opens your licence page in the browser, where you can deactivate a machine to free its slot before activating another.

Offline use. PHON re-checks the licence with the server periodically while it runs. Each successful check leaves a signed token that lets PHON run without a connection for 30 days. The label reads **Offline** when the server cannot be reached and no valid token is held; connecting once refreshes it.

Expiry. When the trial ends without a licence the output is muted until a licence is activated. Everything else keeps working, so your settings are not lost.

3. The main window

The window is one column, read from top to bottom in the order of a session: what plays, how it sounds, then the checks. Hover over any control for its tooltip (View > Show Tooltips).

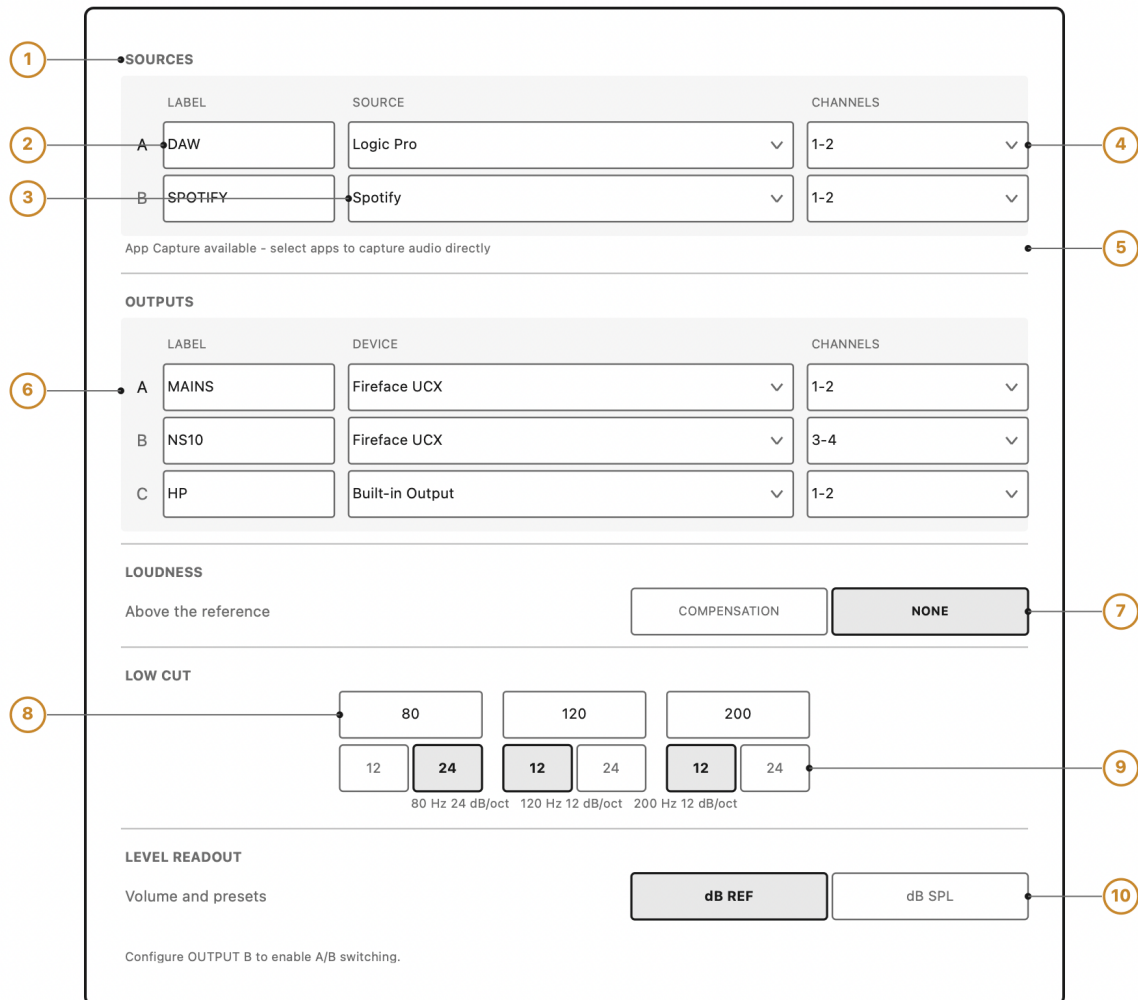


The main window, drawn to the layout of the application. A control shown shaded is one that is active: here source A, output A, the loudness compensation, and the -9 dB level. The numbers are keyed to the table below.

	Control	What it is
1	Correlation	The stereo correlation of what you are listening to, -1 to +1. Hover for the value. (8.4)
2	INPUT	The trim of the current source into the current output, ± 12 dB. Double-click for 0 dB.
3	MATCH	Trims the two sources to the same loudness, so a comparison is not decided by level. (7.3)
4	PAN	Balance between left and right for the current output. Double-click to centre.
5	LOUDNESS	The dosage of the compensation for the source you are listening to, and its value in percent.
6	Loudness fader	0 to 100 %. It spans the meter's scale, so it reads as the volume's peer rather than a setting below it.
7	ON	The compensation on or off, for every source and output. (6.4)
8	VOLUME	The monitor level, in dB from the reference or in dB SPL (4.4). It turns amber above the reference.
9	Meter and volume fader	Peak and RMS of the current output, left and right. The fader lies across the meter, its 0 dB on the calibration mark. The left scale reads dB SPL once calibrated.
10	Clip and limiter	A hairline over the bars: amber while the limiter holds the output, red if it clipped anyway. (8.2)
11	REL / ABS	What the right-hand scale reads: absolute dBFS, or dB from your calibration point.
12	S / I / TP	Short-term loudness, integrated loudness and true peak of the source, measured before the volume. (8.3)
13	SOURCE	The two sources, under the labels you gave them. The lit one plays.
14	OUTPUT	One button per configured output. Only one plays at a time.
15	MUTE and DIM	Mute fades the output out. DIM drops the fader to -24 dB and brings it back where it was.
16	LOW CUT	The three presets, 80, 120 and 200 Hz by default. (4.3)
17	ROUTING	SWAP, L, R, MID and SIDE. No button lit means stereo.
18	LEVEL	Jumps to 0, -3, -6 or -9 dB; the lit one clicked again returns the fader where it was.
19	Footer	The licence state — click it to open the licence window — the sample rate, the latency, and the resize grip.

4. Sources and outputs

Everything about devices lives in one window: **Settings > Audio Settings** (Cmd+,). It is laid out like the main window, sections under small captions, and follows the theme.



Audio Settings, drawn to the layout of the window. Sources and outputs are two tables on the same grid; the sections below are the settings that apply to every output.

4.1 Sources A and B

Each source row has three fields: the **label** shown on the button in the main window, the **source** itself, and the **channels**.

- **Source.** The list starts with (None), then the applications currently playing audio (macOS 14.2 or later), then every input device on the Mac by channel pair: hardware inputs of your interface and virtual devices such as BlackHole or Loopback. An application appears in the list while it is producing audio; if it is missing, start playback in that application and open the list again.
- **Channels.** Stereo, or L or R alone for a mono source. With a mono source the routing row is disabled, since swap, left, right, mid and side would have nothing to act on.
- **Label.** Any name. Leave it empty to show the source's own name.

The usual setup is the DAW as source A and the application playing the reference as source B. Any combination works: two DAWs, a DAW through a virtual device and Spotify captured directly, or a hardware input.

A captured application may run at a different sample rate from your output device. PHON converts it, so a 44.1 kHz stream plays correctly on a 96 kHz interface.

If source B is selected but cannot be read, because the application has stopped or was quit, PHON plays source A and the window shows **B: none** until the source is back.

4.2 Outputs A, B and C

Each output row has a **label**, an **output device** and a **channel pair**. Configure at least output A. As soon as output B has a device, the A and B buttons appear in the main window and switching is enabled; output C works the same way.

Only one output plays at a time. Each output keeps its own volume, input trims, pan, routing, low cut selection, loudness dosages, limiter and safety low cut, so switching from the speakers to the headphones recalls the headphones' settings.

Typical layouts: mains on channels 1-2 of the interface, an alternate pair on 3-4, headphones on the built-in output; or three pairs on three devices. A virtual device can also be an output, for instance to feed another application.

4.3 Low cut presets

The LOW CUT row of the main window is a one-click comparison, like the level buttons, and what each button cuts at is yours to set here. For each of the three presets: the **frequency**, 20 to 1000 Hz, and the **slope**, 12 or 24 dB/oct. Both are Butterworth, so the frequency is the -3 dB point whichever slope you choose. A closed box rolls off at 12 dB/oct, a ported one at 24.

Defaults: 80 Hz at 24 dB/oct (a small ported two-way), 120 Hz at 12 dB/oct (a laptop), 200 Hz at 12 dB/oct (a phone). The presets are the same on every output and in every preset file. The line under the fields shows what the main window will read.

4.4 Level readout

One switch for how the volume value and the four level buttons read: **dB REF**, dB from the reference (the default), or **dB SPL**, the calibrated sound pressure level at the listening position. The four buttons therefore read either as steps below the reference or as the levels your calibration puts them at. The switch is ignored until you have calibrated, where SPL would be a fiction.

4.5 Loudness above the reference

What the compensation does when the fader sits above 0 dB: **NONE** (the default) leaves the mix alone up there; **COMPENSATION** applies the ISO 226 difference in that direction too, a cut in the low end. See section 6.5.

4.6 Buffer size, sample rate and latency

The **Buffer** menu sets the buffer size from 64 to 2048 samples; each entry shows its latency at 48 kHz. The sample rate follows the output device. PHON supports 44.1, 48, 88.2 and 96 kHz. The footer of the window shows the rate and the total latency, which includes the 1 ms of the limiter's lookahead.

PHON runs at its own buffer size, on the monitoring path. It adds nothing to your DAW's recording or playback latency. Per-application capture adds a small buffer of its own on the captured source.

5. Calibration

5.1 Why calibrate

Calibration makes 0 dB on the fader a known sound pressure level at the listening position. Two things follow from it. The fader and the meter read in dB SPL, so "82" means 82 dB SPL and not a knob position. And the reference you mix at becomes the one the broadcast, film and mastering standards describe, which is what makes your decisions comparable with anyone else's.

The loudness compensation itself depends only on how far the fader sits below 0 dB, not on the absolute level. Calibration does not change the curve; it decides what "reference" means in your room.

5.2 References

Choose the reference that matches your work. Each one pairs a pink noise level in the digital domain with a target level in the room, and each states the weighting the meter must be set to.

Reference	Pink noise	Target	Typical use
ITU-R BS.1116-3	-18 dBFS RMS	82 dB(A)	Broadcast, a stereo pair
SMPTE RP 200	-20 dBFS RMS	85 dB(C)	Cinema, screen channel
K-20	-20 dBFS RMS	83 dB(C)	Wide dynamic range
K-14	-14 dBFS RMS	83 dB(C)	Mastered music
Custom	-30 to 0 dBFS RMS	75 to 85 dB SPL	Your own pair of values

Caution. Every one of these targets is defined for **one loudspeaker at a time**, not for the pair playing together. Two speakers reproducing the same noise read several decibels higher at the listening position, so a calibration made with both playing is wrong by that much. PHON sends the calibration signal to one speaker at a time for this reason.

The ITU figure is the general rule $85 - 10 \log(n)$ applied to a stereo pair, n being the number of reproduction channels: 82 dB(A) each. A five-channel system is 78 dB(A) each, which is where that older figure came from. EBU R 128 is not in this table: it normalises the loudness of a programme to -23 LUFS and says nothing about the level you listen at. K-20 and K-14 are the two useful steps of Bob Katz's K-System, which share a target and differ in the headroom above it.

The targets are loud for a long session in a small room. That is what the compensation is for: calibrate to the standard, then work at whatever level is comfortable (section 6.6).

5.3 Procedure

Caution. The calibration signal is pink noise at the level of the reference, with the fader held at 0 dB. Turn your monitors down before generating it, and confirm the warning only when you are ready.

1. Open **Settings > Calibration...** (Cmd+K) and click the reference: ITU, SMPTE, K-20, K-14 or Custom. The line under the row states the signal, the target and the weighting for the one you chose. Custom lets you set the target in dB SPL and the pink noise level in dBFS RMS.
2. In the main window, select the output to calibrate. Start with output A, your main speakers.
3. Place the SPL meter at the listening position, at ear height, pointing at the speakers. Set it to **slow** integration and to the weighting the reference asks for: **A** for ITU-R BS.1116-3, **C** for SMPTE and for the K-System.
4. In **MEASURE**, choose **LEFT**. The calibration signal will play through the left speaker only, which is how every one of these levels is defined.
5. Click **Generate Calibration Signal** and confirm.

6. Adjust the level of your monitors, their input sensitivity or your interface's output level, until the meter reads the target.
7. Switch **MEASURE** to **RIGHT** and repeat step 6 for the other speaker. The two should end up within a decibel of each other; a larger difference is a placement or a gain problem worth finding before you go on.
8. Click **Stop Calibration Signal**, then **Save Calibration**.
9. Repeat steps 2 to 8 for outputs B and C, setting each pair to the same target. Headphones cannot be measured this way: match them by ear against the speakers, with the INPUT trim (section 7.3).

PHON keeps one calibration, shared by the outputs: one pink noise level, one target. Level differences between outputs are settled at the monitors themselves, as in step 6, or with the INPUT trim, which is stored per source and per output.

Filter Pink Noise, under the test signals, restricts the noise to a band, 500 Hz to 2 kHz by default. A band-limited reading is steadier and far less sensitive to room modes, which makes it good for comparing one speaker with another. It is not the wideband signal the targets above are defined for, so leave it off while setting the absolute level. It is off by default.

5.4 What calibration changes

- The left scale of the meter reads in dB SPL, and the calibration point, the reference level, is marked in amber on the meter and on the fader.
- The level readout can be switched to dB SPL (section 4.4): the volume value and the four level buttons then read in dB SPL.
- The tooltip of the fader gives the level in dB SPL and in dBFS.

The screenshot shows the 'CALIBRATION STANDARD' window with the following elements and callouts:

- 1**: Points to the 'ITU' button in the 'CALIBRATION STANDARD' section.
- 2**: Points to the text 'ITU-R BS.1116-3: -18 dBFS RMS → 82 dB(A), one loudspeaker'.
- 3**: Points to the 'LEFT' button in the 'MEASURE' section.
- 4**: Points to the explanatory text in the 'MEASURE' section: 'The targets are defined for one loudspeaker at a time. Play the signal through one speaker, set it to the target, then do the other. Two speakers together read several decibels high.'
- 5**: Points to the 'Reference Level' slider, which is set to 82 dB SPL.
- 6**: Points to the 'Generate Calibration Signal' button.
- 7**: Points to the 'Save Calibration' button.
- 8**: Points to the 'Pink Noise Mono' dropdown menu in the 'TEST SIGNALS' section.
- 9**: Points to the 'Enable Filter (500-2k Hz)' checkbox.
- 10**: Points to the 'LPF' label at the end of the frequency filter slider.

The Calibration window. The reference is one segmented row, MEASURE decides which loudspeaker the signal goes to, and the band-pass at the foot is for comparing one speaker with another.

5.5 Test signals

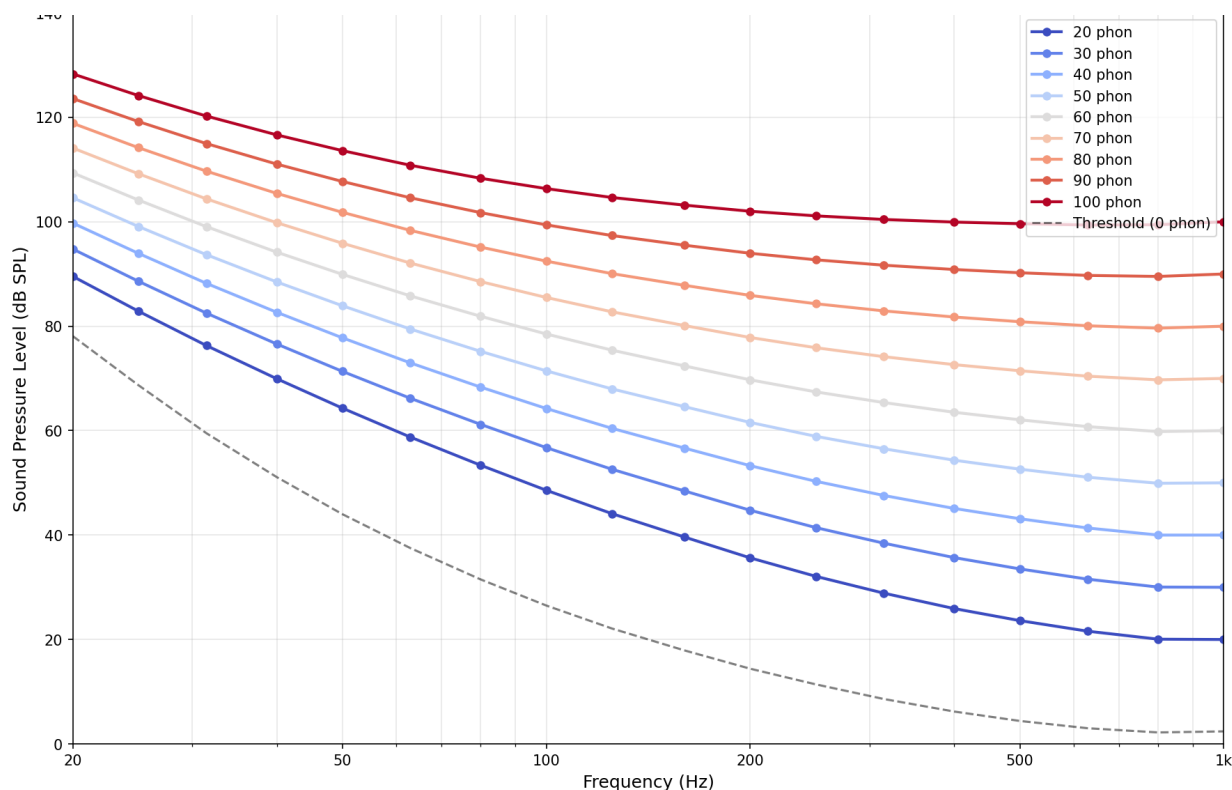
Below the calibration controls, three test signals at **-18 dBFS RMS**: **pink noise** (mono, the same on both channels), a **1 kHz sine** (mono) and **white noise** (stereo, uncorrelated left and right). **MEASURE** applies to all three, so any of them can be sent to one speaker or to both. Enable them with **Enable Test Signal**, after the same warning. While a test signal plays, the fader is held at 0 dB and the trims, pan and low cuts are out of the path, so the signal reaches the output exactly at its level. Use them to check a chain, a channel or a polarity.

6. Loudness compensation

6.1 The problem: equal-loudness contours

Our ears do not have a flat frequency response, and that response changes with level. At quiet listening levels we hear far less bass, and somewhat less treble, than at loud ones. The practical consequence: an engineer monitoring at 65 dB SPL adds bass to hear it; played back at 85 dB SPL, that bass is boomy. This is not a matter of ear training. You cannot train your ears out of their own physiology.

Fletcher and Munson measured the effect in 1933. The current form is the set of equal-loudness contours in ISO 226. Each contour joins the sound pressure levels that sound equally loud at every frequency; by definition, at 1 kHz the level in dB SPL equals the loudness level in phon.



ISO 226 equal-loudness contours. Each curve is a constant perceived loudness. The curves are close together in the midrange and fan out in the bass.

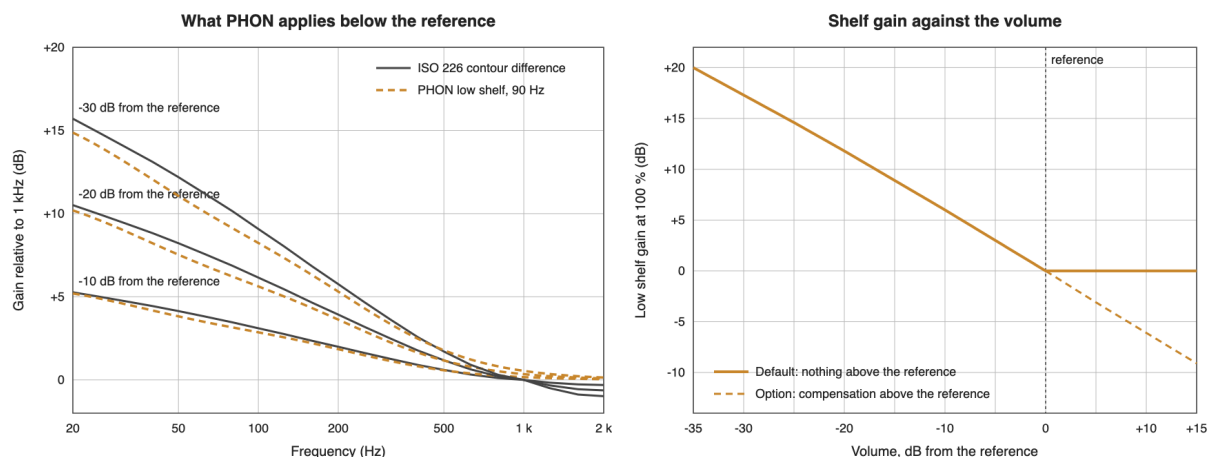
At 20 Hz the 20-phon contour sits about 70 dB above its own 1 kHz value, the 80-phon contour about 39 dB. Between quiet and loud listening the ear's sensitivity to deep bass moves by some 30 dB. That is the size of the effect a fixed "loudness" button pretends to correct with one shelf.

6.2 What PHON applies

PHON does not apply the contour. The contour is your ear's own curve, and the mix was balanced through it at the reference: it is already in the mix. What changes when you turn down is the **difference** between the contour at the listening level and the contour at the reference. That difference is what your ears lose, and that is what PHON puts back.

Computed from the ISO 226 formula, that difference depends, to within 0.35 dB for a reference between 75 and 90 phon, only on how far you turned down and not on the absolute level: 78 to 58 dB and 85 to 65 dB give the same curve. The agreement is closest near the reference and loosens as you turn down — 0.06 dB at -10, 0.16 dB at -20, 0.34 dB at -30. And over 20 Hz to 2 kHz that difference is one low shelf: corner at 90 Hz, Q 0.33, whose gain follows the level change at about 0.6 dB per dB. The fit is within 0.75 dB of the exact difference at -20 dB, 1.24 dB at -30, and 1.47 dB at -35, the fader's floor.

Above 2 kHz and up to 8 kHz the difference stays within ± 1 dB and is left alone. Above 8 kHz it does not: at -30 dB the standard asks for $+2.1$ dB at 10 kHz and $+4.8$ dB at 12.5 kHz. PHON deliberately applies nothing up there. The ISO data above 8 kHz is sparse and scattered, high-frequency hearing varies enormously from one listener to the next and with age, and no monitoring chain is flat to 12.5 kHz at the listening position. Correcting the top octave from an average contour would be guesswork on top of a room. It is a decision, not an oversight.



Left: the ISO 226 contour difference for 10, 20 and 30 dB below the reference (solid) and PHON's low shelf at the same settings (dashed). Right: the shelf gain against the fader position, at 100 % dosage.

The compensation is therefore: shelf gain = $f(\text{volume in dB from the reference})$, times the dosage in percent. Zero at the reference, a boost below it, and nothing above it unless you ask for it (section 6.5). It moves with the fader, smoothly, in real time. At 0 dB there is no EQ and no processing: exactly the sound you are used to.

Fader	Shelf gain at 100 %	Fader	Shelf gain at 100 %
0 dB	0.0 dB	-20 dB	+11.8 dB
-5 dB	+3.0 dB	-25 dB	+14.6 dB
-10 dB	+6.0 dB	-30 dB	+17.3 dB
-15 dB	+8.9 dB	-35 dB	+20.0 dB

The table gives the plateau of the shelf, reached in the deep bass. At 100 Hz the shelf is about half way up, at 200 Hz a third; 1 kHz and above are untouched.

6.3 Dosage, per source

ISO 226 describes an average listener. Individual hearing varies, and so does the material. The **LOUDNESS** fader scales the shelf from 0 to 100 %. There are two values, one for source A and one for source B, and the fader shows the one for the source you are listening to; switching the source recalls its own.

The reason is practical. Your mix was balanced at your reference, so A's dosage is only about your ears: start at 100 % and reduce it if the bass feels excessive. A reference track was mastered at a level nobody knows, so B needs its own dosage, found by ear against the mix. Both values are stored per output and in presets.

The tooltip of the **LOUDNESS** value shows what is applied right now, in dB of low shelf. It reads 0 dB at the reference whatever the dosage.

A right-click on the LOUDNESS fader locks it, and a second one unlocks it. A locked fader ignores the mouse and shows a small padlock in its top right corner. The dosage is a setting you make once for

your ears and your room, unlike the volume you move all day: locking it means an accidental drag can no longer shift the balance you are judging without you noticing. The padlock matters because a locked fader is drawn dimmed, and so is a fader whose compensation is switched off - the padlock is what tells the two apart.

6.4 On and off

The **ON** switch at the foot of the LOUDNESS column turns the compensation on or off, for every source and output. Off is a flat, unprocessed path. The switch is also on the **B** key, on any MIDI control learned as Loudness Bypass, and on the web remote as BYPASS. The change is crossfaded in 20 ms.

6.5 Above the reference

Above the reference the ISO 226 difference asks for a cut: at a louder level the ear hears more bass. By default PHON applies **nothing** above 0 dB. The promise is "nothing at the reference, compensation only when you turn down", and an engineer who pushes the volume to check something wants the mix left alone up there. If you prefer the symmetric behaviour, set **Above the reference to COMPENSATION** in Audio Settings: the shelf then cuts -3.1 dB at +5, -6.1 dB at +10 and -9.1 dB at +15.

6.6 Using it

- Leave the compensation on and forget it. It does nothing at the reference and disappears as soon as you come back up.
- Mix at a comfortable level. The film and broadcast references sit between 82 and 85 dB SPL, where hearing is most linear, but that is loud for a long session in a small room. Most engineers work between 65 and 79 dB; with the compensation, the balance you hear at 68 dB is the one you would hear at 83.
- Check at the reference now and then. Click the 0 button: the compensation is out of the path and you hear the mix as the standards describe it.
- Watch the limiter at low volume. At -30 dB the shelf is +17 dB in the deep bass; a bass-heavy track can reach the limiter, and the hairline over the meter turns amber. Reduce the dosage, or engage the safety low cut on small monitors (chapter 9).

7. Monitoring controls

7.1 Volume and level buttons

The fader runs from -35 to +15 dB from the reference. Drag it, or use the keyboard, a MIDI controller or the remote (chapter 11). The value above it reads in dB from the reference or in dB SPL (section 4.4), and turns amber above the reference.

The four **LEVEL** buttons jump to 0, -3, -6 and -9 dB. They are labelled the way the volume value is, following the level readout switch (section 4.4): as the fader position, dB from the reference, or as the calibrated level each one lands on in dB SPL. Click the lit button again to return to where the fader was. Moving the fader clears the button.

7.2 DIM and MUTE

DIM drops the fader to -24 dB, a level for talking over the mix, and remembers where the fader was; click DIM again to come back. **MUTE** fades the output out in 50 ms and leaves the fader where it is. MUTE has a danger outline in the window because it is the one button you should see at a glance. Both are on the keyboard (Num 0 and Num .) and learnable in MIDI.

7.3 Sources A and B, and level matching

The **SOURCE** row selects what you listen to. The switch is immediate and happens on the monitoring path: your session, your master bus and your export are untouched. Keys: Num 3 for A, Num = for B, R to toggle.

Comparing a mix with a reference is only meaningful at the same loudness, otherwise the louder one simply sounds better. **MATCH**, between the two knobs, does it in one press: PHON measures both sources for three seconds to ITU-R BS.1770 and moves the **INPUT** trim of the source you are **not** listening to. What you are hearing never jumps, and the two are already aligned when you switch.

- Both sources have to be playing. If the other one is silent the button reads **NO SIG** and nothing is changed; if it is not configured, **NO SRC**.
- The button then shows the trim it applied, for two seconds, so you can see what the match was worth.
- A **double-click on INPUT** undoes it, as with any trim.
- Pressing MATCH again converges instead of drifting: the measurement is taken before the trims, so it describes the material and not the current settings.

You can still match by hand. The **INPUT** control is a trim of the current source into the current output, ± 12 dB, stored per source and per output: play the reference on B and read its short-term loudness (**S**), switch to A and set INPUT until your mix reads the same. The S readout is measured before the volume and the compensation, so it compares the material itself.

INPUT locks the same way, by right-click, and shows the same padlock. Once a source is matched to its reference, locking the trim keeps that match safe from a stray drag.

7.4 Outputs and switching

The **OUTPUT** row selects the speakers. The switch is a 40 ms crossfade, click-free and perceptually instant. Keys: Num 1 for A, Num 2 for B, Tab to toggle A and B; output C is reached from the window and from the remote.

Each output recalls its own volume, input trims, pan, routing, low cut selection, loudness dosages and protection, so you can keep the headphones quieter than the speakers, or a small pair with its safety low cut engaged.

7.5 Routing

The **ROUTING** row applies to the current output. One button at a time; click the lit button again to return to stereo.

Button	Operation	What it is for
(none lit)	Stereo, unprocessed	Normal listening
SWAP	Left and right exchanged	Catching a placement you have stopped hearing
L	Left channel on both speakers	Checking one channel
R	Right channel on both speakers	Checking one channel
MID	$(L + R) / 2$ on both speakers	Mono compatibility: what a single speaker or a phone plays
SIDE	$(L - R) / 2$ on both speakers	The stereo difference: reverb, width, what disappears in mono

While MID or SIDE is lit, the meter columns read M and S instead of L and R, measured before the routing, so the two bars do not show the same thing twice. With a mono source the row is disabled. Keys: Num 4 stereo, Num 5 mono (the same operation as MID), Num 6 left, Num 7 right, Ctrl+M mid, Ctrl+S side.

7.6 Low cut

The **LOW CUT** row engages one of the three presets set in Audio Settings (section 4.3): 80, 120 and 200 Hz by default. Click again to turn it off. The change is crossfaded in 20 ms, so you can flip it on and off while the track plays. It is a listening tool, per output, to hear what a small speaker, a laptop or a phone will keep of your low end, and it is not the speaker protection; that is the safety low cut of chapter 9.

7.7 PAN

PAN balances the current output between left and right, ± 100 . It is a balance control, not a pan law: it attenuates the channel you move away from and leaves the other one at its level. The speaker you turn towards therefore plays exactly as loud as it did, and only what you are turning away from goes down. Hard left or right silences the opposite channel; what remains is still at its own level, while the room, with one speaker instead of two, is a few decibels quieter. Double-click to centre.

Use it to compensate a listening position that is not on the centre line. It has no part in calibration: the pan is out of the path while a test signal plays, and it is **MEASURE** (section 5.3) that sends the signal to one speaker.

8. Metering

8.1 The meter

The bargraph shows the current output after the limiter, left and right: a peak bar with a one-second hold, and the RMS as the brighter part. The left scale reads dB SPL once calibrated and dBFS before. The right scale is switched by **REL / ABS**: ABS is absolute dBFS, 0 at full scale; REL is the same scale with 0 at your calibration point, headed dB ref. The amber mark is the calibration point: the pink noise level of your reference in dBFS, and your target level in dB SPL.

8.2 Clip and limiter

The hairline over the bars is the protection indicator. It turns amber while the limiter is holding the output, deeper the more it holds, and red when the output clipped anyway. Hover over it for the gain reduction in dB. The red state holds for a moment so you do not miss it.

8.3 S, I and TP

Three readouts under the meter, to ITU-R BS.1770-4, of the source you are listening to: **S**, the short-term loudness over the last 3 seconds; **I**, the integrated, gated loudness since the last reset; **TP**, the true peak, 4× oversampled, which turns orange above -1 dBTP. Click a readout to reset I and TP.

They are measured after the source selection and the routing but **before** the volume, the compensation and the calibration. A number that moved with the listening level would be useless; these describe the material.

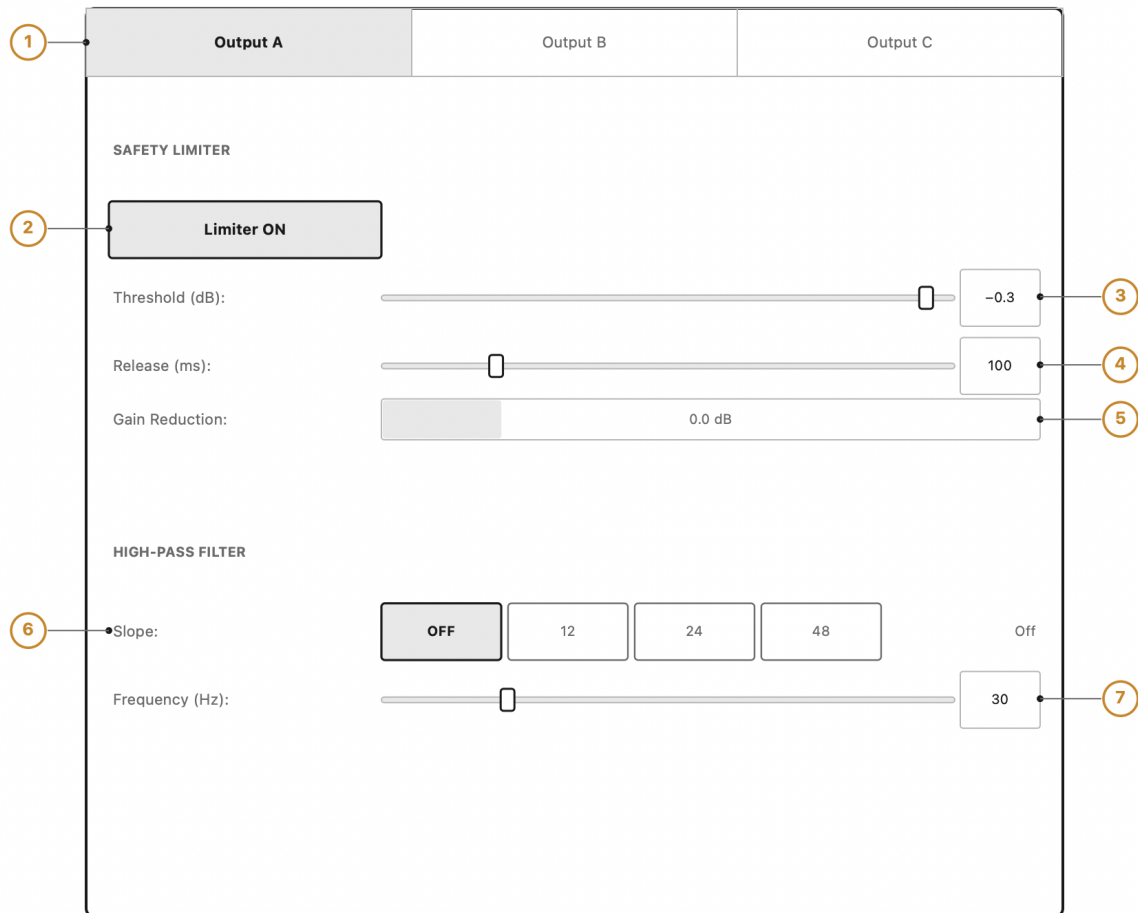
8.4 Correlation

The correlation meter runs from -1 to +1. +1 is a mono signal, 0 an uncorrelated stereo signal, negative values mean left and right are partly out of phase and will cancel in mono. Hover over it for the value.

The plate in chapter 3 shows all of these: the correlation meter (1), the meter and its scales (9), the limiter hairline (10), the REL / ABS switch (11) and the three loudness readouts (12).

9. Protection

Settings > Safety (Limiter, HPF)... opens the protection window, one tab per output. Both stages sit after the volume, so they protect the speakers whatever the fader does.



The Safety window, one tab per output. The limiter is on by default; the high-pass is off.

9.1 Limiter

A brick-wall limiter with 1 ms of lookahead: the gain needed by a sample is known before it leaves the delay line, so nothing above the threshold reaches the output, and the attack is a ramp rather than a step. It is **on by default** at -0.3 dBFS. A DAW glitch, a hot new session or a full-scale burst from a plugin cannot reach your tweeters.

Parameter	Range	Default
Limiter	On / Off	On
Threshold	-12 to 0 dBFS	-0.3 dBFS
Release	10 to 500 ms	100 ms

The window shows the current gain reduction. The lookahead adds 1 ms to the path, included in the latency shown in the footer.

9.2 Safety low cut

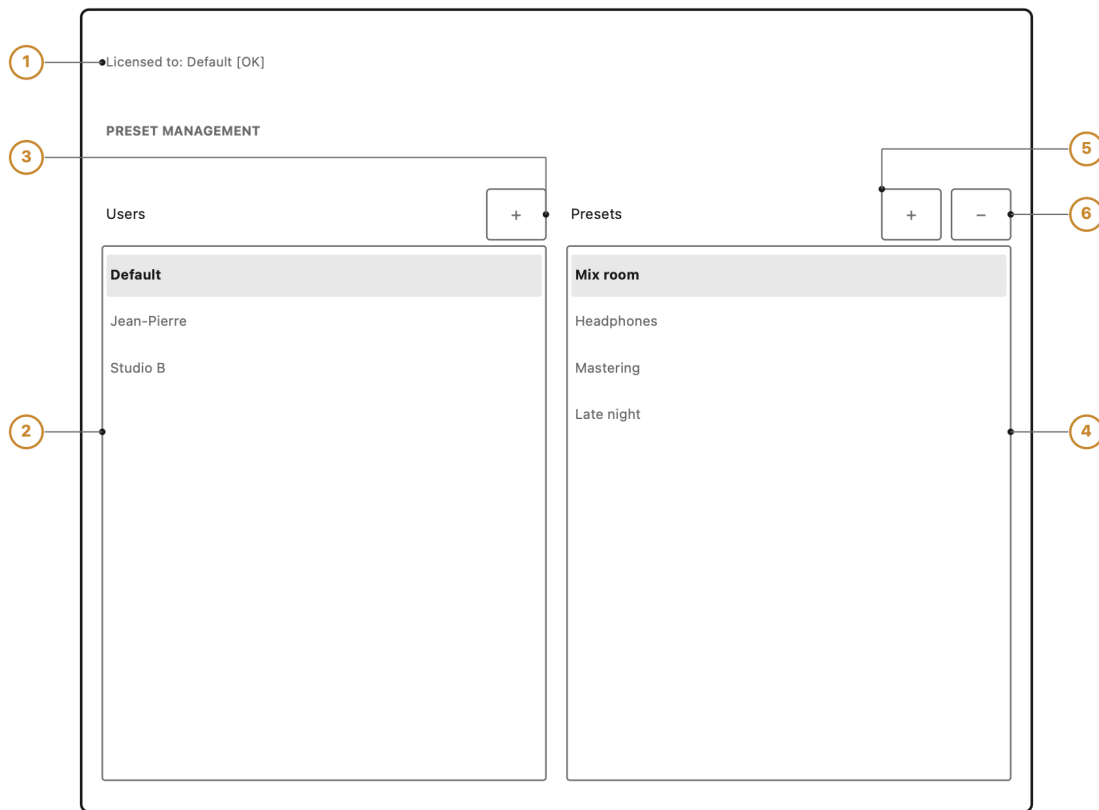
A Linkwitz-Riley high-pass to keep sub-bass energy away from small woofers. It matters most with the compensation at low volume: at -35 dB the shelf is +20 dB in the deep bass, and a small ported box has no use for 25 Hz at that gain. **Off by default**; engage it on the outputs that need it.

Parameter	Range	Default
Slope	Off, 12, 24 or 48 dB/oct (Linkwitz-Riley 2, 4, 8)	Off
Frequency	10 to 100 Hz	30 Hz
Q	0.5 to 1.41	0.707

A reasonable start for a 5-inch two-way: 24 dB/oct at 30 to 40 Hz. Leave it off on full-range monitors and on headphones.

10. Presets

File > Presets... (Cmd+P) opens the preset window. A preset stores a complete setup: the source selection and names, the active output, and for every output its volume, input trims, pan, routing, low cut selection, both loudness dosages, limiter and safety low cut, plus the calibration.



The preset window. Users on the left, that user's presets on the right; the small buttons add a user, save a preset and delete one.

- **Users.** The left list holds users. Each user has their own presets and their own audio setup (sources and outputs), so two engineers sharing a room can each keep theirs. **Add User** creates one, **Delete User** removes one; the licensee user cannot be deleted.
- **Save Preset** asks for a name and saves the current state for the selected user. Saving under an existing name asks before overwriting.
- **Load:** double-click a preset. **Delete Preset** removes the selected one, after confirmation.

Presets are plain XML files in ~/Library/Application Support/PHON/Presets/, one folder per user. To carry a setup to another Mac, copy the files.

11. Remote control

Software does not mean mouse only. Every monitoring action is on the keyboard, any MIDI control can be learned, and a phone or tablet on your network can drive PHON from the couch.

11.1 Keyboard shortcuts

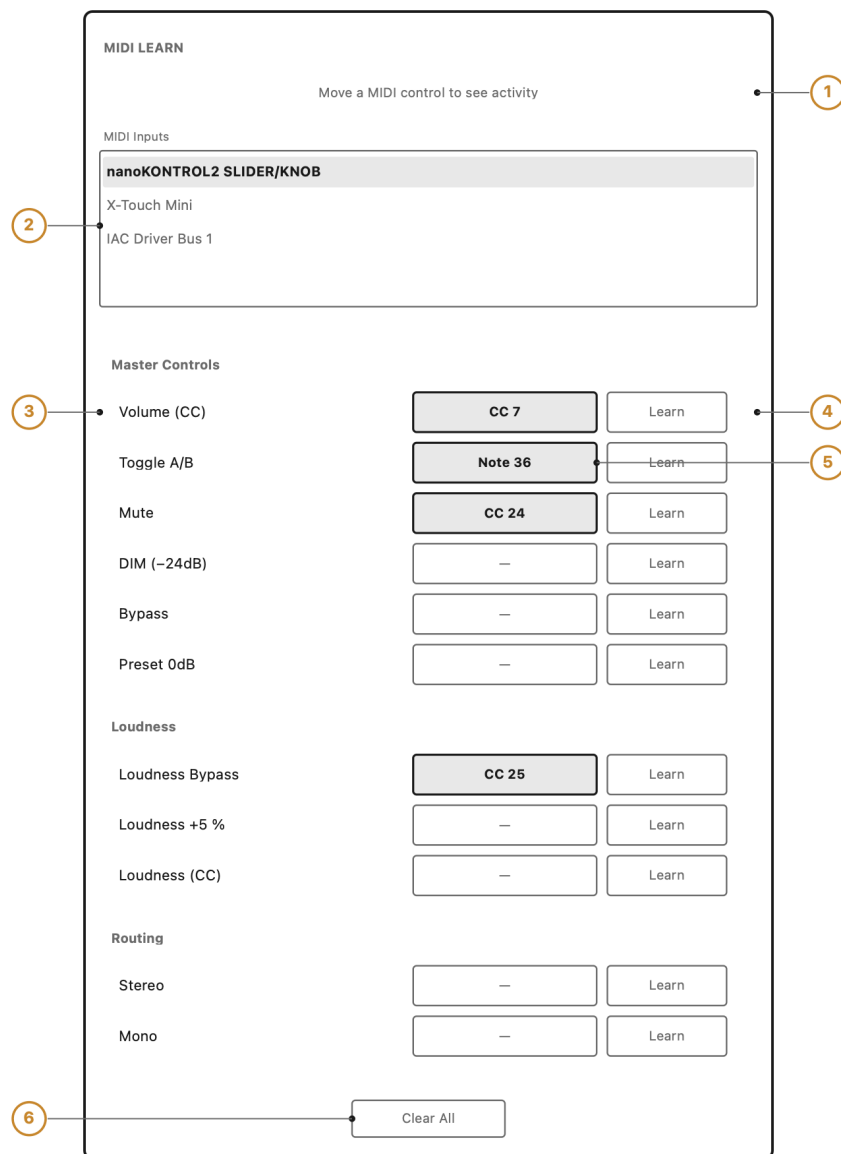
The shortcuts work while the PHON window has the focus. They sit on the numeric keypad to stay clear of DAW shortcuts.

Key	Action	Key	Action
Num 1 / Num 2	Output A / Output B	Num 4	Routing: stereo
Tab	Toggle outputs A and B	Num 5	Routing: mono
Num 3 / Num =	Source A / Source B	Num 6	Routing: left
R	Toggle sources A and B	Num /	Routing: right
Num 0	Mute	Ctrl+M	Routing: mid
Num .	DIM	Ctrl+S	Routing: side
Num + / Num -	Volume +3 dB / -3 dB	B	Loudness compensation on/off
Num 7 / 8 / 9 / *	Level 0 / -3 / -6 / -9 dB	Cmd+,	Audio Settings
Cmd+K	Calibration	Cmd+P	Presets
Cmd+M	MIDI Learn		

The shortcuts are fixed in this version. On a keyboard without a numeric keypad, use MIDI Learn or the web remote for the monitoring actions.

11.2 MIDI Learn

Edit > MIDI Learn... (Cmd+M). Any MIDI controller works: a small surface such as a Korg nanoKONTROL or a Behringer X-Touch Mini gives you a physical volume knob and a row of buttons; a Stream Deck sends MIDI through a plugin.



MIDI Learn. Tick the devices to listen to, then click Learn beside a function and move the control. An assigned control shows what it is bound to.

1. Under **MIDI Inputs**, tick the devices PHON should listen to.
2. Click **Learn** next to a function and move the control on the surface. The activity line shows what PHON receives. The first CC or note received is assigned, on any channel.
3. Repeat for each function. Click the assigned control to change it, or **Clear All** to start over. Mappings are saved automatically.

Buttons and notes trigger on the press (a value above 63). Two functions are continuous and follow the CC value: **Volume (CC)** sweeps the fader over its whole range, **Loudness (CC)** sets the dosage from 0 to 100 %.

Group	Functions
Master controls	Toggle A/B, Mute, DIM, Bypass, Volume +1 dB, Volume -1 dB, Volume (CC), Preset 0 dB, -3 dB, -6 dB, -9 dB, Toggle DAW/REF
Loudness	Loudness Bypass, Loudness +5 %, Loudness -5 %, Loudness (CC)
Routing	Stereo, Mono, Left, Right, Mid, Side

11.3 Web Remote

Settings > Web Remote... opens the pairing window. The remote is **off by default**: it listens on your local network in plain HTTP, so it runs only once you switch it on, and stays as you left it across launches.

1. Tick **Enable** in the Web Remote window. The status reads Server: Running.
2. Scan the QR code with the phone or tablet. It carries the address of your Mac on the network and the pairing token, so the browser opens straight on the remote. **Copy token** and the address are there for typing it by hand.
3. The badge at the top of the page reads **LIVE** while the remote is connected, OFFLINE when it is not.



The Web Remote window. Scanning the code opens the remote already paired, since the token travels in the address.

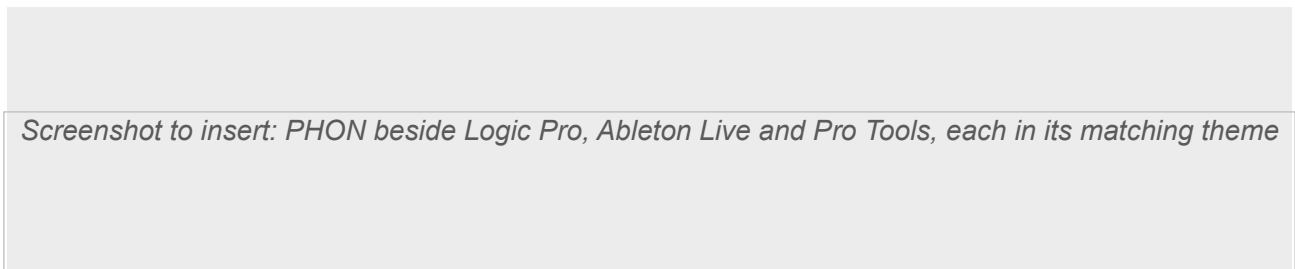
The page mirrors the window, with the controls sized for a thumb: source A/B, output, the volume with its meters and the four level buttons, the loudness dosage, BYPASS, MUTE and DIM, the low cut presets, the routing row, and a theme selector. Up to ten devices can be connected at once. The phone and the Mac must be on the same network; click **Refresh IP** after changing networks and scan again. The token persists, so a paired phone stays paired. Do not expose the port on the internet.

12. Window and appearance

The **View** menu holds the window options.

- **Theme.** Dark and Light, six themes drawn from each DAW's own palette, Ableton Live, FL Studio, Cubase, Logic Pro, Pro Tools and Reaper, and the Original NNA theme. Same greys, same accent, same weight of type as the session beside it. Every window follows the theme.
- **Always on Top** keeps the column above the session, so the fader never hides behind the arrangement.
- **Auto Hide** slides the window off the nearest screen edge when the pointer leaves it, and brings it back when the pointer touches that edge. It turns Always on Top on while it is active.
- **Show Tooltips** turns the tooltips on or off.

The window is a narrow column; drag the grip at the bottom right to resize it. Its size and position are remembered.



Screenshot to insert: PHON beside Logic Pro, Ableton Live and Pro Tools, each in its matching theme

PHON beside Logic Pro, Ableton Live and Pro Tools, each in its matching theme

13. Updates

PHON checks for a new version at launch. When one is available a dialog shows the current and the latest version with the release notes, and offers the download. Updates within version 1 are free. Install the new package over the old one; settings, presets and licence are kept.

14. Troubleshooting

Symptom first, then what to check, in the order that most often finds the cause.

Symptom	What to check
No sound	An output is configured and lit. The source is playing: an application appears in the source list only while it produces audio. MUTE is off. The permission for the source type is granted (section 2.2). The licence label does not read EXPIRED.
B: none	Source B cannot be read: the application stopped, was quit, or its permission is missing. PHON plays A meanwhile. Start the application again, or reopen Audio Settings and select it.
The compensation does nothing	The fader is at or above 0 dB: by design, nothing is applied there. Below it, check that the ON switch is lit and the dosage is not 0 %.
Pumping or a dull low end at low volume	The limiter is holding: the hairline is amber. A bass-heavy track plus +17 dB of shelf at -30 dB reaches it. Lower the dosage, or engage the safety low cut on small monitors.
Clicks or dropouts	Raise the buffer size in the Buffer menu. A source application changing its sample rate can also cause a short dropout while PHON follows.
The meter reads dBFS, not dB SPL	No calibration has been saved. Run the procedure of section 5.3 and click Save Calibration.
Keyboard shortcuts do nothing	The PHON window must have the focus, and most shortcuts need a numeric keypad. Use MIDI Learn or the web remote otherwise.
The web remote cannot connect	The remote is enabled. The phone and the Mac are on the same network. The address changed: click Refresh IP and scan the QR code again. A firewall on the Mac blocks port 8080.
The licence label reads Offline	The server could not be reached and no valid token is held. Connect to the internet once; the next check refreshes the 30-day token.
Latency	PHON runs at the buffer size of the Buffer menu, plus 1 ms for the limiter. Per-application capture adds a small buffer on the source. Your DAW's own latency is unaffected.

15. Specifications

Values for PHON 1.0.3.

Item	Value
Application	Standalone macOS application, universal (Apple Silicon and Intel), macOS 13 or later
Sources	Two, A and B: an application captured through Core Audio taps (macOS 14.2 or later), a virtual device or a hardware input, by channel pair; stereo, left or right
Outputs	Three, A, B and C, one active at a time, each on any Core Audio device and channel pair; 40 ms crossfade
Processing	64-bit floating point throughout
Sample rates	44.1, 48, 88.2 and 96 kHz, following the output device; automatic conversion of a captured source at another rate
Buffer sizes	64 to 2048 samples
Volume	-35 to +15 dB from the reference, 0.1 dB steps; readout in dB from the reference or dB SPL
Input trim	±12 dB per source and per output; MATCH sets the trim of the source not being heard from a three-second ITU-R BS.1770 measurement of both
Loudness compensation	One low shelf, 90 Hz, Q 0.33, gain from the ISO 226 contour difference (0 to +20 dB from 0 to -35 dB), dosage 0 to 100 % per source, optional cut above the reference
Calibration	ITU-R BS.1116-3 (82 dB(A)), SMPTE RP 200 (85 dB(C)), K-20 (83 dB(C)), K-14 (83 dB(C)), or custom (pink noise -30 to 0 dBFS RMS, target 75 to 85 dB SPL), each measured one loudspeaker at a time; pink noise, 1 kHz sine and white noise test signals, to the left speaker, the right or both; optional band-pass 500 Hz to 2 kHz
Routing	Stereo, swap, mono, left, right, mid, side; correlation meter -1 to +1
Low cut	Three presets, 20 to 1000 Hz, 12 or 24 dB/oct Butterworth
Limiter	Brick-wall, 1 ms lookahead, threshold -12 to 0 dBFS, release 10 to 500 ms, per output
Safety low cut	Linkwitz-Riley 12, 24 or 48 dB/oct, 10 to 100 Hz, Q 0.5 to 1.41, per output
Metering	Peak with 1 s hold and RMS per channel; ITU-R BS.1770-4 short-term and integrated loudness and true peak (4× oversampled), measured before the volume
Control	Keyboard shortcuts; MIDI Learn on any CC or note; web remote over HTTP on port 8080, token-paired, up to 10 devices
Themes	Dark, Light, Ableton Live, FL Studio, Cubase, Logic Pro, Pro Tools, Reaper, Original (NNA)
Licence	One-time purchase, two machines, 14-day trial; 30-day offline token

16. Files and folders

PHON writes to two folders in your home Library.

Location	Contents
~/Library/Application Support/PHON/	Settings (PHON.settings), the audio setup (IOConfig.xml, one per user), MIDI mappings, presets (Presets/<user>/*.xml)
~/Library/Logs/PHON/	Log files, useful when writing to support

Deleting the Application Support folder returns PHON to its defaults; the licence is kept separately and survives it.

17. Support

Questions, bug reports and feature requests: **support@neutralandnaturalaudio.com**. Please include your macOS version, the PHON version shown in About PHON, and, for an audio problem, the log files of the day.

Product page and updates: neutralandnaturalaudio.com/phon.html

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