Lepai LP40PA Mini Stereo Plate Amplifier

Latest Design or Retro Rewind

Learn more about the Lepai LP40PA mini plate amplifier and control panel. David Logvin puts this versatile package to the test to see if this device does, in fact, make it easy to turn any speaker pair into an active speaker system with Bluetooth capability.

By
David Logvin
(United States)

If you are like many audio enthusiasts, you probably have a spare pair (or more!) of monitor loudspeakers. And depending on how long ago you retired those speakers, even if those speakers still shine sonically, they may be light on features that are readily available and expected in 2019's portable and compact speaker choices.

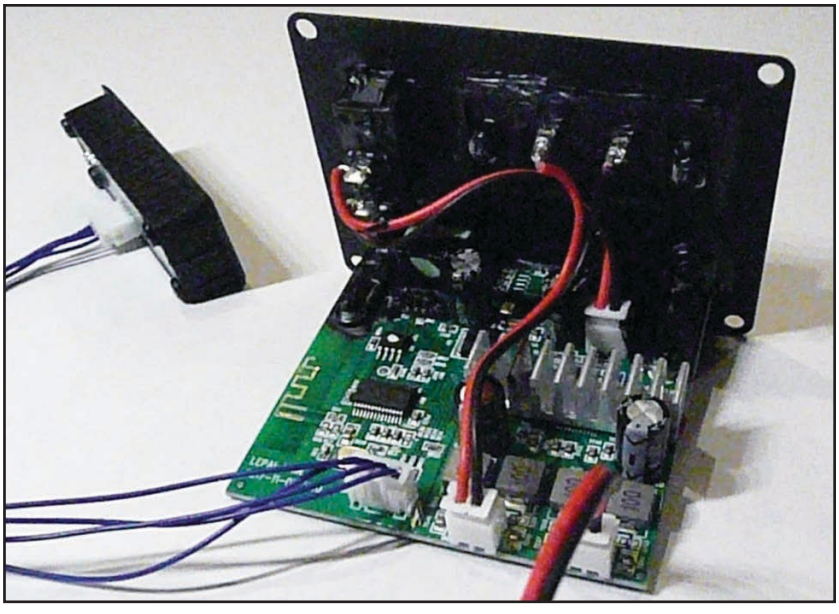

Photo 1: The Lepai LP40PA mini plate amplifier and control panel is a versatile package that consists of two main parts—the plate amplifier and the control panel.

More specifically, what if you wanted to breathe new life into your old college dorm speakers by having a convenient method to add Bluetooth (BT) streaming and built-in Class D amplification? When the opportunity to review the Lepai LP40PA was presented, I happily anticipated being reacquainted with an old speaker friend, melded with modern sensibilities.

The Lepai LP40PA is an ultra-compact amplifier combining Class D technology with a fully integrated Bluetooth 4.2 solution. This is a turnkey digital amplifier, with a compact BT module and an antenna on board (see **Photo 1**).

The Lepai LP40PA provides a simple and elegant solution that is as easy to deploy as any common plate amplifier. There is no coding required, nor the need for external daughterboards, BT modules, or transceivers. Simply connect the mains power, pair your mobile device, and begin streaming. Given the small footprint (it mounts into a svelte 2.6" × 0.79" cutout), providing onboard Bluetooth is a definite plus and a smart design choice for today's enthusiast market.

I/O Configuration

The complete package includes: a plate amplifier (with 1/16" polyethylene gasket), a control panel with a wire harness, an 18 V power supply, and an owner's manual.

The back panel features a rocker mains power switch, an 18 VDC power input, spring clips to wire the slave left speaker, and a 3.5 mm analog input, for those folks who won't always use this amplifier in BT mode. Flipping the unit over, you will find a short cable for the right speaker connections. The wire gauge is 20 AWG and the length is short at just 4", so you will most likely have to heat shrink and splice some extension cables onto all but the most compact of mini-monitors. There is also a header to connect the included control panel.

UI and UX

One of the advantages of this fully-integrated solution is the embedded firmware and simple external control panel that can be conveniently mounted on the project enclosure. The control panel is a compact unit that should be installed as a press fit to the project enclosure. It has four buttons:

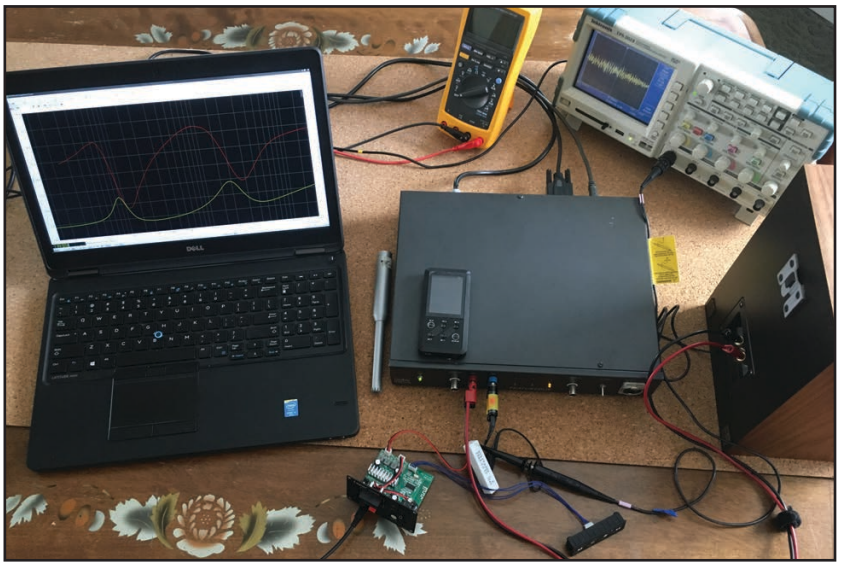

Photo 2: This is my DUT bench setup.

- (M) for mode, which lets you choose between BT mode or Auxiliary input—the LED on the control panel will sensibly light blue for BT and red for analog
- (+) and (-) for volume steps for BT/analog gain
- (Play/pause) for BT track control

Furthermore, thanks to support for Bluetooth Audio/Video Remote Control Profile (AVRCP), you can also use the volume buttons as Skip Forward or Skip Back.

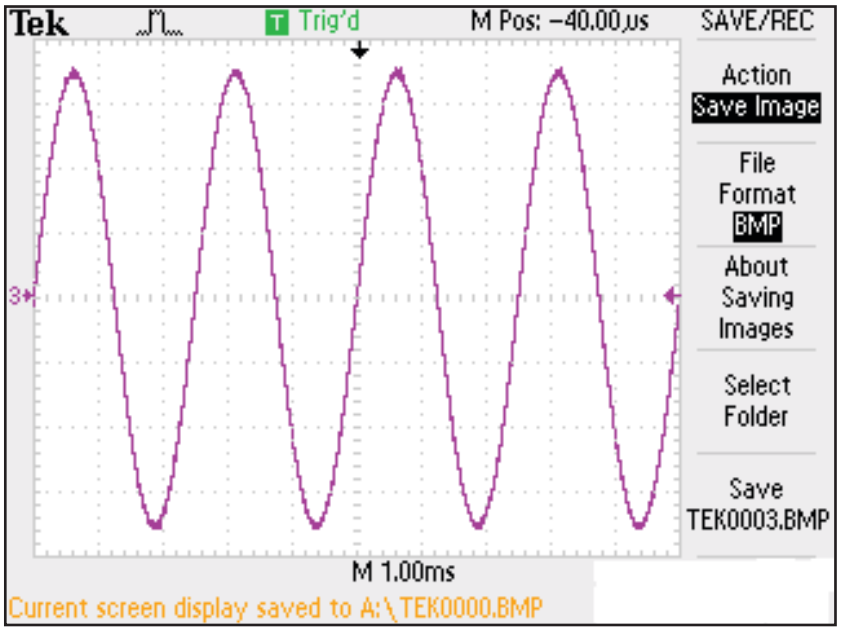

Figure 1: I had no trouble hitting the advertised 20 W x 2 RMS output, with a 400 Hz sine wave driving an 8 Ω, 25 W dummy load.

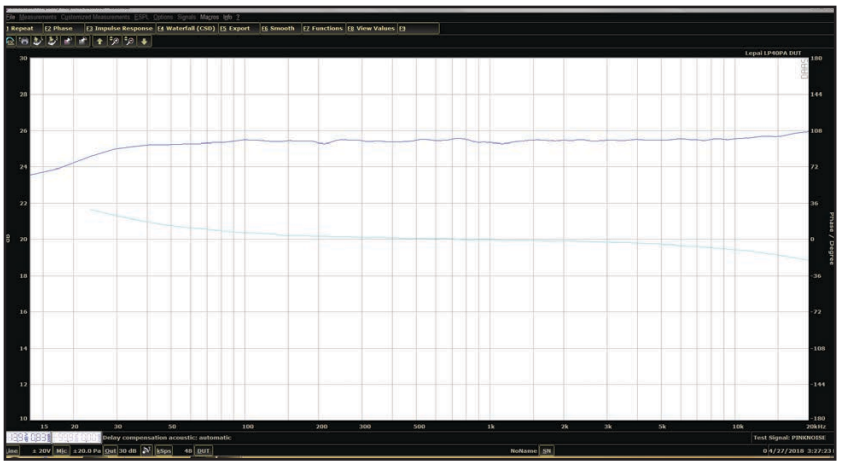

Figure 2: This is the frequency response measurement of the amplifier transfer function.

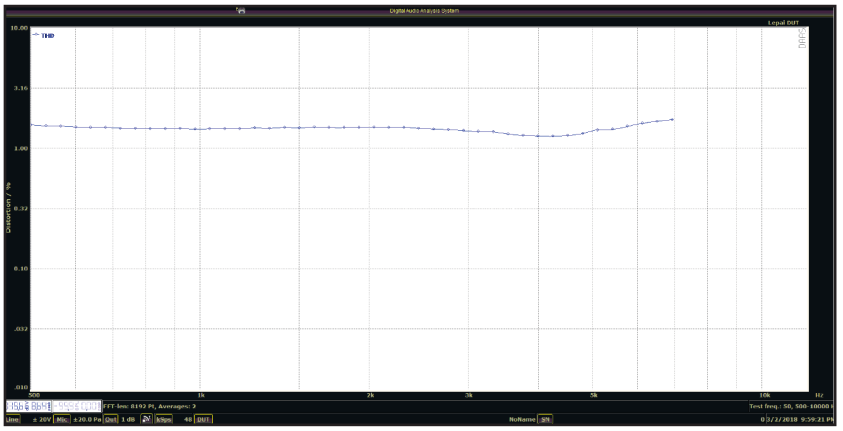

Figure 3: Here, the LP40PA is tested with the THD+N at 19.8 W RMS.

When you turn on the mains power, the system always defaults to BT mode and an audible cue is clearly played on both audio channels. If a BT device that the Lepai has previously paired with is in range, it will make a BT call to that device and auto connect. There is no "pairing mode" state that the user can trigger or enter. Instead, the Lepai is either "connected" or "ready to pair." If you want to pair to a new mobile device, then you need to turn off the BT antenna on your original mobile device and then go through normal pairing/connecting. There is no PIN code or security options available, but this is typical of many consumer-focused BT devices.

The turn-on cue is not adjustable in amplitude. Some users might not like turn-on audio cues, as it is a little jarring as an indicator. It would also be nice if the control panel firmware could accept a user preference for the analog input to be the default. While most users are going to choose this amplifier for the BT functionality, it is a slight detraction to have to press the mode button to select the analog input upon every power cycle.

The AVRCP functions work well on the control panel. When in BT mode, short presses of the "+" and "-" buttons provide volume up or volume down, while long presses provide track skip or previous track for those same buttons. The Play/Pause button provides BT Play and BT Stop commands.

If you pause the music via your mobile device, you will actually have to press the Lepai control "Play/Pause" button twice in order to restart the music. If you do everything via the Lepai, then there is no need to use double presses—single presses will work perfectly.

Audio Measurements

I used the following gear to bench test the Lepai LP40PA: DAAS4 USB (Digital Audio Analysis Software – Windows 7 version), the Textronix DSO 2024, and the Fluke Model 77 (see **Photo 2**).

Specifications wise, this a Class D amplifier and is built around the Texas Instruments (TI) TPA 3116 D2. This flexible design can be run with power supplies from 4.5 V to 26 V. Lepai has provided an 18 VDC, 2 A external power supply. One potential upgrade (recommended in the datasheet from TI) would be to use a higher current capability regulated power supply.

Even so, with the included 2 A power supply, I had no trouble hitting the advertised 20 W x 2 RMS output, as shown in **Figure 1**, with a 400 Hz sine wave driving an 8 Ω, 25 W dummy load. Each division is 5 V, providing 35.6 V_{PP}. Driving both channels, there was no issue delivering 19.8 W RMS x 2, without amplifier clipping.

Advertised frequency response is the expected

20 Hz to 20 kHz. **Figure 2** shows the measurement of the amplifier transfer function.

Maximum gain is 25.5 dB and the frequency response is ruler flat from 40 Hz to 18 kHz. There is a slight -1 dB droop at 20 Hz and 0.25 dB rise starting at 18 kHz. The high-frequency rise is a non-issue and is easily corrected passively or actively. And likewise, the low-frequency droop is also not significant, as this amplifier is unlikely to be paired with transducers capable of reproducing 20 Hz. Even then, the amplifier current limitation (at least with the included 2 A supply) would quickly become the critical constraint.

Distortion specifications for this unit are listed as <0.7% THD+N. With maximum gain (~26 dB), 18 V standard supply, and ambient temperature of 20°C, THD+N is averaging about 1.8% (see **Figure 3**). Setting the gain to output of 8 W RMS, and the THD+N falls to under 0.6 % at 500 Hz and is in very close agreement with the manufacturer's specification (see **Figure 4**).

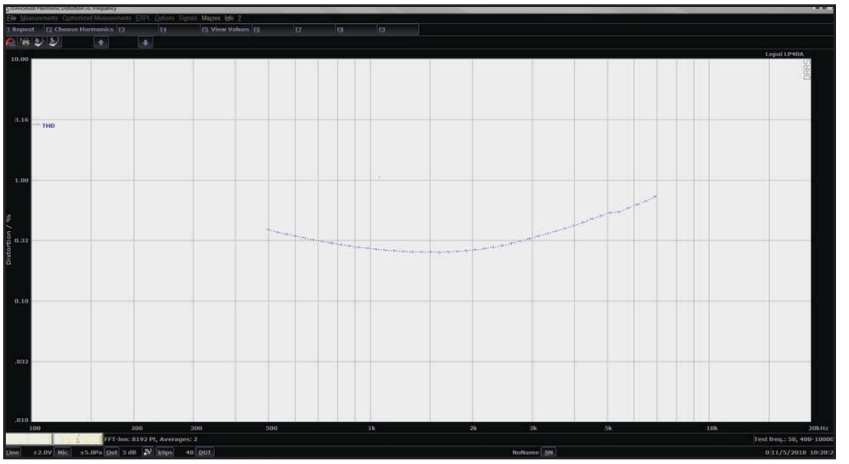

Figure 4: Setting the gain to output of 8 W RMS, and the THD+N falls to under 0.6 % at 500 Hz and is in close agreement with the manufacturer's specification.

Wireless

One of the primary reasons to choose the Lepai is for the built-in Bluetooth functionality. This unit (unlike some other Lepai models) does NOT support aptX codecs, so the maximum achievable bit rate is 328 kbps, 16 bits at 44.1 kHz, per Bluetooth standards. For reference, aptX supports 384 kbps at 48 kHz, and can support bit-depths of either 16 bit, 24 bit, or 32 bit. Lack of aptX support at this price point shouldn't be a deal-breaker, it just

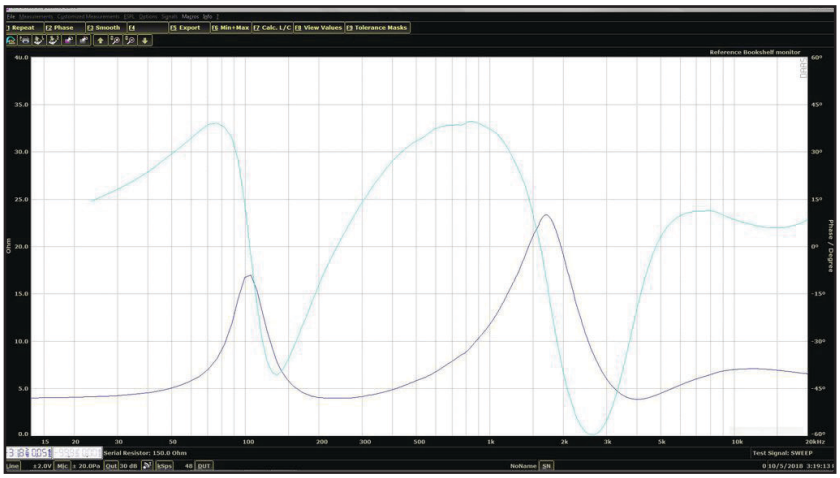

Figure 5: Driving a pair of these monitors is a simple affair for the LP40A, thanks to the loudspeakers' modest 8 Ω nominal curve and a minimum impedance of 3.9 Ω in the crossover overlap region.

would have been a "nice-to-have."

This BT module supports BT 4.2 with a maximum range of 30 m and the antenna is a simple PC board trace, not an external device that would require additional mounting. Practically speaking, 30 m BT range is only achievable in a free field, as found in an open warehouse. This unit had no issues at 10 m going through multiple walls without dropouts. In fact, I set up the unit on the ground floor of my home, started streaming and then went to an upstairs bedroom without any issues. Of course, the gods of RF are fickle, and your mileage may vary.

Given the amplifier's footprint, the available power budget, and the intended use for small monitors or mini-monitors, the wireless performance seems perfectly reasonable for the intended application.

Audio Quality

To investigate the Lepai LP40PA's audio quality, I used a suitable pair of compact bookshelf speakers.

About the Author

David Logvin is an acoustics engineer with more than 20 years of experience. He has designed loudspeakers and other products for Snell Acoustics, Outlaw Audio, ClearView Audio, Cambridge Sound Management and others. During his 14 years at Snell Acoustics, he developed and designed dozens of high-end loudspeakers and amplifiers, as well as helped to create loudspeaker standards in close collaboration with THX. David then focused his efforts into R&D in creating innovative, award-winning piezo-driven membrane loudspeakers with ClearView Audio (formerly known as Emo Labs). At Cambridge Sound Management, he put his skills in room acoustics to use in the field of sound masking for corporate applications. Most recently, he rejoined his fellow Snell Acoustics alumni, Dr. Joseph D'Appolito, to design several new loudspeakers for Outlaw Audio. In addition to his lifelong love of music and acoustics, David is an active participant in the Boston tabletop game design community. He is a member of the Audio Engineering Society (AES) and the Boston AES Section and lives in Lowell, MA with his wife and son.

My system uses all Peerless drivers (designed and manufactured in Denmark) and is intended for a half-space installation to provide some additional low-frequency boost. Driving a pair of these monitors is a simple affair for this LP40PA, thanks to its modest 8 Ω nominal curve (see **Figure 5**) and a minimum impedance of 3.9 Ω in the crossover overlap region. System sensitivity for my bookshelf speakers is 90 dB SPL at 1 m with 2.83 Vrms, a respectable and appropriate match for this amplifier. (Given the power and current limitations of this device, I wouldn't recommend using the LP40PA with an audiophile monitor, which has a typical sensitivity in the 84 to 86 dB SPL range or strong current demands.)

Since we are deploying a high-value and low-cost Class D amplifier, you should try and find an appropriate mate in the passive speaker world. In real world applications, this means that you will most likely be pairing the Lepai LP40PA with over-performing loudspeakers that would be categorized as: Mid-Fi, high value Hi-Fi, college dorm, thrift store finds, or your latest DIY build for a desktop audio system.

For wireless listening, I chose to only use BT with downloaded songs on my phone, to avoid any issues with downgrades from the typical streaming services. On my iOS device, that translates to listening solely to AAC files at 256 kbps.

I started with straight-ahead blues-rock—"Made Up Mind" by the Tedeschi Trucks Band. On this track, the Lepai did quite well and had no trouble with driving and steady rhythms or in letting Susan Tedeschi's masterful voice command the stage. This produced a tight soundfield that held together, even at higher drive levels.

My next BT test cut was Jenner Fox's "Dams are for Beavers." The Lepai LP40PA perfectly captured the open and airy soundstage that this track provides. Micro-details could be analyzed and Jenner's soulful vocals were clear and strong while percussive effects (like striking the body of his guitar) rang out perfectly without any smearing. This amplifier definitely over-delivered here and provided solid musicality with a warm experience.

I decided to test the analog input as well as explore the available dynamic range, given the power supply limitations. I used my classic FiiO X3 as my hi-resolution source, using both FLAC and 64-bit DSD files for program material. On Amber Rubarth's rendition of "Kiss to Build a Dream On," the system really soared, capturing the rolling waves of her vocals along with the perfect counterpoint from violinist Tim Snider. This is a deep, rich recording and it handled the dynamic range nicely;

breaths and empty space were quiet and beautiful, and there were no issues with self-noise or digital noise that might degrade this type of recording.

Next, I used a gorgeously remastered 1959 recording of Arthur Fiedler and the Boston Pops performing George Gershwin's "Rhapsody in Blue" to evaluate how the Lepai LP40PA handles music with a high crest factor. I was pleasantly surprised that the peak power capability of the power supply could handle the high transients these programs could demand. I did notice that when the power supply was under heavy load due to very dense and complex material, there was a coarseness and rough characteristic that taxed the system more than transients alone.

Final Thoughts

One of the favorite features of this design is its compact footprint. Practically, this means that if you choose to mount it as a "retro-fit upgrade to some retro-speakers," the panel cutout that you need to mill is petite. This is good news and means that you can mount this amplifier in almost any compact bookshelf speaker.

Photo 3 shows the candidate speaker, a classic Boston Acoustics (circa mid 1990s) HD5 bookshelf speaker, in both its before (with round plastic input cup for speaker wires) and after (with Lepai LP40A installed) states.

As speaker kludges go, this one is easy. You don't even need to drill a pilot hole for a starter hole, simply trace out the new aperture for the panel, insert the jigsaw into the existing panel cutout and you now have a clean and secure install for this 2018 refresh of a 1995 classic.

Good engineering is always about compromises. In a perfect world, I would have preferred higher quality input connectors, lower gauge (and longer) speaker wires, a larger power supply, lower THD numbers, and the option to high pass filter the mains channels and use a wireless subwoofer. But given this amplifier's low cost, you should have plenty of funds left over to modify and start making some improvements to further improve what is already a solid design.

The Lepai design team did many things well with this product. It is built around a solid TI chip. The BT module is well-integrated and performs logically and reliably right out of the box. There are nice extras, like the simple control panel that can be conveniently mounted separately from the back panel and including a die-cut gasket to maintain the enclosure's air seal. The Lepai LP40PA is a smart and thoughtful amplifier solution that shows off high value and high quality design.

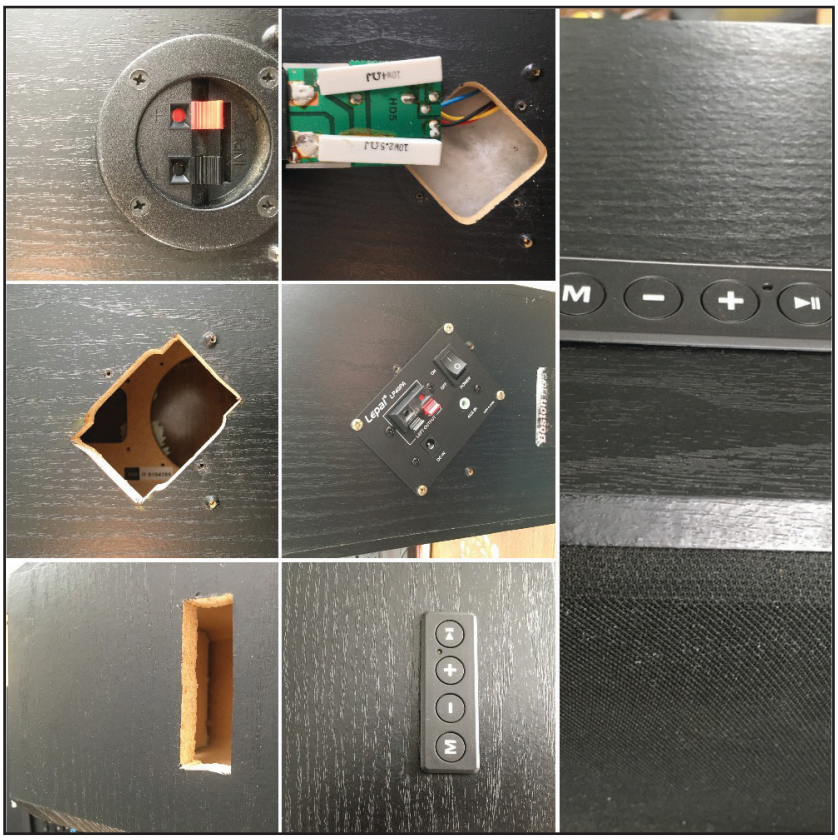

Photo 3: This series of photos demonstrate how easily an existing passive loudspeaker can be modified to use the Lepai LP40PA.