

Retio vintage speakers

User manual version 1.0

This documentation describes the features and use of Retio and Retio Lite speakers.

More products, please visit our [Shopify store at www.Retio.co](https://www.Retio.co).

Note: For any of  mentioned in the article, please refer to the Quick Start Guide image.

Introduction

Retio is a handcrafted retro radio speaker with vintage Nixie tubes, a tribute to the precious moments in the past. It was brought into life with the help of 3,185 Kickstarter backers and their \$1,092,597 pledges.

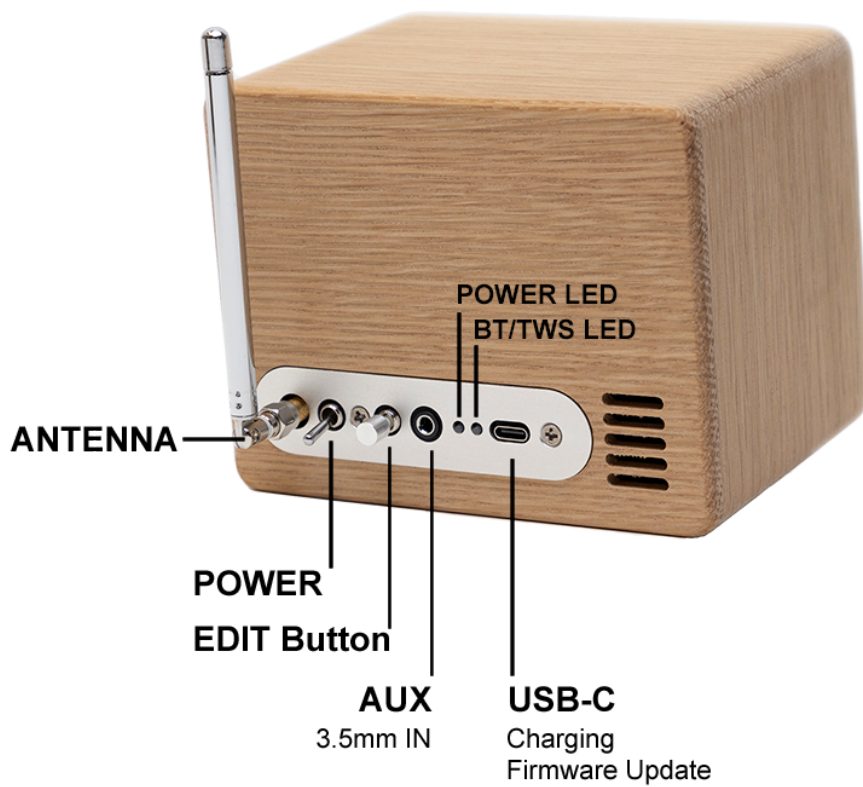
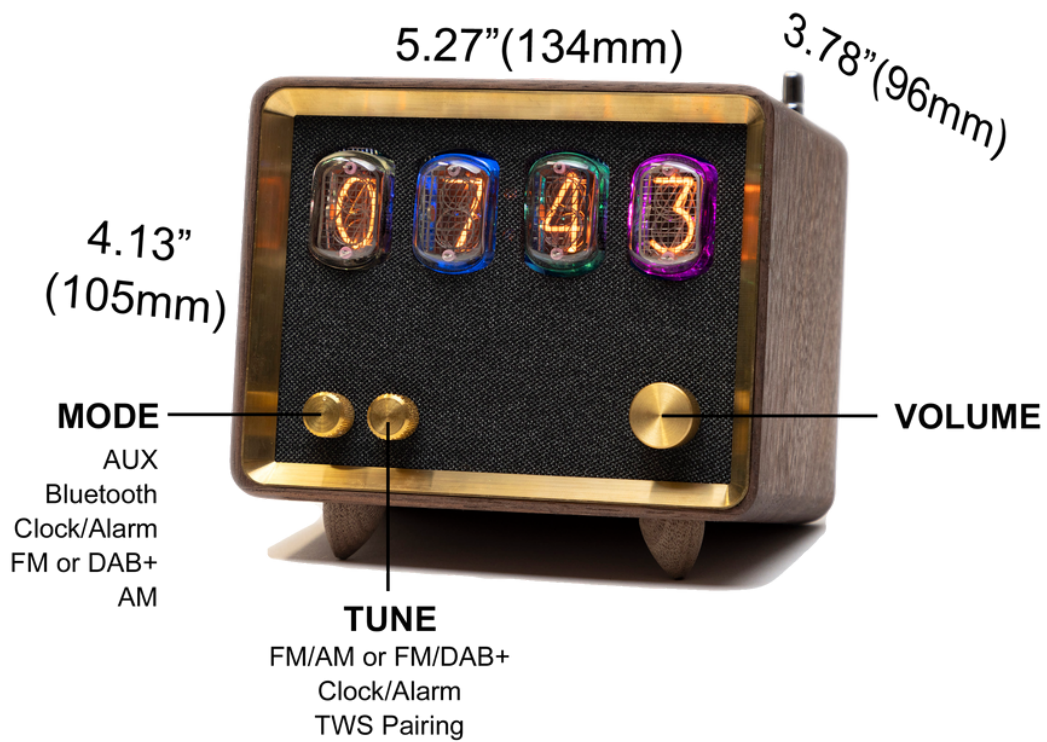
Features

- Modes: FM, AM or DAB+, Clock with Alarm, Bluetooth, AUX
- Alarm can go off once, on weekdays, on all days and disabled.
- Stereo/Party mode (Two Retios/Retio Lites required)
- Manual Nixie tube dimming
- 7 colors backlight and backlight off
- Touch pad on top: BT Play/Pause, Nixie on/off, Mute alarm
- Easy firmware update

Specifications

Dimensions: 5.27" x 4.13" x 3.78", or 134mm x 105mm x 96mm

Weight: about 1.6kg, 3.5lb (varies based on the case material)



Clock

- Time Keeping Accuracy: up to ± 13 seconds deviation per month.

Nixie Tubes

Retio uses four (4) original vintage `Nixie tubes` manufactured in 1970s to 1990s. They are replaceable on sockets.

Nixie tube type used in Retio (from left to right):

- IN-12A: displays digits 0-9
- IN-12A: displays digits 0-9
- IN-12A: displays digits 0-9
- IN-12B: displays digits 0-9, and a decimal at the bottom left corner

Bluetooth

Retio supports:

- Bluetooth 5.0
- Codec: Qualcomm aptX, SBC and AAC
- Stereo/Party mode: TWS pairing (Two Retios/Retio Lites required)

Radio

- Bands: FM/AM, or FM/DAB+
- Radio Chip: TEF6686 (FM/AM)
- For FM/AM model: FM 65-108MHz, AM: 522-1620 kHz
- For FM/DAB model: FM 76-108MHz, DAB, DAB+ Band III support (168-240MHz); Supports WorldDMB Receiver Profiles 1 & 2

Audio

- Aux 3.5mm audio input
- Speaker size: 46mm
- Frequency response range: 150hz-17khz
- Amplifier: 10W class-D

Power, Battery and Charging

- Power: USB-C port, 5V/2.4A (adapter and cable included)
- Cable: USB Type C to USB Type C, or USB Type A to USB Type C
- Internal Batteries: 2 pieces of 18650 Li-Ion rechargeable batteries; 6,700mAh in total for Retio; 5,200mAh in total for Retio Lite; replaceable
- Charging time: ~5 hours
- 1 out of 4 plug types for your countries included
- Battery life: 6 hours nixie-on + playback time, or 16 hours nixie-on time

- Power management: Designed for continuously plugged in. Battery overcharge and degradation protection integrated.

Charging Behavior of Retio & Power LED States

Power LED is the one closer to the AUX port.

- Battery <1%: RED LED flashes three times and then automatically powers off.
- Battery 1% - 10%, RED LED solid on
- When charging, RED LED solid on
- When charging complete, GREEN LED solid on
- Not connected to power, battery >10%: LED off
- Not connected to power, battery <10%: RED LED solid on
- Not connected to power, battery <1%: RED LED flashing

Charging Behavior of Retio Lite & Power LED States

Power LED is the one closer to the AUX port.

- Battery <1%: RED LED flashes three times and then automatically powers off.
- Battery 1% - 10%, RED LED solid on
- When charging, RED LED solid on
- When charging complete, GREEN LED solid on
- Not connected to power, battery >10%: LED off
- Not connected to power, battery <10%: RED LED solid on
- Not connected to power, battery <1%: RED LED flashing

Models

Currently, Retio has three (3) models with different features.

1. Retio FM/AM
2. Retio FM/DAB+
3. Retio Lite

Wood Case Materials

Retio provides four (4) wood materials for the wood case.

- Walnut
- Rift Sawn White Oak
- Zebrawood
- Wenge

Zebrawood and Wenge are Kickstarter limited editions, and will be discontinued once sold out.

Feet Materials

We also provide two (2) materials for the feet.

- Matching wood to the case
- Brass

Feature Comparisons

Model	Nixie Tubes	Clock	BT	FM	AM	DAB	AUX	Built-in Battery
Retio FM/AM	Y	Y	Y	Y	Y	-	Y	6,700mAh (2x18650)
Retio FM/DAB+	Y	Y	Y	Y	-	Y	Y	6,700mAh (2x18650)
Retio LITE	-		Y	-	-	-	-	5,200mAh (2x18650)

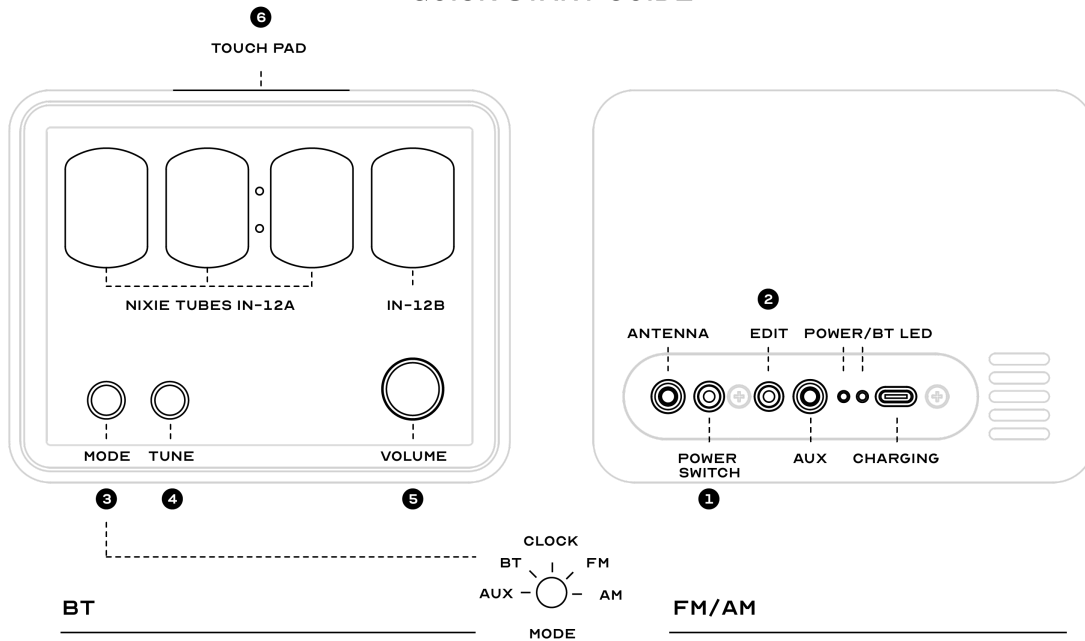
Retio Basics

Quick Start Guide

- When a Retio is received, remove it from the box, and charge it up using the USB Type C to USB Type A cable (included).
- When the power LED is soild green, Retio is fully charged.
- For FM and AM reception, install the telescopic antenna on the back.
- Start using Retio ~

Retio

QUICK START GUIDE



BT

- CHANGE ③ MODE TO BT
- LONG PRESS ② EDIT - START PAIRING
- SELECT "RETIO" ON YOUR PHONE
- TAP ⑥ TOUCH PAD TO PAUSE/RESUME

CLOCK/ALARM

- LONG PRESS ② EDIT TO EDIT CLOCK/DATE
- PRESS ④ TUNE TO VIEW ALARM SETTING
- LONG PRESS ④ TUNE TO EDIT ALARM SETTING
- TAP ⑥ TOUCH PAD TO TURN ON/OFF NIXIE

FM/AM

- CHANGE ③ MODE TO FM/AM
- TURN ④ TUNE TO YOUR STATION
- PRESS ④ TUNE TO AUTO SCAN
- TAP ⑥ TOUCH PAD TO SHOW FM/AM STATION

TIPS

- PRESS ② EDIT TO CHANGE THE NIXIE BACKLIT COLOR
- LONG PRESS ④ TUNE - STEREO MODE + RETIO LITE
- RETIO LITE - PRESS ② EDIT - AUTO PAIRING
- FULL INSTRUCTION AT:
<https://retio.co/pages/retio-user-manual>

Inputs: Knobs & Buttons

- ① POWER SWITCH Flip Up/Down
- ② EDIT Click(=Single Press); Long Press(=Press & Hold for 3 sec)
- ③ MODE 5 Stops (Modes)
- ④ TUNE Turn indefinitely; Click(=Single Press); Long Press(=Press & Hold for 3 sec)
- ⑤ VOLUME Turn indefinitely; Click(=Single Press); Long Press(=Press & Hold for 3 sec)
- ⑥ TOUCH PAD Tap

Feature Matrix

MODE	AUX	Bluetooth	CLOCK	FM	AM	DAB
Default display	Time	Time	Time	Time after showing FM Frequency for 5 sec	Time after showing AM Frequency for 5 sec	Time after showing DAB Station # for 5 sec
Audio Source	AUX	Bluetooth	/	FM Radio	AM Radio	DAB Radio
TAP	/	Pause/Resume	Nixie Tubes On/Off (Turn off alarm if it goes off)	Show FM Frequency Momentarily	Show AM Frequency Momentarily	Show DAB Station # Momentarily
EDIT Single Press	Change background LED color (RGB looping-Same color looping-Red-Yellow-Green-Purple-Blue-Cyan-White-OFF)					
EDIT Long Press	/	Set BT to Discoverable	Set Up Clock/Date	/	/	/
TUNE Turning	Change Nixie Brightness	Change Nixie Brightness	Change Nixie Brightness	FM Radio Tuning	AM Radio Tuning	DAB Radio Tuning
TUNE Single-Press	/	/	Set Up Alarm	Auto-scan to The Next Station	/	/
TUNE Long-Press	/	/	/	/	/	Search Through All Available Stations
VOL Turning	Changing Volume					
VOL Single Press	/	/	/	Turn Off/On Nixie Tube	Turn Off/On Nixie Tube	Turn Off/On Nixie Tube
Note			Decimal Point ON indicates Alarm Is Active	How To Change Frequency Ranges & Steps		

During any set up process, when no operation is made for 30 seconds, it will automatically return to its normal status without saving.

5 Modes

Retio has 5 modes, controlled by the MODE knob ③. From counterclockwise (CCW) to clockwise (CW), they are:

- AUX
- Bluetooth
- Clock
- FM
- AM (for FM/AM model), or DAB+ (for FM/DAB+ model)

AUX Mode

Connect your audio source using a 3.5mm audio cable (not included). Plug in one end to the AUX port on the back of Retio.

Retio will always display time in this mode.



Bluetooth Mode

Bluetooth Pairing

- Change MODE ③ to BT.
- Press and hold EDIT ② to start pairing.
- Open the Bluetooth page on your device (phone or computer), select RETIO to pair.
- Wait for a few seconds for the pairing to complete.
- While playing, tap on the touch pad ⑥ on the top of Reito will pause/resume.

For any reason the pairing process is interrupted, power cycle Retio and restart the process.

Bluetooth LED States for Retio

Bluetooth LED is the one closer to the USB-C port.

LED Color	LED Behavior	Status	Operation
BLUE	Slow Flashing	No Connection	
RED	Quick Flashing	TWS Pairing Mode	Long-Press TUNE ④ to Activate
RED	Solid On	TWS Pairing Success	
BLUE	Quick Flashing	BT Pairing Mode	Long-Press EDIT ② to Activate
BLUE	Solid On	BT Pairing Success	

Bluetooth LED States for Retio Lite

Bluetooth LED is the one closer to the USB-C port.

LED Color	LED Behavior	Status	Operation
BLUE	Slow Flashing	No Connection	
RED	Quick Flashing	TWS Pairing Mode	Single-Press EDIT ② to Activate
RED	Solid On	TWS Pairing Success	
BLUE	Quick Flashing	BT Pairing Mode	Long-Press EDIT ② to Activate
BLUE	Solid On	BT Pairing Success	

Clock Mode

- Retio shows clock in HH:MM format.
- Supports 12-hr and 24-hr mode.
- Alarm: Artist-curated soundtracks
- Recurring Alarm: Once, Weekday, 7 Days

To set up time and date

1. Change **MODE** ③ to CLOCK.
2. Long-press **EDIT** ② to start, the hours display will flash.
3. Rotate **TUNE** ④ to change the hour.
4. Single-press **EDIT** ② to advance to minute. Rotate **TUNE** ④ to change.
5. Single-press **EDIT** ② to advance to 12-hr or 24-hr mode. Rotate **TUNE** ④ to toggle.
6. Single-press **EDIT** ② to advance to year. Rotate **TUNE** ④ to change.
7. Single-press **EDIT** ② to advance to month. Rotate **TUNE** ④ to change.
8. Single-press **EDIT** ② to advance to date. Rotate **TUNE** ④ to change.
9. Single-press **EDIT** ② to save and return to normal display.

When the hour is being set, it always uses 24-hr format despite of the 12-hr/24-hr mode settings.

When hour or minute is being set, if the **TUNE** ④ is NOT rotated at all, Retio's time will stay unchanged.

If any/both of hour & minute is changed, this change will be saved when it advances to 12/24-hr settings, and the second will be reset to 00 at this moment.

To set up alarm

1. Change **MODE** ③ to CLOCK.
2. Press **TUNE** ④ to view ALARM settings.
3. Long-press **TUNE** ④ to start editing ALARM settings. Hour will flash. Rotate **TUNE** ④ to change.
4. Single-press **TUNE** ④ to advance to minutes. Rotate **TUNE** ④ to change.

5. Single-press **TUNE** ④ to confirm. Flashing will stop.
6. Single-press **TUNE** ④ again, it will show the alarm frequency (how many times per week.) 0 means alarm off; 1 means alarm once; 5 means all weekdays; 7 means all days. To edit, long press **TUNE** ④ until it flashes. Rotate **TUNE** ④ to change. Single press **TUNE** ④ to save.
7. Single-press **TUNE** ④ again to choose soundtrack for the alarm. There are 5 soundtracks available. To edit, long press **TUNE** ④ until it flashes. Rotate **TUNE** ④ to change. Single press **TUNE** ④ to save.
8. Now it exits the alarm setting mode and return to CLOCK display.

When the alarm frequency is set to 1, it will automatically reset to 0 after the alarm goes off.

During any set up process, when no operation is made for 30 seconds, it will automatically return to its normal status without saving.

FM Mode

FM frequency range:

- 65 - 108MHz (for FM/AM model)
- 76 - 108MHz (for FM/DAB+ model)

When a station is played for more than 5 seconds, this station will be saved in memory as the last-played station.

When Retio is switched to FM mode, it will automatically load the last-played station if available.

How to use

- Change **MODE** ③ to FM
- Rotate **TUNE** ④ to change frequency. Press **TUNE** ④ to AUTO SCAN. It will stop at the next available station.
- Rotate **VOLUME** ⑤ to adjust volume.
- The tubes will display time after a few seconds of displaying frequency.
- Tap on the top to display frequency of the current station momentarily.

When Retio runs on battery and is not in FM mode, the power to FM module will be automatically cut off to conserve battery.

It will takes approx. 1.5 seconds for the FM module to initialize when Retio is switched to FM mode. This ONLY applies in the case of operating Retio on its batteries.

AM Mode

AM frequency range:

- 522-1620 kHz (for FM/AM model)

The FM/DAB model does NOT have AM feature.

How to use

- Change **MODE** ③ to AM
- Rotate **TUNE** ④ to change frequency.
- Rotate **VOLUME** ⑤ to adjust volume.
- The tubes will display time after a few seconds of displaying frequency.
- Tap on the top to display frequency of the current station momentarily.

DAB+ Mode

How to use

- Change **MODE** ③ to DAB
- Rotate **TUNE** ④ to change station.
- Long-press **TUNE** ④ to re-index all available stations.
- Rotate **VOLUME** ⑤ to adjust volume.
- The tubes will display time after a few seconds of displaying station number.
- Tap on the top to display the current station momentarily.

Backlit LEDs

To change the LED color

In any mode, single press the **EDIT** ② button on the back will change the color of the LEDs behind the nixie tubes in the following order:

- RGB looping
- Same color looping
- Red
- Yellow
- Green
- Purple
- Blue
- Cyan
- White
- OFF

Nixie Brightness

To change the brightness of Nixie tubes:

- Change **MODE** ③ to AUX, BT or CLOCK.
- Rotate **TUNE** ④ to change brightness.

There will be a low humming sound when the nixie tubes are NOT at their full brightness.

To momentarily turn off/on Nixie tubes

- In CLOCK mode, tap on the top to turn off/on Nixie tubes momentarily.
- In FM/AM/DAB mode, single-press VOLUME to turn off/on Nixie tubes momentarily.*

* A [firmware update](#) is required to use this feature. The firmware version must be v1.0.1 or higher.

Advanced Features

TWS Pairing

TWS Requirement

Two Retio devices are required to use TWS, no matter they are Retio or Lite. In other words:

- Retio + Retio
- Retio + Retio Lite
- Retio Lite + Retio Lite

(+ means pairing via TWS)

How to pair

- On Retio: Long-press **TUNE** ④ to activate **TWS Pairing Mode**.
- On Retio Lite: Single-press **EDIT** ② to activate **TWS Pairing Mode**.
- Once Retio/Retio Lite enters **TWS Pairing Mode**, the BT LED on the back will turn RED and flashes quickly.
- Position them side by side, and TWS pairing will complete in a few seconds.

TWS pairing only needs to be done once and for all.

No matter what the audio source is (smartphone, computer, AUX, etc.), Retio will automatically play them on the two Retio devices via TWS.

Serial Port

When connected to a computer with a USB Type C cable, the serial port of Retio is accessible using the configuration below.

Port name: usbserial-1410 or similar

- Baud rate: 115200
- Data Bits: 8
- Parity: none
- Stop bits: 1
- Flow Control: none

Retio will output operation messages on its serial port, which can be used by advanced users to communicate with external devices.

FM/AM Frequency Range Selection

Retio has four (4) FM frequency ranges.

FM Frequency Range

1. 88.1-107.9MHz, step 0.2MHz (mainly for USA)
2. 87.5-108MHz, step 0.1MHz (mainly for Europe, Africa, Australia, part of America and Asia)
3. 76-95MHz, step 0.1MHz (for Japan)
4. 64-108MHz, step 0.1MHz (other)

AM Frequency Range

1. 520 kHz - 1710 kHz, 10 kHz spacing: mainly for North American and South America
2. 522 kHz - 1611 kHz, 9 kHz spacing

How to Change FM/AM Frequency Range

1. Make sure Retio is in either FM or AM MODE
2. Press and hold both **EDIT** ② button and **VOLUME** ⑤ knob for 2 seconds, Retio will display the current frequency range selection.
3. The digit to the left (range: 1-2) is for AM frequency range, and the digit to the right (range: 1-4) is for FM frequency range. The digits are corresponding to the numbering above.
4. To change the FM frequency range, tune the **VOLUME** ⑤ knob.
5. To change the AM frequency range, tune the **TUNE** ④ knob.
6. To save your settings, single-press **EDIT** ② button.
7. Retio will restart and your selection is saved.

Firmware Update

Performing firmware update will erase **all** your settings and saved radio stations.

Go to update.retio.co and follow the instructions on that page.

How To Check the Current Firmware Version of your Retio

- Change **MODE**  to AUX
- Single-press **VOLUME**  to see the firmware version on the tube display.
- For example: 101 means version 1.0.1
- If the tube doesn't show anything, it means your firmware is the default v1.0.0.

FAQ

What if some digits of nixie tubes won't light up

Due to the transportation, the tubes may get loose causing a bad contact on their pins.

This can be solved by:

Press your thumb on the face of the tube in question firmly, and move it slightly to either side until the digit lights up.

DO NOT wiggle too vigorously as it may damage the tube or its socket underneath.

All digits for ALL nixie tubes were 100% tested twice independently before they are shipped. So most of the time following the above method will solve the issue.

How to improve the FM/AM radio reception

The telescopic antenna (included) will greatly improve the radio reception for FM and AM.

Extend the antenna and pose it to different orientations to achieve the best effects.

Retio has a standard **SMA** female connector on the back for antenna.

If desired, one can use their own antenna as long as it uses male **SMA** connector.

How to test the Nixie tube display (TEST MODE)

Turn OFF Retio using the **Power Switch** on the back.

Tune to **Clock** Mode (the 3rd stop from clockwise).

Press and hold the **EDIT** button on the back, and turn on Retio.

Wait until the Nixie tubes are on, and then release the **EDIT** button.

Now Retio is in **TEST Mode**. All 4 tubes will display the same digits.

Tuning the **VOLUME** knob changes the digits from 0 through 9.

Press down the **VOLUME** will turn on/off the two colons as well as the decimal at the bottom left corner of the 4th tube (rightmost).

Exit the Test Mode by powering cycle Retio (turn off and then on).

What if my Retio is acting/out of order

Under rare circumstances, Retio may not act as expected, such as playing FM radio on BT/AUX mode.

This can be solved by flashing the latest firmware using the link below:

[Retio Firmware Update](#)

In TWS pairing mode, which Retio speaker plays left/right audio channel?

When two Retio devices are paired via TWS, the Retio with higher MAC address on the bluetooth module will play LEFT channel, and the lower MAC address will play RIGHT.

Retio always has higher MAC address than Retio Lite. So when they are paired, Retio is LEFT, and Lite is RIGHT.

When two same devices are paired (Retio+Retio, or Lite+Lite), the device with higher MAC address on its BT module will be LEFT. Simply play a speaker test audio to tell which is which. (Try [this one on YouTube](#))

Can I turn off the LED on the back?

The charging and bt LED on the back are controlled by hardware circuits (instead of software) so there is no way to disable them (without hardware modification).

If you think they are too bright, you may cover them with a tape. Poke a tiny hole on the tape if needed.

My Retio has a low humming sound. Why?

There will be a low humming sound when the nixie tubes are NOT at their full brightness.

Please refer to [here](#) to change the brightness.

Contact Us

Please send email to: support@retio.co

FCC Caution.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

*RF warning for Mobile device:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.