



**PRACTICAL DEVICES  
CORPORATION**

# **XM5**

## **Headphone Amplifier**



User's Manual

**Practical  
DEVICES**



# PRACTICAL DEVICES CORPORATION

Thank you, and congratulations on your purchase of the XM5 Portable Headphone Amplifier!

We've worked very hard to provide you with what may be one of the most advanced, feature packed, and best sounding headphone amplifiers on the market today. The XM5 is designed to be durable, flexible, easy to use, practical, and above all, sound great. Each unit is carefully manufactured, and then rigorously tested for performance, durability, and sound quality.

If you have any questions that are not answered by this manual, please feel free to send us an email. Enjoy the amp!

Yours truly,

James Forest  
President & CEO

**PLEASE  
READ!**

**A Word About Protecting Your Hearing:** The most valuable piece of audio equipment you own are your ears. Smart people protect their hearing. When using the XM5, or any headphones, [get in the habit of removing the headphones from your ears](#) whenever you:

- Turn the XM5 on;
- Connect or disconnect any cables, including the USB cable;
- Turn your computer off/on/sleep/standby with the USB cable connected;
- Press the USB select button on the back of the XM5.
- Anything that may cause a sudden burst of loud sound.

Your only have one set of ears, and you can't replace them. **Always** listen to music at reasonable volume, and most importantly, **use good common sense.**

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# XM5 Block Diagram

## Gain Boost Switch

IN position: +10db extra boost  
OUT position: +0db extra boost

## 75Ω Switch

IN position: 75Ω output impedance  
OUT position: 0Ω output impedance

## Crossfeed Enable Switch

IN position: XFeed enabled.  
OUT position: XFeed disabled

## Treble +2.5dB

## Bass +6dB

## Output

Connect to Headphones

## Input

Connect to MP3 player or other audio source.

## Amber LED

Flashes battery voltage when Power Button is pressed.

Low-Battery warning: Flashes a one-flash warning when the battery is low (below 6.5 volts). Flashes a two-flash warning when the battery is very low (below 5.2 volts).

## Power Button

Press button:

- 1 time = Turn on power for 1 hour
- 3 times = Turn on power for 3 hours
- 6 times = Turn on power for 6 hours
- 7 times = Turn on power forever

- 2 times = Toggle flashlight mode
- 5 times = Toggle blue LED dim

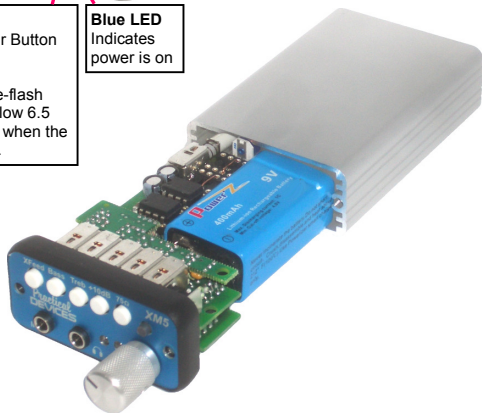
Press and HOLD to turn unit off.

Press once to display battery voltage. For example, if battery is at 8.5 volts, the amber LED will flash 8, then 5

## Main Volume

## Blue LED

Indicates power is on



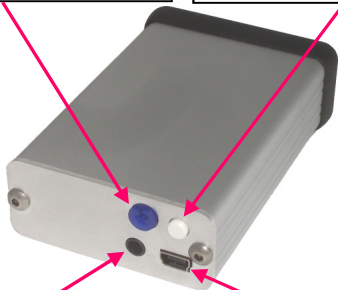
# XM5 Block Diagram, cont.

## Crossfeed Adjuster

Turn this potentiometer to adjust the amount of Crossfeed, from near-stereo to 100% mono.

## Source Switch

IN position: Source is USB DAC  
OUT position: Source is FrontPanel input



## Power Connector

Used to power and recharge the XM5. Use only the AC adapter supplied from Practical Devices.

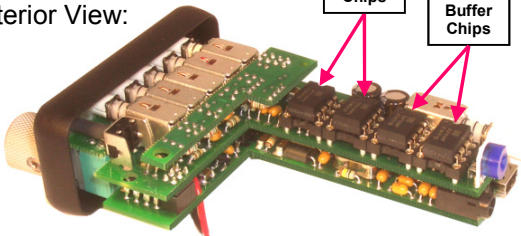
Note: Before plugging in the AC adapter: unplug the USB cable, plug in the adapter, then reconnect the USB cable.

## USB Connector:

Mates with Mini-USB type B 5-pin plug.



## Interior View:



## Amplifier Chips

## Buffer Chips

# Connecting Your XM5

1. Connect your headphones to the output jack.
2. Connect a suitable source to the input jack, as pictured. Sources may be MP3 or CD players, iPods, or any line-level devices. Alternatively, you may connect the XM5's rear-panel USB port. Be sure to set the rear-panel source-select switch (switch-out selects front panel input; switch-in selects USB).



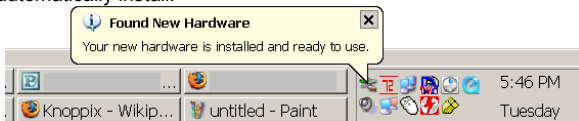
*Your headphones can have an impedance of 24 to 600 ohms.*

# USB DAC

To use the XM5's USB DAC, simply connect the XM5 to your computer, using the included USB cable.

- The XM5's RearPanel USB connector takes a "Mini USB Type B 5-pin plug".
- You may connect the XM5 through a USB hub, if desired.
- The XM5 will not recharge from the USB cable.
- **IMPORTANT:** If the USB cable is connected, and you want to plug in the AC adapter: you must 1) unplug the USB cable, 2) plug in the adapter, then 3) reconnect the USB. Failure to do so can cause USB hang-ups.

**Driver Support (Windows XP and Windows Vista):** Windows XP and Windows Vista have built-in drivers to support the XM5. The first time you plug in the XM5, the drivers will automatically install:



You may have to choose the XM5 to be the default audio device ([Start->Settings->Control Panel->Sounds and Audio Devices->Audio->Sound playback Default device](#)). If your media-playing software (Winamp, Windows Media Player, etc) was running when you plugged in the XM5, you may have to **exit and restart** the media-playing software.

**Driver Support (Linux, MAC OS):** Most Linux distributions natively support the XM5, using ALSA. Mac OS X and OS 9 also support the XM5

**IMPORTANT:** Get in the habit of **REMOVING YOUR HEADPHONES** when doing such things as:

- connecting or disconnecting the USB cable, or
- Waking your computer up, or putting it to sleep, hibernation, or shutdown
- Switching the XM5's RearPanel switch
- Connecting or disconnecting the XM5's Line-In connector

Doing so will prevent your ears from being exposed to excessively-loud bumps, thumps, clicks, or overly-loud music. Smart people protect their hearing!

# Power Button Functions



The power button functions are activated by pressing repeatedly within a three second window:

**1** press: Turn unit on. The XM5 turns off automatically after **one** hour.

**3** presses: Turn unit on for **three** hours.

**6** presses: Turn unit on for **six** hours.

**7** presses: Turn unit on. The XM5 will not turn itself off.

Press and hold: Turn unit off.



*The unit will respond to button presses by flashing the blue LED once for each hour it will stay on.*

## Additional power button functions:

**2** presses: Toggle flashlight mode (all LEDs on full).

**5** presses: Toggle LED dimming.



# CrossFeed Controls

Crossfeed Enable Switch



Crossfeed Adjuster

Only works when switch is enabled.



The XM5's Active Crossfeed circuit simulates the sound stage of loudspeakers, through your headphones.

- Press the Switch IN to activate Crossfeed.
- Leave the button OUT for full stereo operation, bypassing the Crossfeed circuit entirely.

Use a small screwdriver (Philips or Straightblade) to adjust the Crossfeed Potentiometer:

- All the way clockwise to produce a mono signal;
- All the way counter-clockwise to produce a near-stereo image.



**Why would you want Crossfeed?** Most music is mixed to be listened to on loudspeakers. The studio technicians mixing the recording assume there will be a lot of crosstalk, since with speakers the listener's left ear clearly hears the right speaker's output, and vice versa. Thus, most music is mixed with a very wide stereo soundstage.

With headphones, however, the left ear only hears the left channel, and the right ear only hears the right channel, with nearly zero crosstalk. This can, for many recordings, cause the soundstage to appear to be "in the center of your head". Further, some recordings (early Beatles recordings are infamous for this) have each instrument and vocal track panned 100% to either left or right, which can almost immediately cause listener fatigue. Crossfeed corrects this by bleeding some of the left channel into the right, and vice-versa.

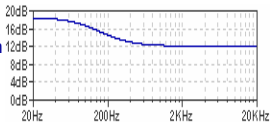
# Bass and Treble Boost

You may use the bass and treble boost buttons to give the following approximate boosts:

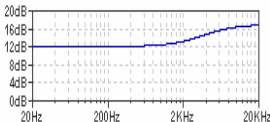
**Bass Boost: +6dB @ 100Hz**

**Treble Boost: +3dB @ 10kHz**

Frequency response with  
Bass Boost enabled



Frequency response with  
Treble Boost enabled



# Gain Boost

With the volume knob at full, your XM5 will deliver +12dB of gain. Additionally, you can enable the gain boost switch, which will give you an extra +10dB of gain, for a total of approximately +22dB.

In order to get the best possible noise floor, you should **not** enable the Gain Boost unless:

- a) the volume of your headphones is too quiet, and,
- b) you have already tried turning up the volume of your source (mp3 player).



Usually, the Gain Boost is only needed when using headphones which have an impedance **greater** than around 150 ohms.

# 75Ω Output Impedance

You can insert a 75 ohm impedance at the output jack by pushing the 75Ω switch:



Switch = OUT; Normal mode.  
Output Impedance: 0Ω



Switch = IN; High-impedance mode.  
Output Impedance: 75Ω

## Why would you want 75Ω output impedance?



There are several headphone systems which can benefit. In particular, etymotic's ER-4P in-ear headphones, when used with the 75Ω feature enabled, perform nearly identically to the generally-regarded-as-much-better ER-4S's. Other headphones, **especially lower-impedance headphones**, can also benefit. It is a matter of personal preference.

# Testing the Battery

## The XM5 also acts as a battery tester.

When the XM5 is turned on, the amber LED will display the battery voltage by flashing. For example, if the voltage is 8.5 volts, the LED will flash 8 times, then 5 times.

To see the battery voltage if the unit is already on, press the power button



The XM5 will warn you if the power falls below certain thresholds:

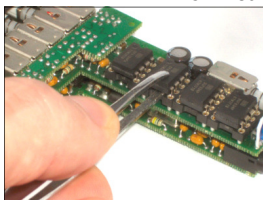
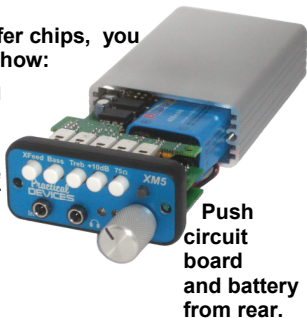
- At around 6.5 volts, the amber LED will begin to flash.
- Below around 5.2 volts, the amber LED will double-flash, indicating the battery is very low.

# Disassembling the Unit

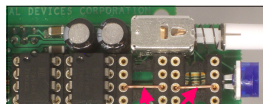
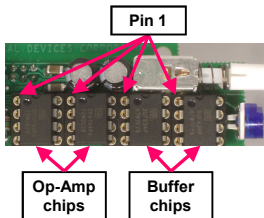
## FOR ADVANCED USERS ONLY!

If you want to replace the amplifier or buffer chips, you will need to disassemble the unit. Here's how:

1. Turn the unit off, and remove the external power adapter if connected.
2. Remove the two screws on the rear panel, and the two screws on the front panel, using the included 7/64" hex key. Note: you do **NOT** need to remove the volume knob!
3. From the rear, push the circuit board and battery out the **front** of the case.
4. Using tweezers or a small flat screwdriver, gently wedge the chips out of their sockets. Take care not to bend the pins of the chips. See Figure 1.
5. Insert the new chips (also known as "rolling" the amp). Make sure pin 1 is oriented properly. Take care not to bend the pins. Alternatively, copper Busbars may be used instead of buffer chips (see Figure 2).



**Figure 1.** Removing chips: Wedge tweezers or a small flat screwdriver between chip and socket, and gently work chip up and out.



**Figure 2.** Busbars installed instead of buffer chips.

**What opamps and buffers can I use?** See the faq on page 15,.

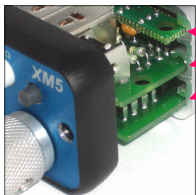
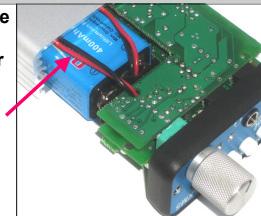
# Re-assembling the Unit

## To re-assemble the unit:

1. Slide the unit together (make sure the circuit board slides **smoothly** on the case's guide rails). When sliding, ensure the following:
2. Battery should be oriented such that battery clip is toward **FRONT** of unit (Fig 1)
3. Battery cable is neatly underneath battery and circuit board (Fig1)
4. All 3 circuitboards in the correct slot (Fig.2).
5. Volume pot may catch edge of case (Fig. 3).
6. Press on Faceplate to ensure circuitboards are inserted completely.
7. Re-install the two front screws. Do not overtighten.
8. Re-install the rear panel.

Battery cable should be neatly under battery

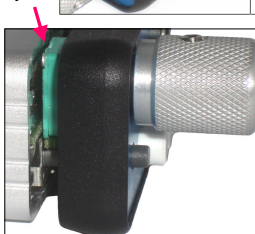
Fig. 1



**Note:** Make sure all THREE circuit boards slide in the correct slot.

**DO NOT FORCE.**

Fig. 2



**Important!** When sliding together: the "volume pot body" may interfere with the metal case (shown by arrow). If so, push on black bezel to allow pot body to clear. **Fig3**

## Other Reassembly Hints:

1. Don't put excessive force on the volume knob. The pot is precision equipment, and doesn't like to be manhandled.
2. Similarly, don't put force on the power button (this can happen if the faceplate slips off during reassembly).
3. Never try to remove the plastic pushbutton switch caps while the switch is in the "IN" position, or you *will* break the switch.

# Battery Systems

Your XM5 was equipped with one of the following battery systems:

1. **Lithium-Ion FastCharge™ System**, including a rechargeable battery, and an AC adapter/recharger.
2. **Alkaline battery**

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## 1. Lithium Battery FastCharge™ System

If your XM5 came equipped with the optional Lithium-Ion rechargeable system, just plug the charger into the powerjack on the rear of the XM5.

- The battery will fully charge within two hours. When charging is finished, the LED on the charger will turn from red to green.
- The battery will charge even if the XM5 is turned on.
- You can leave the charger connected indefinitely.
- You can expect up to 40 hours of use per charge, with no buffers installed.
- Your Charger is a “World” charger—it will work with AC Mains voltages from 105 to 240 VAC, at 50 or 60Hz. If you are using the charger outside of North America, you may need a plug adapter (available from your local electronics store).
- **DO NOT** plug anything else into the powerjack, or damage may result.



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## 2. Alkaline battery

You CANNOT use any AC adapter whatsoever when using an alkaline battery.

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## 3. Lithium NON-rechargeable battery

You may use a 9.6V Lithium non-rechargeable battery (often used in smoke detectors). These give extremely long battery life, and slightly higher headroom from the higher voltage. The downside is they are not cheap. You CANNOT use any AC adapter whatsoever when using a Lithium non-rechargeable.

Want to upgrade your existing alkaline unit to Lithium FastCharge? Email us at [sales@practicaldevices.com](mailto:sales@practicaldevices.com).

**NOTE:** Do not use any AC adapter with an alkaline or non-rechargeable battery. Doing so may cause device damage, battery leakage, or battery overheating, explosion, or fire.



# Frequently-Asked Questions

## **Can I use a line-level input to the XM5, such as from a CD/DVD player or VCR?**

Yes, the XM5 will accept a line-level input.

## **Can I use the XM5 to drive speakers?**

Usually, no. The XM5 was designed as a *headphone* amp, and will usually not do a good job of driving speakers, even small ones (most speakers have impedances of around eight ohms). What you are looking for is a *power* amplifier, not a *headphone* amplifier

## **What are my options for buffering the amp?**

The XM5 has two sockets for two *amplifier* chips, and two sockets for two *buffer* chips.

- Amplification: The XM5 comes with two OPA134 amplifier chips. There are many other amp chips you can also use.
- Buffering: For the buffer sockets, you can use:
  - 1) Copper Busbars, which connect pins 3 and 6 of the buffer sockets. In this case, all output drive from the XM5 comes from the amplifier chips.
  - 2) BUF634 buffer chips from TexasInstruments, which are very strong and quiet dedicated buffers.

For more FAQs, see our website:

<http://www.practicaldevices.com/faq.htm>

# Troubleshooting

Here are some common problems, and their solutions:

USB doesn't work:

- Unplug the USB connector, wait 10 seconds, then plug it back in, and restart your multimedia application.
- Remember: plugging in the AC adapter while USB is connected can cause USB malfunction. You must disconnect USB, connect the AC adapter, *then* reconnect USB. **Always** connect AC before USB!



Amp does not turn on or respond to pushing the power button:

- Battery is flat, and needs to be recharged or replace.
- Disconnect the battery, **hold down the power button for 10 seconds**, then reconnect the battery.

Headphone volume is too quiet, even with the volume knob at full:

- Increase volume of source (MP3 player). If it is still too quiet, then use the Gain Boost.

Output is in one ear only; the other channel is dead:

- Check that all cables are **completely** plugged in all the way
- Check that your cable is a **stereo** cable, not a **mono** cable.

Output is louder in one ear than the other:

- Source is too strong—turn down volume on source
- Headphone impedance is too low. Use headphones with a higher impedance.

No Sound:

- Rearpanel audio source selector switch is set wrong. Switch it.



# Warranty and Guarantee



## **PRACTICAL DEVICES CORPORATION**

**Practical Devices stands behind its products with a full no-risk warranty and money-back satisfaction guarantee.**

Practical Devices offers a 30-day money-back guarantee on all of our products. If, for any reason whatsoever, you are unsatisfied with your purchase, you may return it for your money back, including your original shipping cost. (The fine print: Unit must be returned within **30 days** of sale; Unit must be returned in the same undamaged, good working order as it was received; Practical Devices will refund you the original cost, plus the cost of the original shipping. Customer must pay for return shipping cost).

Further, we warranty, for a period of one year, that our products are free from any defects in workmanship. Should you have any problems, we promise to make it right. (The fine print: warranty is in effect for a period of one year. Problems must be reported to [sales@practicaldevices.com](mailto:sales@practicaldevices.com) This warranty covers any defects in workmanship. It does not cover abuse, physical damage, or the like).

Should you need any service, please email us at  
[sales@practicaldevices.com](mailto:sales@practicaldevices.com)

# Specifications

Description:	Portable Audio Headphone Amplifier
Weight:	157 grams (5.5 oz)
Power Source:	<ul style="list-style-type: none"><li>• Optional Lithium-Ion Rechargeable System, or</li><li>• 9-volt Alkaline, or</li><li>• 9.6V Lithium non-rechargeable</li></ul>
External Power Supply:	Optional Lithium-Ion charger
Battery Charge Time	Lithium FastCharge System: 1.5 hours
Battery Life (approximate):	Alkaline: 50 hours Lithium-Ion: 40 hours Lithium NON-rechargeable: 100 hours
Maximum Gain:	+20.6 dB (Gain Boost enabled) +12.1 dB (Gain Boost disabled)
Frequency Response (20-20,000Hz, typical, FrontPanel input):	+0.1dB, -0.4dB
-3dB Point (typical, FrontPanel input):	21 kHz at top end; 9 Hz at low end
Total Harmonic Distortion (typical, FrontPanel input)	0.0007%
Intermodulation Distortion (typical, FrontPanel input)	0.005%
Signal to Noise ratio (20-20,000Hz, typical, FrontPanel input):	103 dB

# Specifications (Continued)

Dynamic Range (20-20,000Hz, typical):	103dB
Bass Boost (approx.)	+6dB @ 100Hz
Treble Boost (approx.)	+3dB @ 10kHz
Crossfeed	Active, user-adjustable from mono to stereo using potentiometer; User can bypass using pushbutton.
Auto Power-OFF	User selects between 1, 3, or 6 hour poweroff interval, or unit can be set to stay on indefinitely
Status Indicators	Two LEDS (one blue, one amber)
Integrated Voltmeter accuracy (typical)	±100mV
Mechanicals	Anodized aluminum case; Glossy laser-anodized faceplate; Polished aluminum volume knob; FR-4 dual-layer Printed Circuit Board with 1 oz. copper
Other Features	Flashlight Mode: Turns on both LEDs to full brightness; Dimming mode: Allows user to optionally dim the blue LED.
USB DAC	Japanese TI2702/04 DAC, 0.006% THD; 44.1/48kHz, USB 2.0 Compliant; Native compatibility with Windows XP, Vista, MAC OS 9, OS X, and most Linux installs.

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