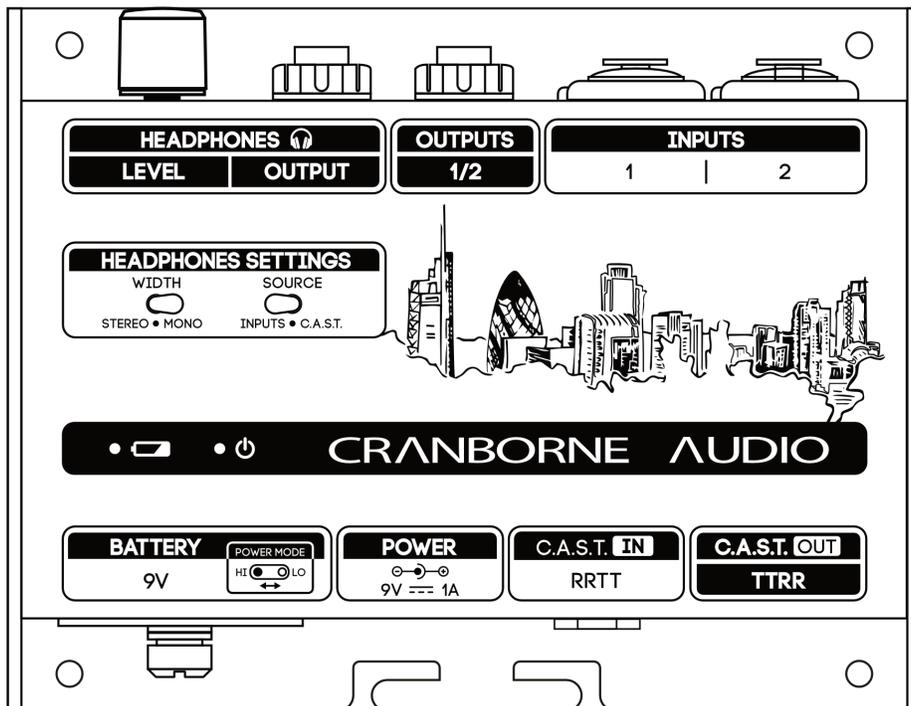


# CRANBORNE AUDIO



**N22H - Reference-Grade Headphone Amplifier, Cat 5 Snake, and C.A.S.T. Breakout Box.**

## User Manual

# Welcome to the family

Cranborne Audio represents a commitment by four product designers to build an audio brand that does things the right way. We don't take shortcuts. We don't compromise. We don't accept "good enough."

We're just like you. We're musicians. We're audio engineers.

We make products that we want to use. We create, innovate, and design with passion, purpose, and belief. We strive to design products that remain accessible, whilst offering the highest quality and truly innovative new ways of working and achieving that sound that we all desire.

Cranborne Audio, for us, means so much more than metal boxes with components in them. These are our labours of love that embody and demonstrate our demand for excellence. By distilling what matters and putting our soul into these tools, we hope to help other people make magic and express themselves, and in some way, become part of our Cranborne Audio family.

So welcome to the family. We care for our family. And we care about making your tracks, albums, scores sound as good as they should.



Sean Karpowicz



Edward Holmes



Elliott Thomas



Andrew Pat

# Cranborne Audio N22H

Congratulations on your purchase of N22H and thank you for selecting Cranborne Audio to be a part of your music creation process.

There is a lot of innovative technology packed into this unassuming little box! Not only is it a powerful, reference-grade headphone amplifier based on the same design as our 500R8 and 500ADAT interfaces, it's also a gateway to our powerful C.A.S.T. system that simplifies and expands the headphone monitoring capabilities of your studio.

Headphone amplifiers are often overlooked. Many of us engineers are willing to invest significant amounts of money on the latest and greatest headphones in the hope that it could be the silver bullet to more accurate monitoring. However, all too often, it is the headphone amplifier itself that fails to deliver. That inability to drive 'those' headphones properly, will only leave you wondering, 'what's missing?'

When we designed the headphone amplifier in our flagship 500R8, we quickly realised that we had something special. It's low distortion, high power, and frequency linear performance 'lifted the veil' on any set of headphones we used with it - our customers agreed.

Whether tracking with high-impedance, over-ear headphones or low-impedance, in-ear monitors, N22H delivers maximum performance with a flick of a switch between high and low power modes.

For maximum flexibility, your N22H can be powered in multiple ways with the included 9V DC power supply or any guitar pedal power supply. Optionally, a 9 volt battery will provide up to 10 hours of operation during location recording.

It doesn't stop there. We built our C.A.S.T. system into N22H to allow it to be positioned anywhere in your recording space using a single, shielded Cat 5e, Cat 6, or Cat 7 cable. With a range of 330ft/100m, your N22H serves as the ideal solution for convenient headphone distribution, or as a connectivity hub for mic/line sources as an all-analogue, Cat 5e snake.

N22H is the perfect tool for those who are building their studio around Cranborne Audio products and need an unmatched audio distribution system in their studio and It's ideal for those looking to get a bit of Cranborne Audio's renowned sound into their recording workflow in the form of a reference-quality headphone amplifier. N22H packs a powerful feature set, and the highest quality sound for a price you may not expect. For us, it's the perfect reflection of everything a Cranborne Audio product should be.

We hope you enjoy using it!

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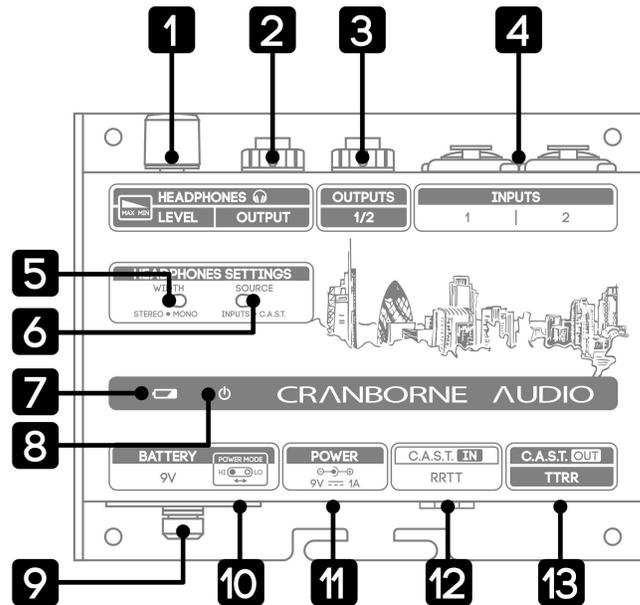
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**Warning:**

***N22H's Headphone Output is extremely loud! Prolonged exposure to loud music can cause permanent hearing loss. Please exercise caution when using N22H and reduce the Headphones Level Control [1] when listening for long periods of time.***

# Getting started

## Controls and Connectors



<p><b>[1] Headphones Level Control:</b> Adjusts the volume of the headphones output.</p>	<p><b>[8] Power Indicator:</b> Lights Blue when N22H is Powered On via battery or mains power.</p>
<p><b>[2] Headphones Output:</b> Used for connecting headphones to N22H. When using battery power, N22H automatically powers on when headphones are connected to this ¼" jack.</p>	<p><b>[9] Battery Cover/Battery Compartment:</b> Removable cover for the 9V battery compartment and Power Mode switch. <b>Note: Only 9V batteries should be used.</b></p>
<p><b>[3] Outputs:</b> Balanced, TRS outputs of the C.A.S.T. RR paths. These Outputs are passive and do not require power to operate.</p>	<p><b>[10] Power Mode Switch:</b> Switches the headphone output between Low and High Power modes. <b>Note: Only switch Power Modes when N22H is Powered Off.</b></p>
<p><b>[4] Inputs:</b> Combi jack inputs for connecting audio to the C.A.S.T. TT paths. Also used for connecting stereo playback during standalone operation. These analogue Inputs send audio into the C.A.S.T. TT ports passively and do not require power to operate.</p>	<p><b>[11] Power Inlet:</b> Powers N22H's headphone output using the supplied 9V DC power supply. Battery is disconnected internally when a DC supply is being used. <b>Note: When power inlet is used, N22H stays Powered On.</b></p>
<p><b>[5] Width Switch:</b> Adjusts the Width of the headphones output between true Stereo or Mono.</p>	<p><b>[12] C.A.S.T. IN:</b> Used to connect N22H to the C.A.S.T. Output of another C.A.S.T.-enabled device. <b>Note: The C.A.S.T. IN port is covered using a Cat5 plug. Only remove this plug when N22H is to be used with a C.A.S.T. OUT of another device.</b></p>
<p><b>[6] Source Switch:</b> Selects the input source of N22H's headphone amplifier between the C.A.S.T. connections [12/13] and Inputs 1-2 [4] for standalone operation.</p>	<p><b>[13] C.A.S.T. OUT:</b> Used to connect N22H to the C.A.S.T. IN of another C.A.S.T.-enabled device.</p>
<p><b>[7] Battery Low Indicator:</b> Lights Red when internal power drops below 6.8v. <b>Note: Duration between LED lighting Red and unit powering off will vary from battery to battery and headphones being used.</b></p>	<p><b>[14] Mic Stand Mount [Underside of N22H]:</b> ⅜" thread mount used to fix N22H onto a mic stand or bracket. <b>Note: For mic stands with a larger thread, a 5/8" male to 3/8" female screw thread adapter should be used.</b></p>

## Package Contents

So now your N22H is out of its packaging, you're probably itching to get it powered on and making music! Before you get started, please read the sections below that will help guide you through the process of getting your N22H setup, plugged in, and ready-to-use as quickly as possible!

The following items can be found in the packaging alongside N22H:

- 9v DC power adapter - (*Located in compartment below N22H*)
- Quickstart Guide

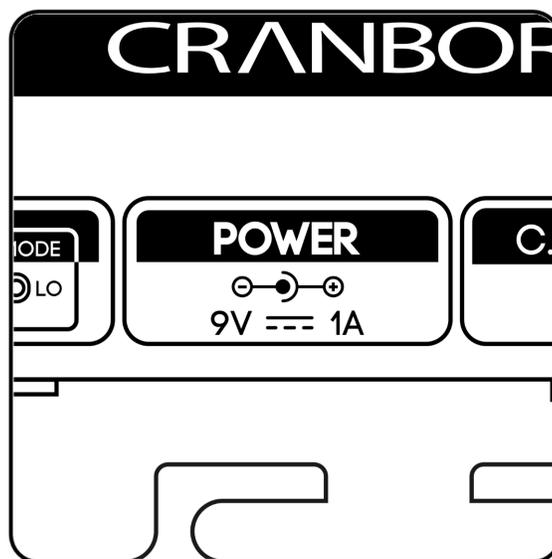
## Power Supply

The power adapter supplied with N22H is a **9v, DC, 500mA** power supply with a **centre-negative, 2.1mm** barrel fitted on the end. This supply is the same type of supply that is used to power many popular guitar pedals and pedalboards such including isolated multi-output power supplies, or inline daisy chain adapters.

Using 3rd party power supplies with N22H is supported provided the supply is of the correct specification. We recommend a supply with **between 500mA and 1A** of available current.

**Note:**

***Please only use the supplied power supply or one that has the same power specifications. Damage caused using an improper PSU with incorrect polarity or voltage is not covered under warranty.***



# Powering Procedures

## Power Supply

**Powering On** - First, make sure any headphones are disconnected from N22H and the Headphones Level Control [1] is reduced to minimum. Locate the 2.1mm barrel connector on the end of the included 9v DC power supply and connect that to the Power Inlet [11]. Then, connect the plug of the power adapter to the socket on the wall.

N22H powers up automatically when the correct power requirements are detected at its Power Inlet [11]. N22H is now ready for use and you may connect your headphones.

**Powering Off** - First, make sure any headphones are disconnected from N22H and the Headphones Level Control [1] is reduced to minimum. Then disconnect the power supply from the wall or switch off the power supply to your N22H.

## Battery

**Powering On** - First, make sure any headphones are disconnected from N22H and the Headphones Level Control [1] is reduced to minimum. Remove the Battery Cover [9] by twisting the spring-loaded thumb screw anticlockwise and remove the cover to reveal the 9v battery fly lead. Carefully connect the Battery terminals to the push-fit battery connector, tuck the loose leads back inside N22H, and locate the battery into the cavity. Once the battery is secure and the fly lead is hidden away in N22H, refit the Battery Cover [9] and tighten the thumb screw.

**Note:**

***Please be careful when pulling on the battery fly lead when fitting the battery. Excessive force on the connector could damage the wires of the connector or PCB. When installing the battery, please ensure that the terminals are the correct way around before push-fitting the battery. Attempting to connect the wrong polarity could cause irreparable damage to N22H and is not covered under warranty.***

Lastly, connect your headphones to N22H's Headphone Output [2] and N22H will power up automatically. N22H is now ready for use.

**Powering Off** - First, make sure the Headphones Level Control [1] is reduced to minimum. Carefully remove your headphones from the Headphone Output [2] and N22H will switch off automatically when the headphone jack is removed.

**Note:**

***Please follow the safe sequences above carefully in order to prevent any unwanted pops or power spikes causing damage to N22H or downstream audio components including speakers and headphones. Damage caused as a result of incorrect procedures is not covered under warranty.***

## Using Simultaneous Battery and External Power Supply

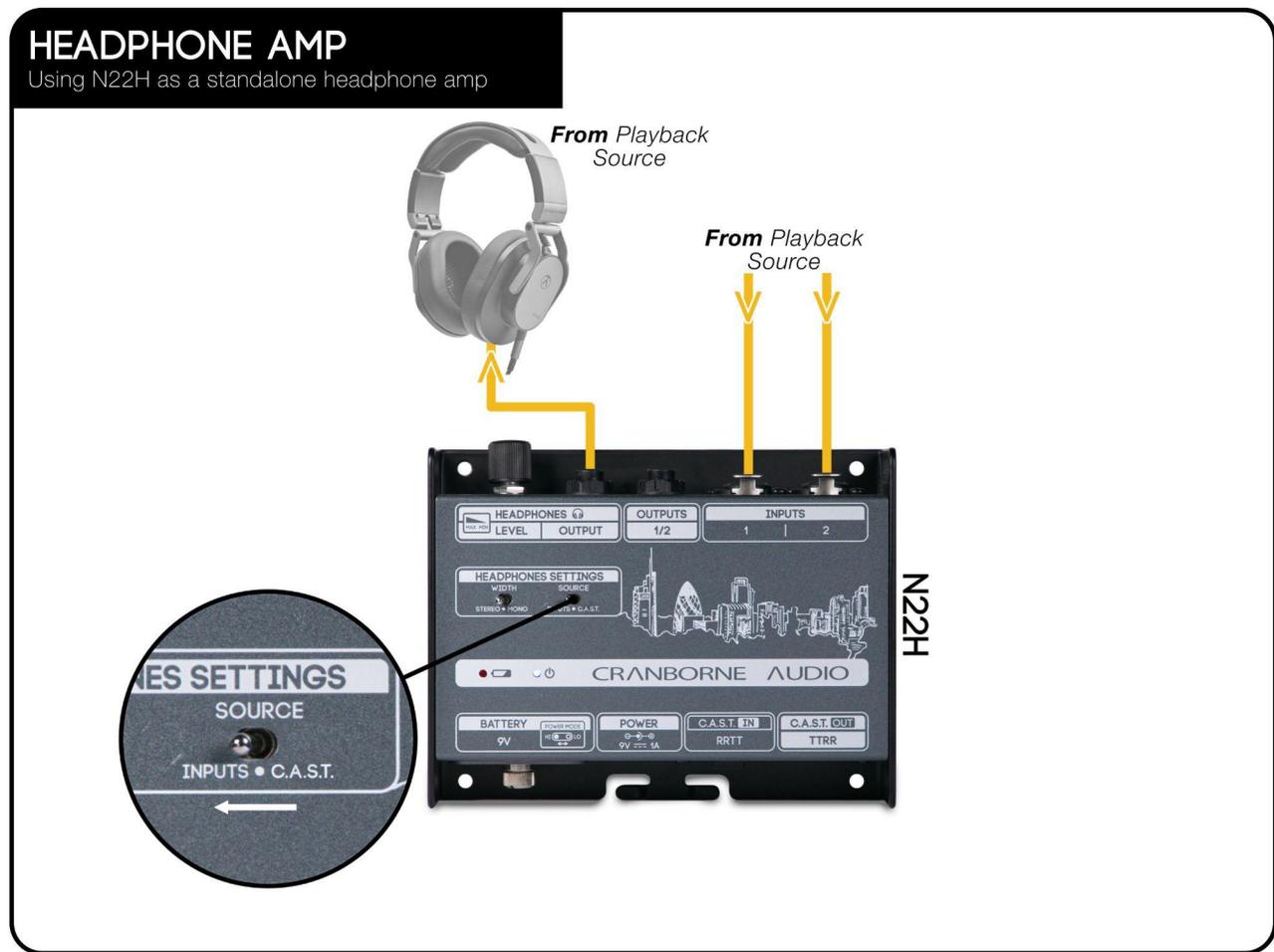
Both the battery and external power supply can be connected to N22H at the same time without causing any damage to the internal circuitry - just like a guitar pedal. The Power Inlet **[11]** takes priority when connected to the mains and the internal battery will not drain when mains power is connected.

If you're operating with both Battery and External power supplies connected, when the Power Inlet **[11]** is removed, N22H will default back to Battery power seamlessly without any drop out of audio. The Power Inlet can then be reconnected and N22H will switch back to using external power without any drop out of audio.

**Note:**

***N22H does not support trickle-charging of rechargeable 9v batteries when installed. Rechargeable batteries will need to be removed in order to be charged.***

# Hardware Setup: Standalone Mode

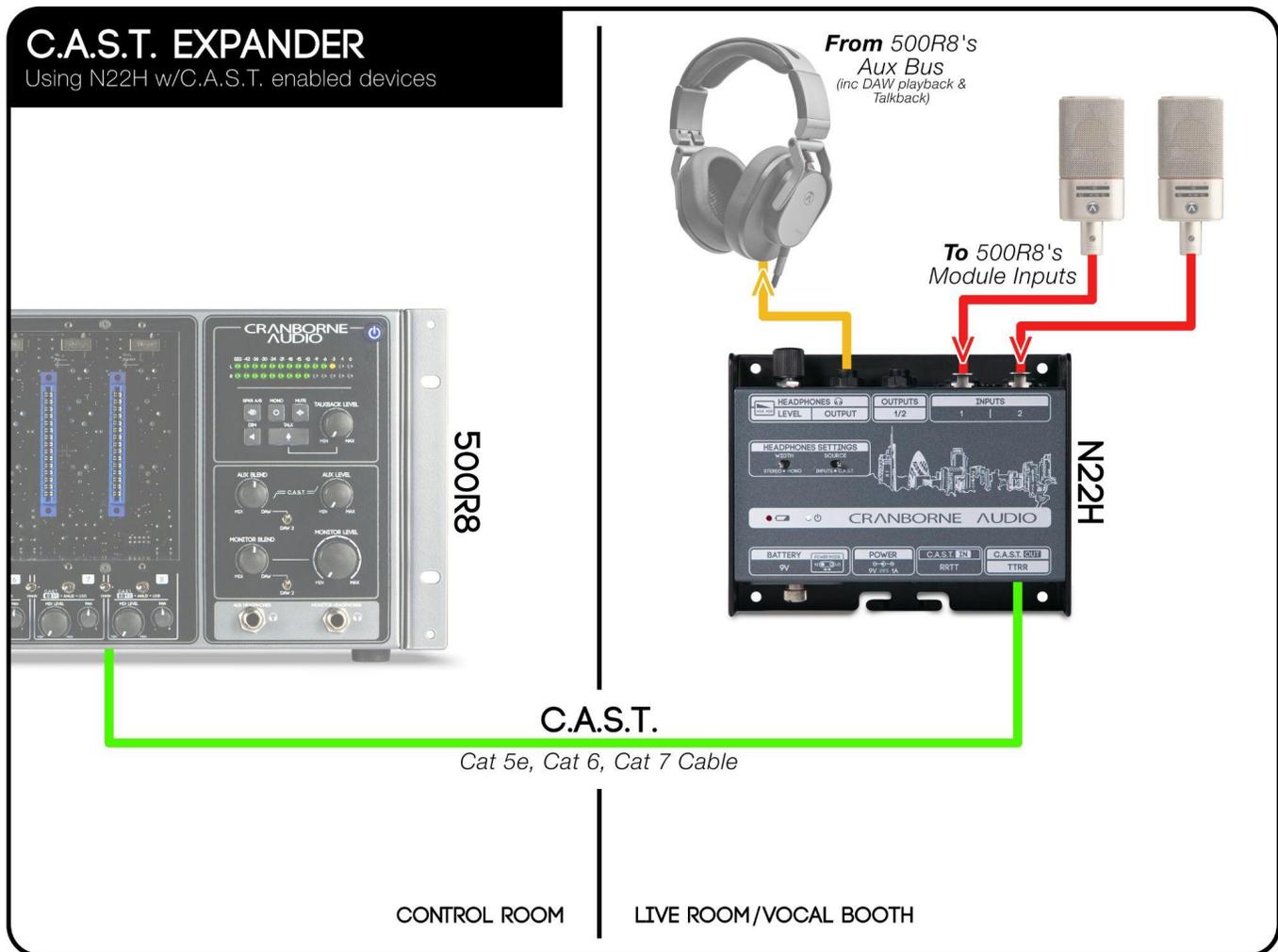


This hardware setup diagram will get N22H configured as a standalone, reference-quality headphone amplifier for use with audio interfaces, mixers, and other line-level sources.

- 1) Connect your stereo playback source from an audio interface or similar into N22H's combi jack inputs **[4]**.
  - i) For best performance, ensure that the playback source is a line-level output from an audio interface or preamp.
- 2) Select the 'Inputs' option using the Source Switch **[6]**.
- 3) Connect headphones to N22H's Headphones Output **[2]**.
  - i) If using battery power, the unit will power on automatically when headphones are connected.
  - ii) If using mains power, N22H will power on automatically when power is detected.

Once connected, stereo line sources passed into N22H's inputs will be sent directly through to the headphone amplifier for reference-grade monitoring. Adjust Headphone Level **[1]** to taste.

# Hardware Setup: C.A.S.T.



This hardware setup diagram will get N22H connected within a C.A.S.T.-enabled system.

- 1) Connect N22H's C.A.S.T. Output **[13]** to the C.A.S.T. Input of another C.A.S.T.-enabled device using shielded Cat 5e, Cat 6, or Cat 7 cable.
- 2) Connect balanced Mic/Line sources to the combi jack inputs **[4]** of N22H.
- 3) Select the 'C.A.S.T.' input option using the Source Switch **[6]**.
- 4) Connect headphones to N22H's Headphone Output **[2]**.
  - i) If using battery power, N22H will power on automatically when headphones are connected.
  - ii) If using mains power, N22H will power on automatically when power is detected.

Once connected, Mic/Line sources connected to N22H will travel through the C.A.S.T. connection and arrive at the inputs of the device for processing, whilst the mix created on the other C.A.S.T. device arrives at N22H's Headphone Output **[2]** for monitoring. Adjust the Headphone Level **[1]** to taste.

# Feature Overview

## Headphones Level Control [1]

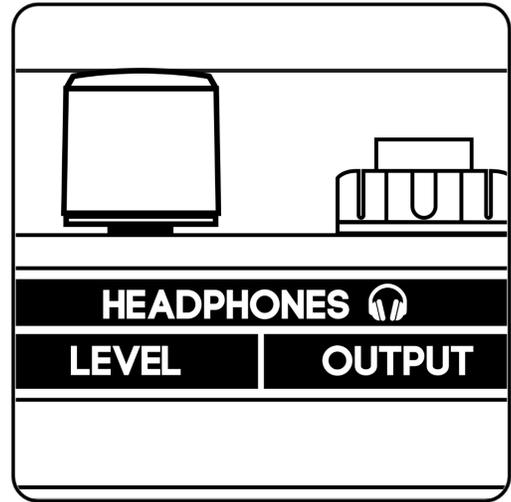
The Headphones Level Control [1] controls the overall level of N22H's Headphones Output. The level control features a steep curve that prevents gain bunching with high or low sensitivity headphones and allows for maximum resolution across the range of the pot's travel.



***Warning:***

***N22H's Headphone Output is extremely loud! Prolonged exposure to loud music can cause permanent hearing loss. Please exercise caution when using N22H and***

***reduce the Headphones Level Control [1] when listening for long periods of time.***



## Headphones Output [2]

The Headphones Output [2] is used for connecting headphones to N22H's headphone amplifier. The connection is made by a ¼" TRS connector that is found on popular professional and prosumer headphones. For consumer headphones or earbuds with smaller ⅛" connectors, you can connect a suitable adapter to convert the ⅛" jack to a larger ¼" jack.

Splitters and headphone extenders can be used with N22H but please exercise caution when connecting them to N22H as improper connections can cause damage to the unit or degrade N22H's headphone performance.

***Note:***

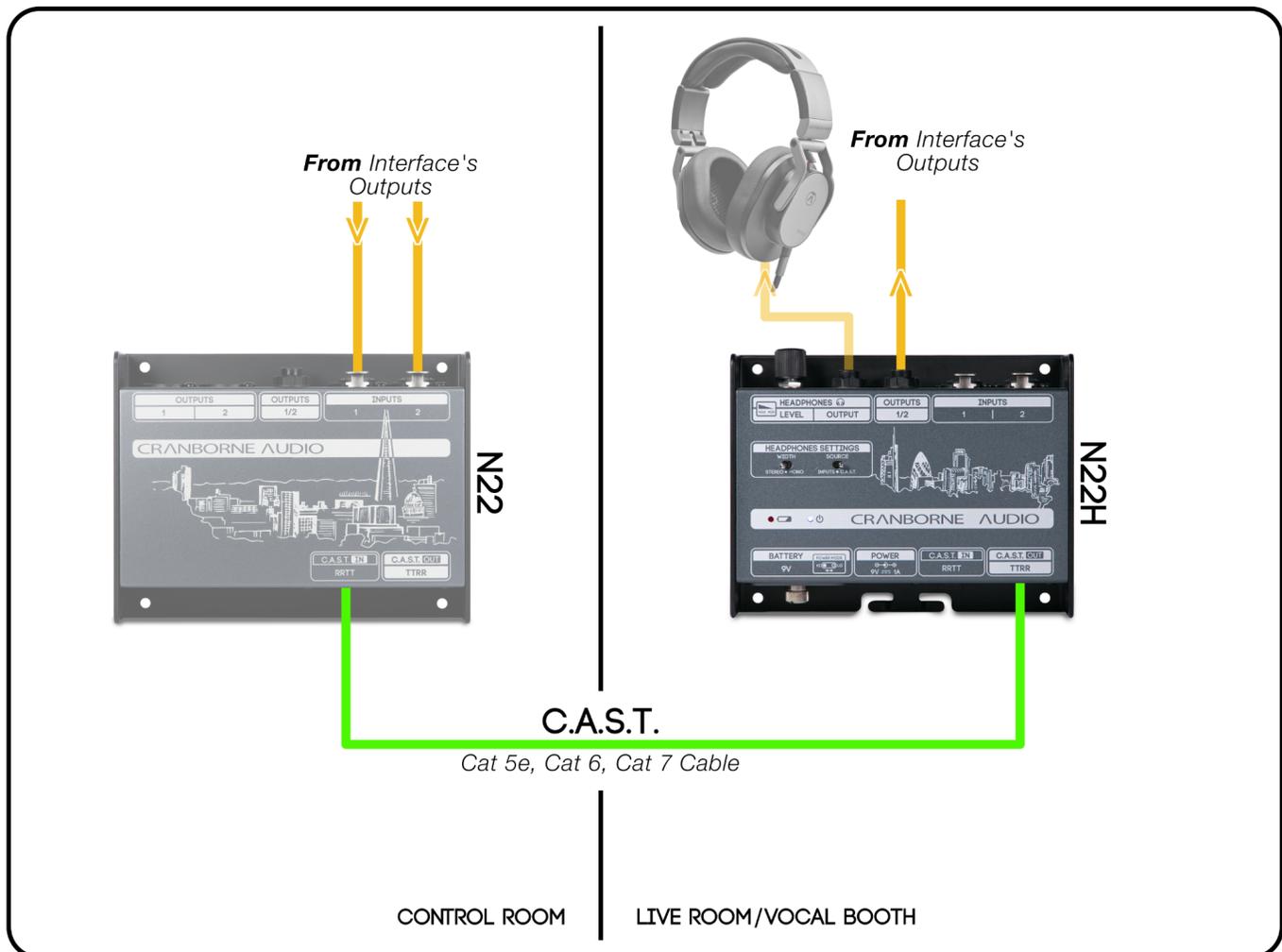
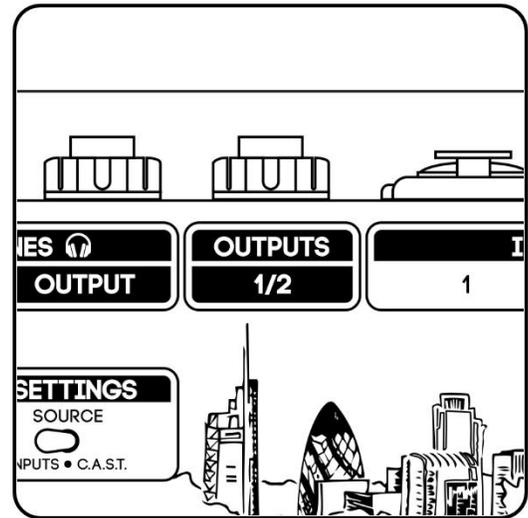
***Do not connect unbalanced ¼" TS cables such as guitar cables to N22H's Headphones Output. These connections could short the leg to ground and cause a spike in power consumption. Any damage caused to the unit as a result of unsupported connections is not covered under the Cranborne Audio warranty.***

## Outputs [3]

The Outputs [3] are TRS outputs that are used when N22H is connected via C.A.S.T. These outputs receive signal from the device connected at the other end of the C.A.S.T. system.

N22H's Outputs are always patched to the RR Input paths of the C.A.S.T. connectors for remote patching and other operations with C.A.S.T. enabled devices. They also work passively and so do not require N22H to be powered on to operate.

When the Source Switch [6] is set to 'C.A.S.T.', both the headphone amplifier and Outputs [3] of N22H receive the same signal from the C.A.S.T. system.



In the above diagram, the C.A.S.T. Output [14] of N22H is connected to the C.A.S.T. Input of an N22 using a shielded Cat 5e, Cat 6, or Cat 7 cable.

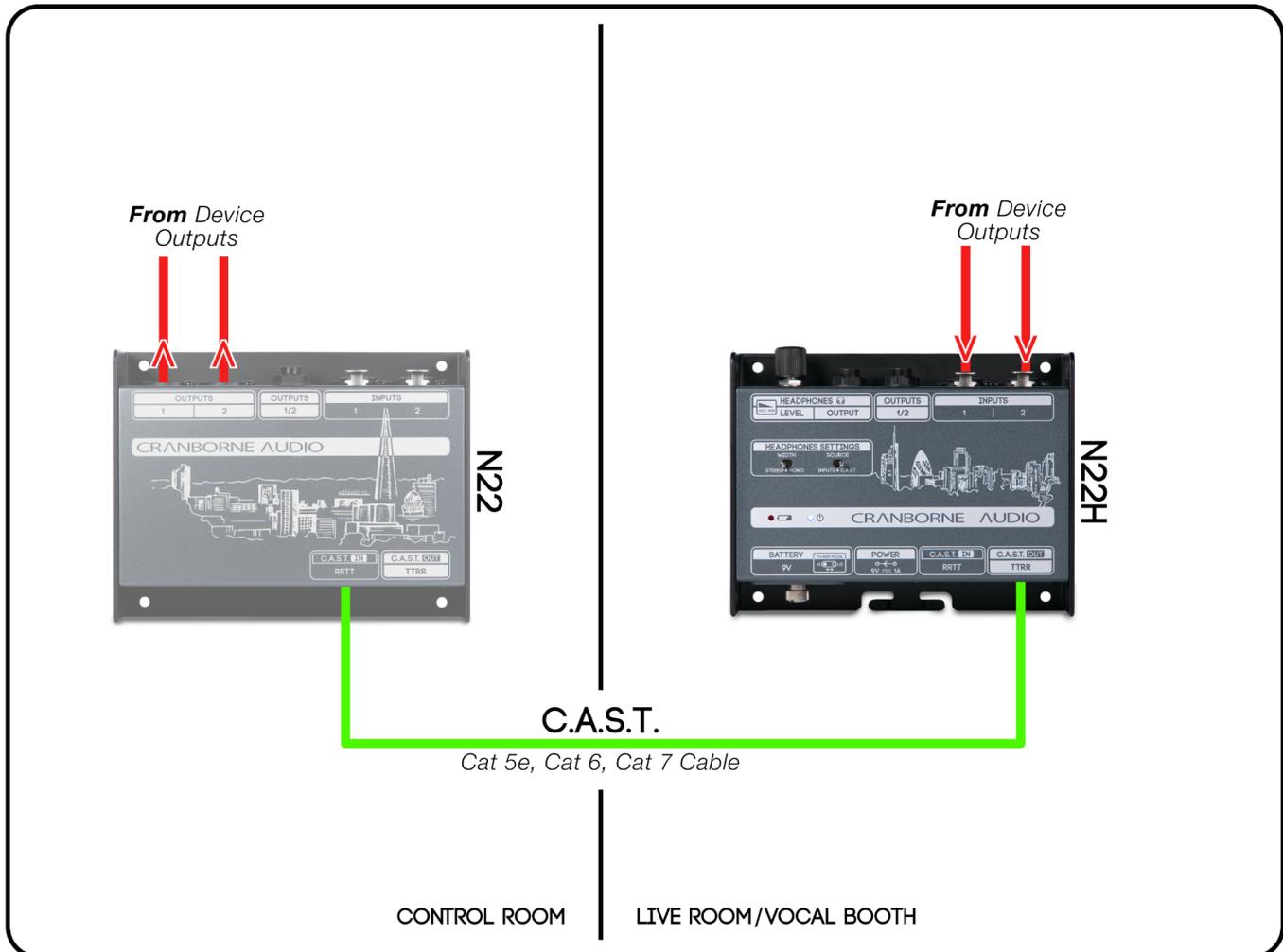
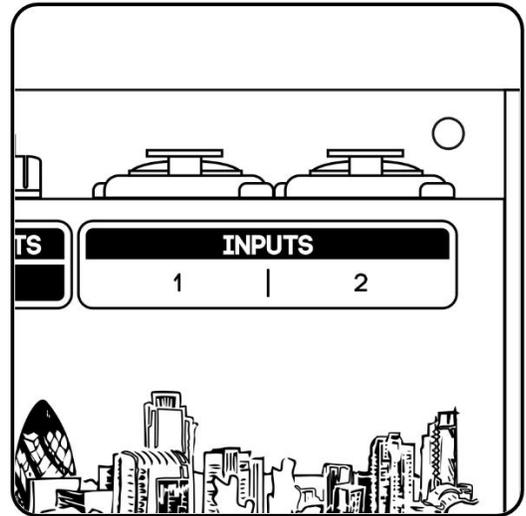
Audio connected to the inputs of N22 (or any other C.A.S.T. device) will arrive at N22H's Outputs [3] recording or patching elsewhere. N22H's Outputs can accept balanced mic/line signals as well as unbalanced line signals.

## Inputs [4]

The Inputs [4] on N22H are used to connect audio from an external device into the C.A.S.T. system or directly into N22H's headphone amplifier during standalone operation (when the Source Switch [6] is set to 'Inputs').

Devices connected to N22H's Inputs are always patched to the TT Output paths of the C.A.S.T. connectors for connectivity with other C.A.S.T.-enabled devices. The Inputs on N22H send into the C.A.S.T. system *passively* and do not require N22H to be powered on to operate.

N22H's Inputs accept balanced mic/line signals as well as unbalanced line signals from external devices. It can also safely pass 48v Phantom Power depending on the devices used in the system. ["Using C.A.S.T. with 48v Phantom Power"](#)



In the above diagram, the C.A.S.T. Output [14] of N22H is connected to the C.A.S.T. Input of an N22 using a shielded Cat 5e, Cat 6, or Cat 7 cable. Audio connected to the Inputs [4] of N22H (or any other C.A.S.T. device) will arrive at the connected N22's Outputs recording or patching elsewhere. N22H's Inputs can accept balanced mic/line signals as well as unbalanced line signals.

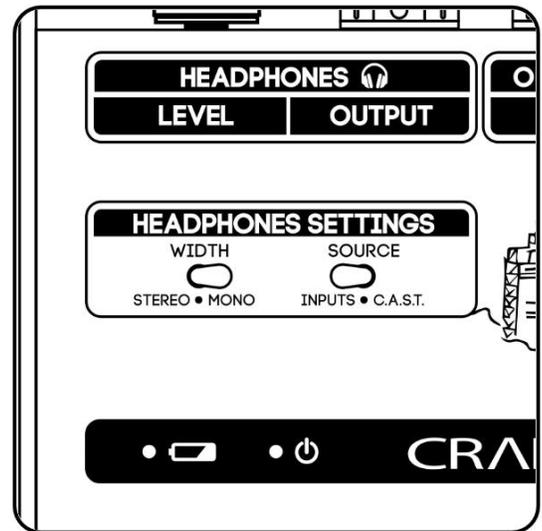
## Width Switch [5]

The Width Switch [5] toggles the stereo image of the Headphones Output between true Stereo and a Mono sum. This is useful for checking a mix for mono compatibility during mixing, or when recording musicians who prefer listening to a single headphone/earphone.

The Width Switch [5] only affects the Headphones Output [2] and not the physical outputs of N22H.

**Tip:**

**Switching the Headphones Output to Mono could be desirable if the performer prefers to only listen to one headphone/earphone when they are performing. For example, many singers prefer to only monitor through a single headphone/earphone so that they can better intonate during recording. Switching to Mono ensures that they will hear all of the stereo information through a single earphone.**



## Source Switch [6]

The Source Switch [6] determines the audio source for N22H's Headphone Amplifier for C.A.S.T. operation or standalone operation (when set to 'Inputs').

### C.A.S.T.

The Source Switch [6] should be set to C.A.S.T. when N22H is being used as part of a C.A.S.T. system. In this mode, the headphone amplifier will receive the audio signal incoming from C.A.S.T.

For example, if N22H's C.A.S.T. Output [13] is connected to a C.A.S.T. Input of a Cranborne Audio 500R8, N22H's headphone amplifier will monitor the Aux Mix and Talkback generated from the connected 500R8.

### INPUTS

The Source Switch [6] should be set to Inputs when N22H is being used as a standalone headphone amplifier without C.A.S.T. In this mode, the headphone amplifier will receive the audio signal incoming from the Inputs [4] of N22H.

For example, if N22H's Inputs are connected to a line-level output source such as a keyboard, mixer, or audio interface, switching the Source Switch [6] to Inputs allows the user to monitor those line sources directly.

**Tip:**

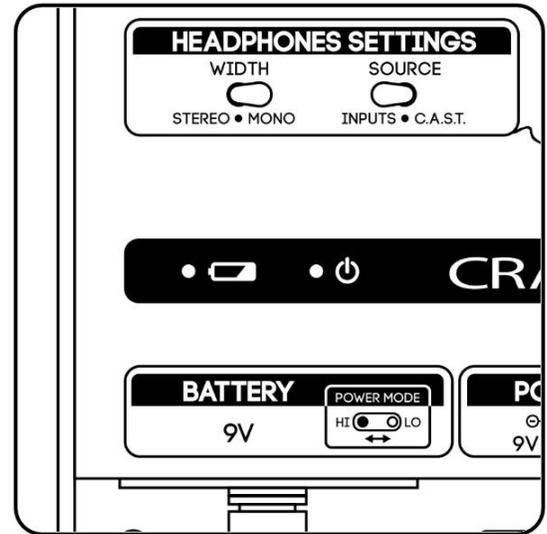
**The Source Switch [6] can be used to toggle between two different input sources connected to N22H at the same time. In a live application, if N22H's Inputs [4] are connected to the outputs of a keyboard and the C.A.S.T. Output is connected to an N22 and mixer downstream, the performer can monitor their own IEM monitor mix from C.A.S.T. or monitor the keyboard's output directly using the Source Switch.**

## Battery Low Indicator [7]

The Battery Low indicator [7] offers a visual indication of internal operating voltage. The LED lights up red when the internal voltage drops below **6.8v**.

With some batteries, it is possible that the LED may flicker when the voltage is on the 6.8v threshold.

The Battery Low Indicator can also light up when N22H is powered by an external 9v power source via the Power Inlet [11] and the voltage requirements of the connected headphones are too great. In these circumstances, reducing the volume will prevent the power rails dropping and improve sonic performance.



### **Note:**

**Actual remaining battery performance once the Battery Low Indicator is lit up may vary depending on the battery type being used and its voltage performance. Some 9v batteries can drop quickly below 6.8v and remain in use for a long time, whilst others can stay above 6.8v for extended periods and then drop suddenly. Please see our ["Real World Battery Tests"](#) for more information on real-world battery tests.**

## Power Indicator [8]

The Power Indicator [8] lights Blue when N22H is Powered On and ready for use.

When N22H is powered via an external power source via the Power Inlet [11], the Power Indicator will light up indicating N22H is Powered On until the Power supply is switched off.

When N22H is powered via an internal 9v Battery, the Power Indicator will light up Blue indicating N22H is Powered On only when headphones are inserted into the Headphones Output [2]. The Power Indicator will turn off when headphones are removed from the Headphones Output.

## Power Mode Switch [10]

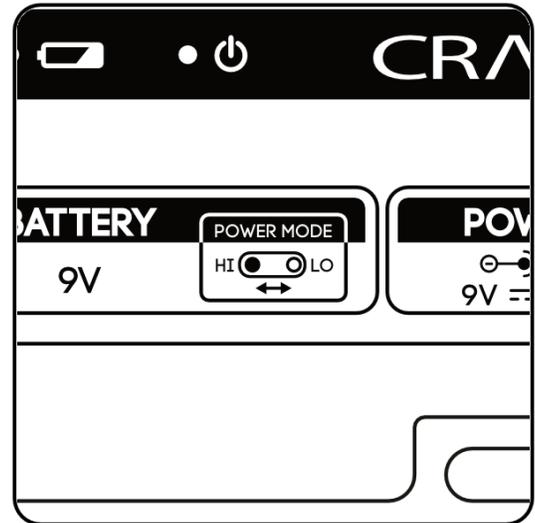
The Power Mode Switch [10] is accessible from underneath the Battery Compartment [9] and toggles the internal Power Mode of N22H's headphone amplifier between Maximum Performance (High Power Mode) and Maximum Battery Life (Low Power Mode). Each power mode also offers specific optimisations between best performance for high-impedance headphones and low-impedance headphones.

### Low Power Mode

Low Power Mode optimises N22H to achieve the longest battery life and optimum volume range when using low-impedance headphones and earphones. When engaged, N22H's current consumption is approximately 30mA idle (80mA peak) and you can achieve ~8+ hours of battery life.

### High Power Mode

High Power Mode optimises N22H to achieve the highest headroom and maximum volume when using high-impedance headphones and earphones. When engaged, N22H's current consumption is approximately 110mA idle (390mA peak) and you can achieve ~2 hours of battery life.



**Note:**

**Actual battery life will vary depending on battery type being used, headphone impedance/sensitivity, source material and it's frequency content, as well as overall headphone volume.**

### Changing Power Modes

First, make sure any headphones are disconnected from N22H, the Headphones Level Control [1] is reduced to minimum, and the Power Inlet [11] is disconnected.

Remove the Battery Cover [9] by twisting the spring-loaded thumb screw anticlockwise and remove the cover. Use a fingernail, guitar pick, or the botched edge of the battery cover to move the Power Mode switch to the correct position. Once the desired Power Mode is selected, ensure the Battery wires are hidden away inside N22H, refit the Battery Cover and tighten the thumb screw.

**Warning:**

**Do not change the Power Mode whilst N22H is Powered On and in use. Please follow the safe sequences above carefully in order to prevent any unwanted pops or power spikes causing damage to N22H or downstream audio components including speakers and headphones. Any damage caused to the unit as a result of unsupported procedures is not covered under the Cranborne Audio warranty.**



## Power Inlet [11]

The Power Inlet [11] on N22H is required to power N22H from the mains when battery power is not required. N22H can be powered using the supplied power adapter, or any compatible 3rd party power source commonly used for guitar pedals including multi-output isolated supplies.

**Power Requirements** - 9v, DC, 500mA (min), 2.1mm barrel connector, centre-negative polarity.



## C.A.S.T. Input [12]

The C.A.S.T. Input [12] is used to connect N22H to the C.A.S.T. Output of another C.A.S.T.-enabled device.

The single C.A.S.T. connector transports 4 channels of balanced analogue audio in both directions (2-In, 2-Out) and each path is labelled as either a 'Receive' path (for signals *received* by N22H) or 'Transmit' path (for signals *transmitted* from N22H).

**Note:**

**The C.A.S.T. Input [12] comes shipping with a plastic RJ45 blocker to ensure that it is not accidentally connected to the common C.A.S.T. Input on 500R8 and 500ADAT rack. This blocker should only be removed when N22H is to be connected to another device's C.A.S.T. Output.**



C.A.S.T. Input (RRTT)			
Receive (R)	Receive (R)	Transmit (T)	Transmit (T)
To Output 1 To HP Output L	To Output 2 HP Output R	From Input 1	From Input 2

## C.A.S.T. Output [13]

The C.A.S.T. Output [13] is used to connect N22H to the C.A.S.T. Input of another C.A.S.T.-enabled device.

The single C.A.S.T. connector transports 4 channels of balanced analogue audio in both directions (2-In, 2-Out) and each path is labelled as either a 'Receive' path (for signals *received* by N22H) or 'Transmit' path (for signals *transmitted* from N22H).

C.A.S.T. Output (TTRR)			
Transmit (T)	Transmit (T)	Receive (R)	Receive (R)
From Input 1	From Input 2	To Output 1 To HP Output L	To Output 2 HP Output R

# C.A.S.T

## Cable Requirements

C.A.S.T. is a system that we use to transport balanced, analogue audio using standard network cabling. Using a shielded Cat 5e, Cat 6, or Cat 7 cable instead of 4 XLRs allows you to not only reduce cable spaghetti in your studio but also distribute audio around studios or stages using affordable, readily available cabling whilst achieving the highest sonic results

Each C.A.S.T. connection on a Cranborne Audio product features unique optimisation to ensure that the maximum signal integrity is transmitted over shielded Cat 5, Cat 6, and Cat 7 cables for distances of up to 100m(330ft) without high-end roll-off and with very low-crosstalk.

### C.A.S.T. CABLE REQUIREMENTS

Minimum Requirements For C.A.S.T. Cabling

**Minimum Requirement:**  
*Shielded Cat 5e*

**Recommended:**  
*Cat 7*

**Cat 7**  
*Separate shield per Twisted Pair*

**Unshielded Connectors**

**Shielded Connectors**

**Recommendation** - For best possible performance over maximum distances, we recommend using **Cat 7** cables with robust connectors to ensure that the C.A.S.T. connection is secure and will remain impervious to RF and crosstalk.

**Minimum Requirement** - As a minimum requirement, you can consider using Shielded Cat 5e or Cat 6 cabling provided that the cables and connectors themselves are fully shielded and are not needed at distances above 20m.

**Note:**

**Many Cat 7 cables are marketed as Cat 7 but feature plastic connectors on either end. In order for C.A.S.T. to work correctly, the cable as well as the connectors themselves need to be shielded. Cables with incorrect shielding will not perform as expected and 48v Phantom Power will not pass through correctly. Any damage caused to the unit as a result of unsupported cabling is not covered under the Cranborne Audio warranty.**

## C.A.S.T. Wiring

Below is the wiring table that is used in both TTRR Output and RRTT Input paths of C.A.S.T. Using this diagram, you are able to create your own C.A.S.T devices if desired.

TTRR		RRTT	
Pin	Signal	Pin	Signal
1	C.A.S.T. IN 1-	1	C.A.S.T. OUT 1-
2	C.A.S.T. IN 1+	2	C.A.S.T. OUT 1+
3	C.A.S.T. IN 2-	3	C.A.S.T. OUT 2-
4	C.A.S.T. OUT 1-	4	C.A.S.T. IN 1-
5	C.A.S.T. OUT 1+	5	C.A.S.T. IN 1+
6	C.A.S.T. IN 2+	6	C.A.S.T. OUT 2+
7	C.A.S.T. OUT 2-	7	C.A.S.T. IN 2-
8	C.A.S.T. OUT 2+	8	C.A.S.T. IN 2+

**Note:**

**Any equipment designed by users or 3rd parties that supports C.A.S.T. that has not had our direct involvement cannot be guaranteed to work to our exacting specifications and could suffer a loss in signal quality. Any damage caused to the unit as a result of unsupported cabling made by the user is not covered under the Cranborne Audio warranty.**

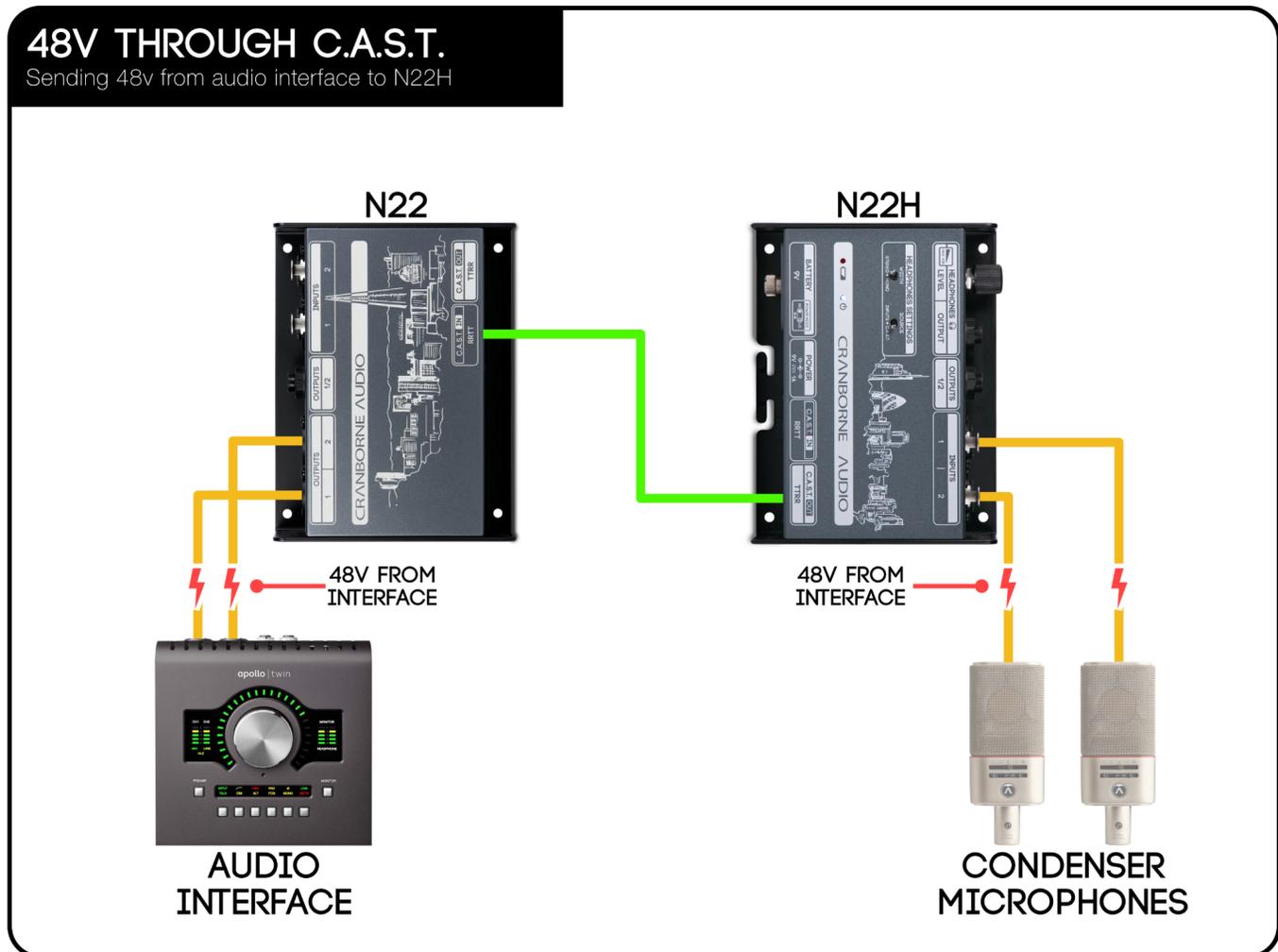
## C.A.S.T. Warnings

C.A.S.T. is designed to be a simple, plug and play solution for total cable management however there are a number of warnings that you should heed in order to prevent causing damage to your Cranborne Audio product or instrument/device connected to each end.

<b><i>Do NOT connect a C.A.S.T. device to your home network or router</i></b>	C.A.S.T. is a point-to-point connection and can not be used on any network hardware of any kind.  The voltages that pass through C.A.S.T. including 48v phantom power is easily high enough to cause <i>permanent</i> damage to home routers or computers.
<b><i>Only connect C.A.S.T. Outputs to Input and Vice Versa</i></b>	Connecting a C.A.S.T. Input to another C.A.S.T. Input can cause irreparable damage to microphones, speakers, and Cranborne Audio gear.
<b><i>Ensure the Cat 5e, Cat 6, and Cat 7 cable used is fully shielded</i></b>	C.A.S.T. 's performance is limited when non-shielded cables are used and 48v will not work through a cable that is not fully shielded.
<b><i>Ensure that all breakout panels/through connectors are also fully shielded</i></b>	If you have RJ45 patch points on the wall of your studio, please ensure the connectors and internal cabling is fully shielded.

## Using C.A.S.T. with 48v Phantom Power

All connections on N22H supports 48v Phantom Power from upstream equipment for powering DI boxes or condenser microphones. C.A.S.T. itself does not generate 48V, but it is able to pass 48V power from a connected device, through the shielded Cat 5e, Cat 6, or Cat 7 cable, and directly to the XLR on the other end - just like a normal analogue snake.



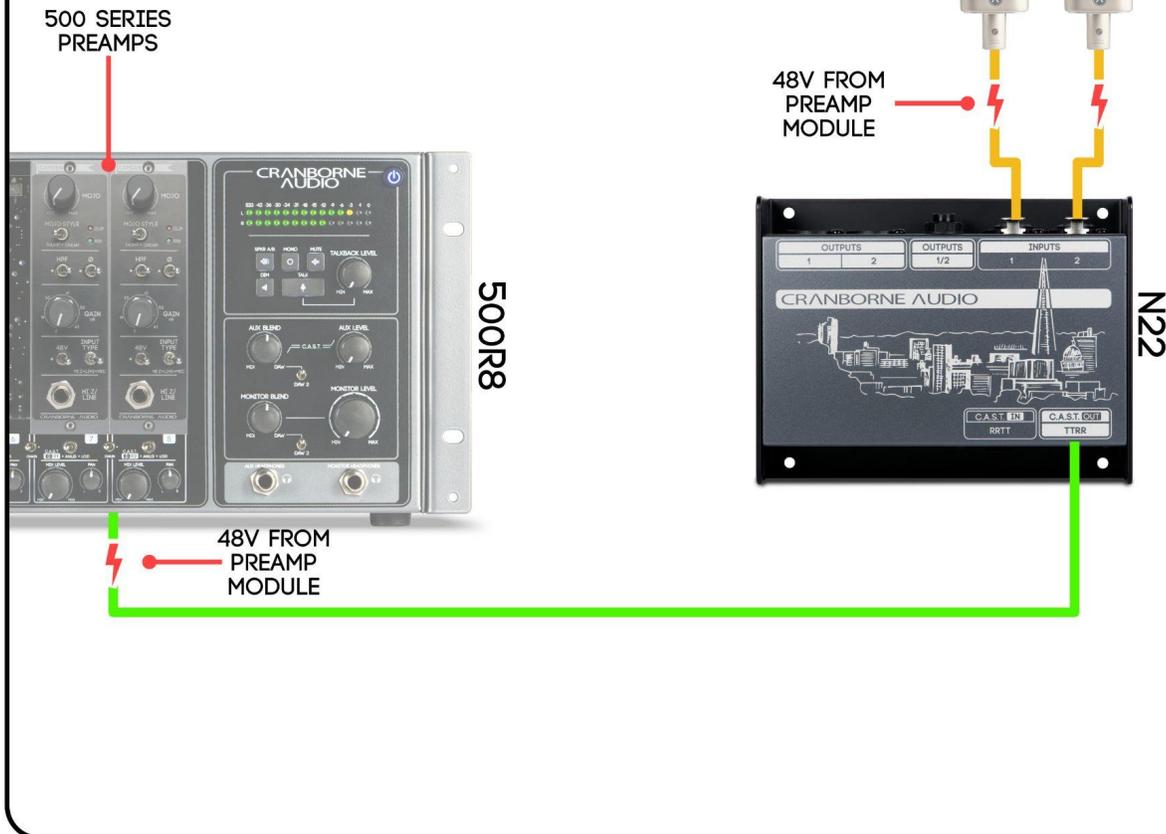
In the above diagram, N22H is connected to an N22 as a remote stagebox via C.A.S.T. with an audio interface or 3rd party preamp with full 48v Phantom Power support.

1. Connect the XLR Outputs of N22 to your audio interface's preamp inputs.
2. Connect the C.A.S.T. Output of the N22 to the C.A.S.T. Input **[12]** of N22H using shielded Cat 5e, Cat 6, or Cat 7 cable.
3. Connect your DI box or condenser microphone to N22H's Inputs **[4]**.
4. Engage 48v from your interface/preamp and adjust the gain to match your source.

Now you can now record all signals connected to N22H's input as normal as though they are connected via a single XLR cable.

## 48V THROUGH C.A.S.T.

Sending 48v from 500R8 to N22



In the above diagram, N22H is connected to a 500R8 as a remote stagebox via C.A.S.T. with full 48v Phantom Power support.

1. Connect the C.A.S.T. Output of N22H to the C.A.S.T. Input of 500R8/500ADAT.
2. Set the source switch of 500R8/500ADAT to receive C.A.S.T.
3. Connect your DI box or condenser microphone to N22H's Inputs [4].
4. Engage 48v on the preamps installed into 500R8/500ADAT and adjust preamp Gain and settings to suit the source.

Now you can now record all signals connected to N22H's input as normal as though they are connected via a single XLR cable.

### **Note:**

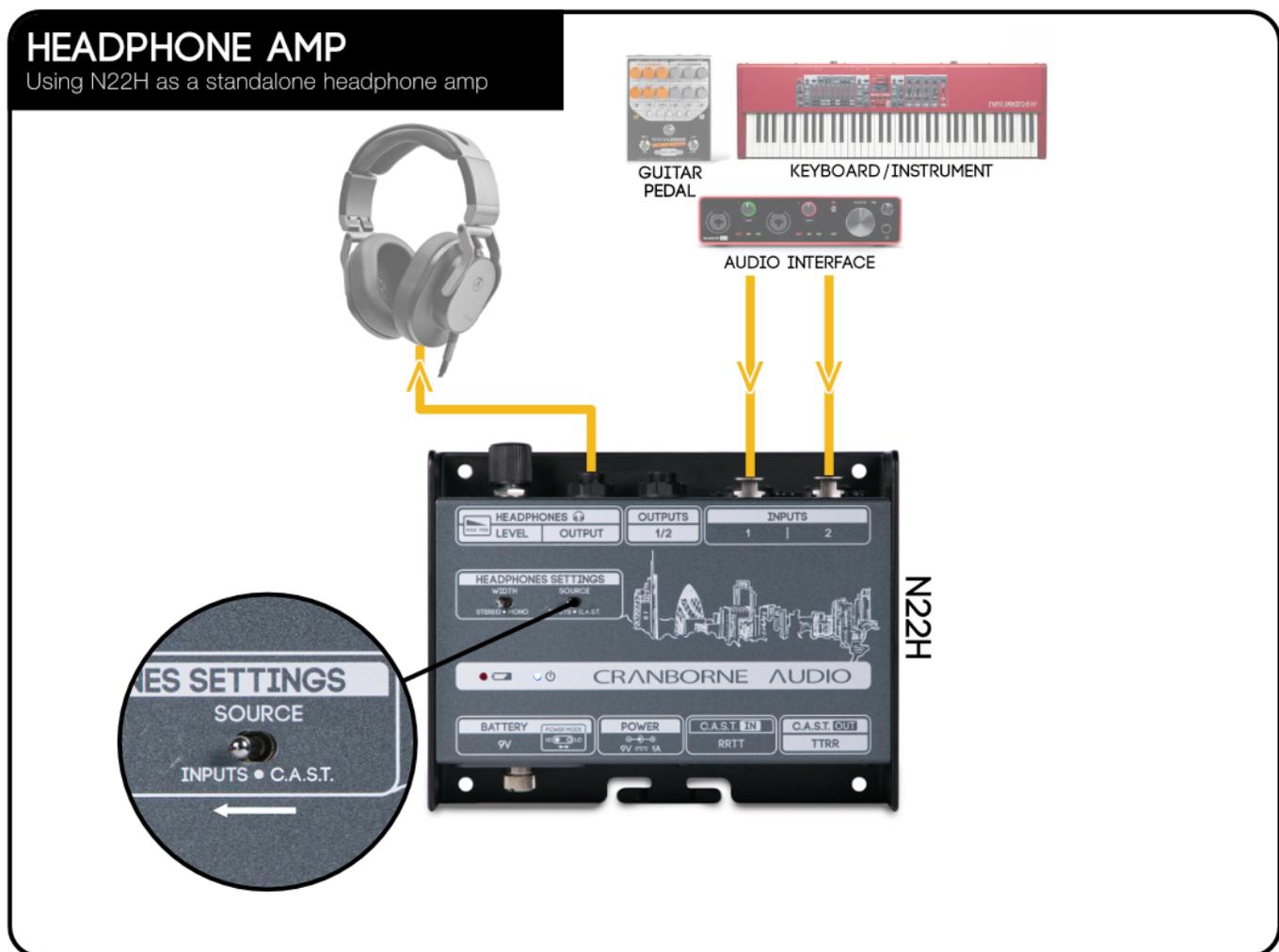
**Please ensure that C.A.S.T. Outputs are connected to C.A.S.T. inputs of the next device and vice versa. Mismatching connections and connecting Inputs to Inputs or Outputs to Outputs C.A.S.T. can cause serious harm to downstream equipment - especially when using 48v Phantom Power. Any damage caused to the unit as a result of unsupported connections is not covered under the Cranborne Audio warranty.**

# Application Guides

## Standalone Reference-Grade Headphone Amplifier

Even without using C.A.S.T., you can still use N22H as your new standalone, reference headphone amplifier in the studio or on stage whilst benefiting from its superior performance. You can connect N22H to devices such as mixing consoles, audio interfaces, keyboards, CD players, 500 series racks, outboard hardware - any device with line-level outputs.

You can also use unbalanced connections such as from guitar pedalboards and FX processors. However, please ensure the level is line-level for maximum volume and best performance.



This hardware setup diagram will get N22H configured as a standalone, reference-quality headphone amplifier.

1. Connect your stereo playback source from an audio interface or similar into N22H's combi jack inputs **[4]**.
  - i. For best performance, ensure that the playback source is a line-level output from an audio interface or preamp.

2. Select the 'Inputs' option using the Source Switch **[6]**.
3. Connect headphones to N22H's headphone output **[2]**.
  - i. If using battery power, the unit will power on automatically when headphones are connected.
  - ii. If using mains power, N22H powers on automatically when power is detected.

Once connected, stereo line sources passed into N22H's inputs will be sent directly through to the headphone amplifier for monitoring. Adjust headphone level **[1]** to taste.

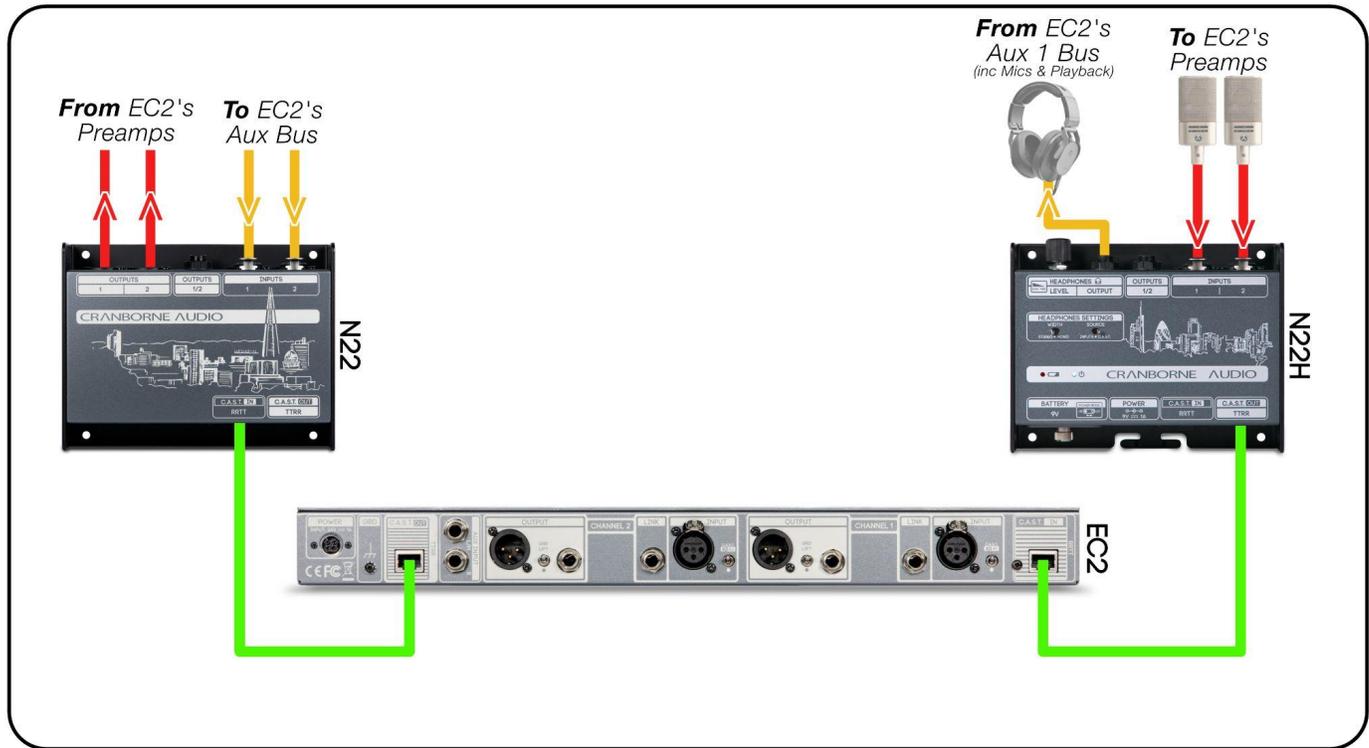
Using N22H instead of the headphone outputs of your interface allows you to upgrade the headphone monitoring quality of your existing setup and benefit from more power and higher clean volume with a wider range of headphones.

**Note:**

***Connecting N22H to the headphone port of another device such as a computer will work however the technical performance of N22H cannot be guaranteed and the amount of level available will vary depending on the device being used.***

# Using N22H with Camden EC2

C.A.S.T. comes alive when you start to pair it with other Cranborne Audio products. Products such as Camden EC1/EC2 and 500R8/500ADAT are all designed to facilitate deep integration into the C.A.S.T. system for useful routing around your studio space.



This hardware setup diagram will get N22H connected within a C.A.S.T. enabled system alongside a Camden EC2 and a passive N22 breakout box for advanced remote recording and monitoring possibilities.

## Connecting N22H to Camden EC2

1. Connect N22H's C.A.S.T. Output [13] to the C.A.S.T. Input on Camden EC2 using a shielded Cat 5e, Cat 6, or Cat 7 cable.
  - i. **Note: A fully shielded connector is required in order to pass 48v correctly.**
2. Connect Camden EC2's C.A.S.T. Output to the C.A.S.T. Input on N22 using a shielded Cat 5e, Cat 6, or Cat 7 cable.
3. On N22H, set the Source Switch [6] to C.A.S.T. and connect your headphones to the Headphone Output [2].
  - i. If using battery power, the unit will power on automatically when headphones are connected.
  - ii. If using mains power, N22H powers on automatically when power is detected.
4. On Camden EC2, set the rear panel Source Switches for each Preamp to C.A.S.T. to enable Camden EC2's preamps to receive their input via the C.A.S.T. connection.
5. Connect balanced Mic/Line sources to either of N22H's Inputs [4]

- i. If you'd like to connect an instrument, you will need to either use a DI Box, or connect an instrument directly to Camden EC2's Hi-Z DI Input.

You can then apply preamp Gain, HPF, Polarity, and other preamp functions using Camden EC2.

6. Create a monitor mix using the Aux 1 level controls on Camden EC2.
  - i. The Ch 1 Lvl control corresponds with the first preamp and source connected to N22H's Input 1.
  - ii. This mix will then be sent through C.A.S.T. and to the Headphone output on N22H.

With this setup, you are able to position Camden EC2 in your control room and use N22H in the live room/vocal booth as a remote stagebox for your artist to connect their microphones and headphones.

### **Adding N22 To The System**

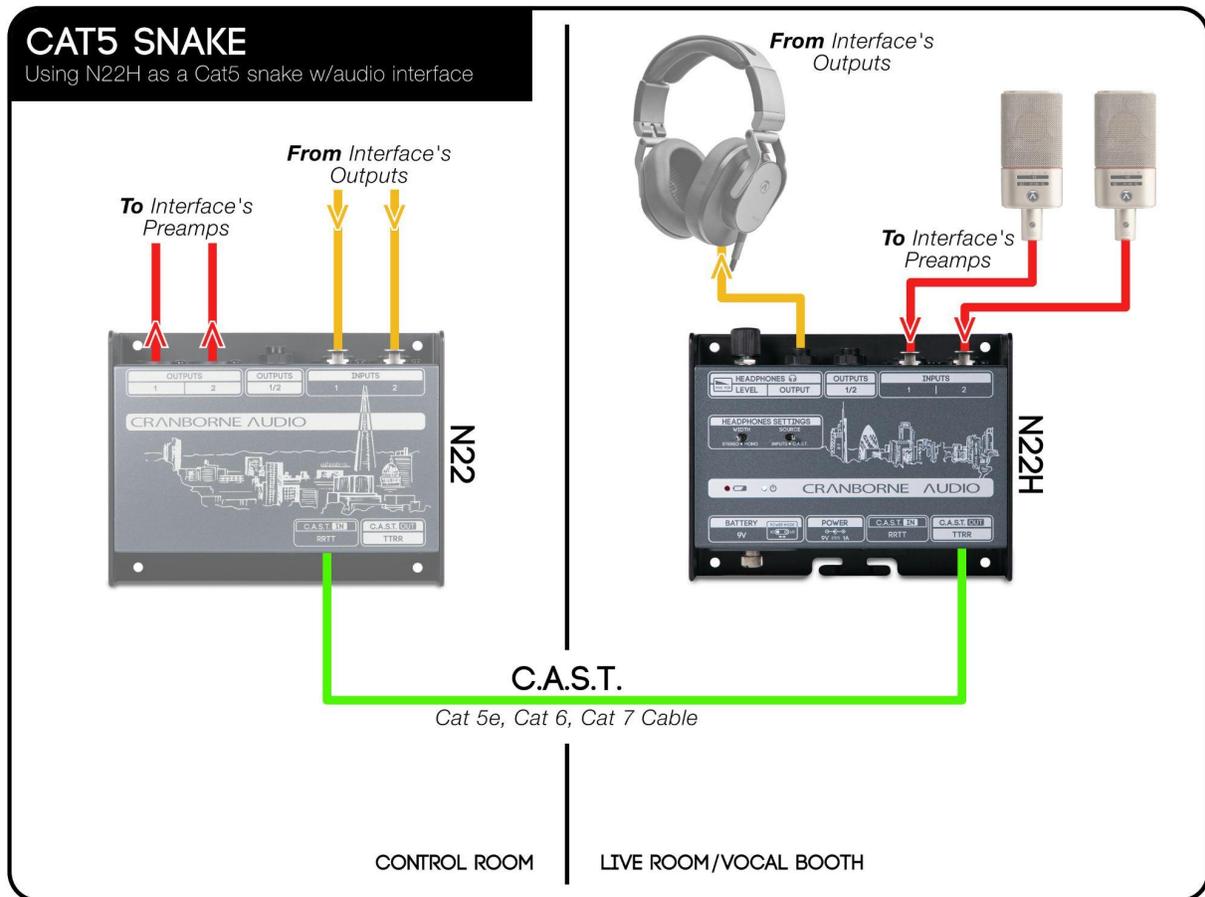
Next, we will connect an N22 to the C.A.S.T. system to enable even more remote mixing possibilities.

7. Connect Camden EC2's C.A.S.T. Output to the C.A.S.T. Input on N22 using a shielded Cat 5e, Cat 6, or Cat 7 cable.
8. Connect the outputs of N22 to the inputs of your recording device.
  - i. Output 1 = Camden EC2's Channel 1 output
  - ii. Output 2 = Camden EC2's Channel 2 output
9. Connect the outputs of your recording device to N22's inputs. These connections are sent through C.A.S.T. and to Camden EC2's Aux In/C.A.S.T. level control.
  - i. Input 1 = Camden EC2's Aux Input L
  - ii. Input 2 = Camden EC2's Aux Input R

You can then send a click track, backing track, or similar from your recording device and that audio signal will pass from through N22, into Camden EC2, and then onwards to N22H's headphone output. At the same time, sources connected to N22H will pass through Camden EC2, to N22's outputs, and then onwards to the recording device's inputs for recording.

Both C.A.S.T. connections can be 100m long and enables the user to position each device where it is needed in the studio or live space for more flexible recording in the studio, on stage, or on location.

# Remote Monitoring With N22H and N22



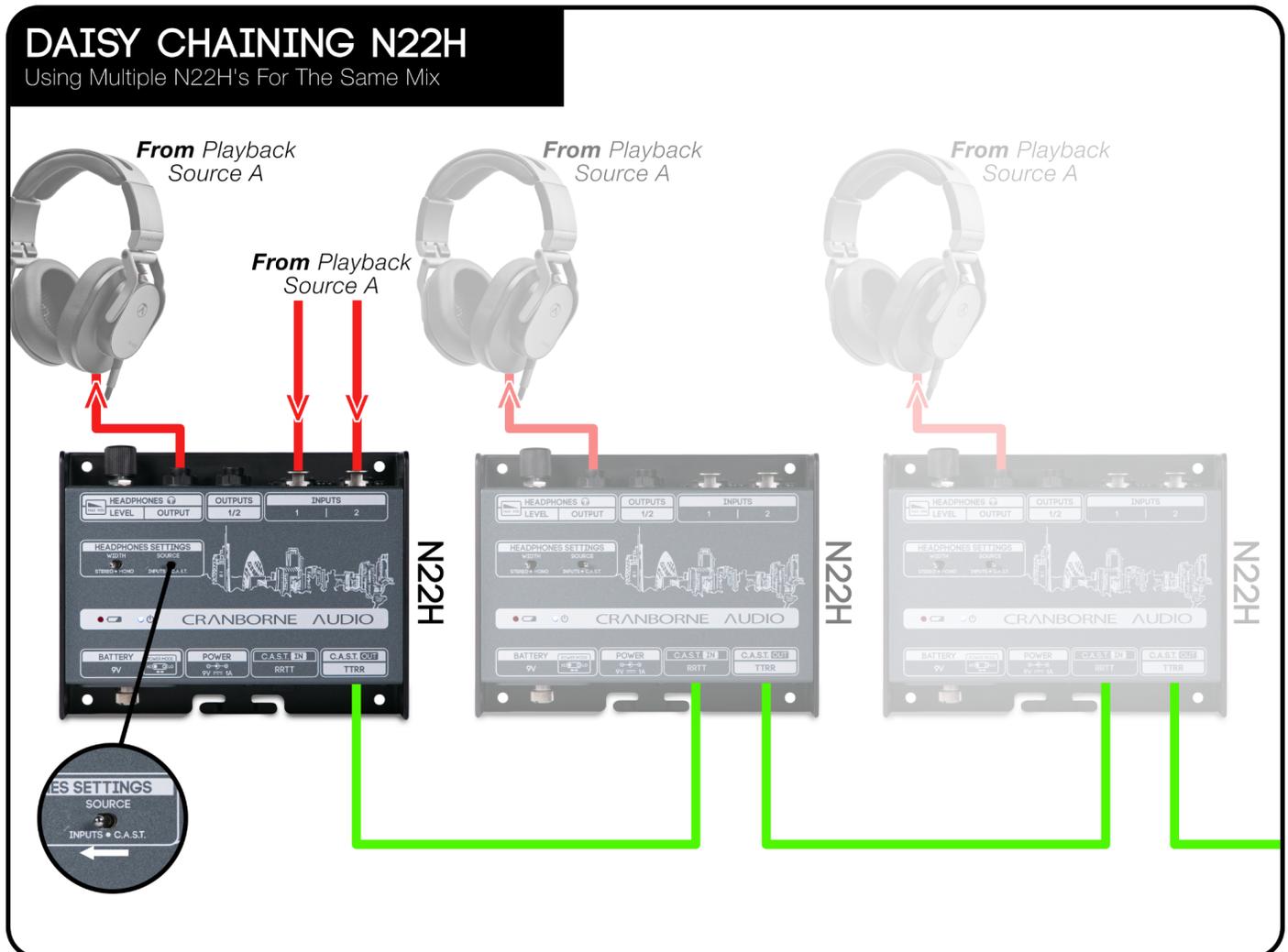
This hardware setup diagram will get N22H connected to a passive N22 for advanced remote headphone monitoring and stagebox connectivity.

- 1) Connect N22H's C.A.S.T. Output **[13]** to the C.A.S.T. Input of N22 using shielded Cat 5e, Cat 6, or Cat 7 cable.
  - i) A fully shielded connector is required in order to pass 48v correctly.
- 2) Connect balanced Mic/Line sources to the combi jack inputs **[4]** of N22H.
- 3) Select the 'C.A.S.T.' input option using the Source Switch **[6]**.
- 4) Connect headphones to N22H's headphone output **[2]**.
  - i) If using battery power, the unit will power on automatically when headphones are connected.
  - ii) If using mains power, N22H powers on automatically when power is detected.
- 5) Connect the XLR outputs of N22 to the Preamp Inputs of your recording device or Audio interface.
- 6) Connect the Input of N22 to the line outputs of your recording device or Audio interface.

Once connected, mic/line sources connected to N22H will travel through the C.A.S.T. connection and arrive at the inputs of the device for processing whilst the mix created on the other C.A.S.T. device travels directly to N22H's headphone output for monitoring. Adjust headphone level **[1]** to taste.

# Daisy Chaining N22H

Multiple N22H's can be easily daisy chained in order to send the same mix to multiple headphone outputs. This is especially useful for live streaming, radio stations, and other broadcast situations where multiple people need to listen to the same source.



This hardware setup diagram will get several N22H's connected in a daisy chain for easy headphone sharing and monitoring.

- 1) Connect the line output of your playback source into the Inputs **[4]** of the 1st N22H
  - i) Set the Source Switch **[6]** of the 1st N22H to Inputs
- 2) Connect C.A.S.T. Output **[13]** of the 1st N22H to the C.A.S.T. Input of the next N22H using shielded Cat 5e, Cat 6, or Cat 7 cable.
  - i) Set the Source Switch **[6]** of the 2nd N22H to C.A.S.T.
- 3) Connect C.A.S.T. Output **[13]** of the 2nd N22H to the C.A.S.T. Input of the next N22H using shielded Cat 5e, Cat 6, or Cat 7 cable.
  - i) Set the Source Switch **[6]** of the 3rd N22H to C.A.S.T.

You can safely connect up to 4 N22H in this format before you may begin to hear extra distortion and frequency roll off due to the impedance being halved each time a unit is added.

# Real-World N22H Battery Life Tests

Below are some tests that we run during development when optimising the Battery life performance of N22H. It is worth noting that it is easy to make *any* headphone amp last a long time under battery power - wireless IEM beltpacks have been doing this for years, but it is very difficult to power a reference-grade headphone amp with performance N22H using battery power!

Actual battery life will vary depending on battery type being used, headphone impedance/sensitivity, source material and it's frequency content, as well as overall headphone volume.

## Audio Technica ATH-M50x (38Ω)

*Playing program material at maximum level*

**High Power Mode** - 1h = Battery Low Indicator, 2h = Unit Off  
*Energizer Max Battery*

**Low Power Mode** - 8h 10m = Battery Low Indicator, 10h 25m = Unit Off  
*Energizer Max Battery*

## Shure SE215 (17Ω)

*Playing program material at maximum level*

**High Power Mode** - 45m = Battery Low Indicator, 1h 44m = Unit Off  
*Duracell Plus Battery*

**Low Power Mode** - 7h = Battery Low Indicator On, 9h = Unit Off  
*Duracell Plus Battery*

## Battery Performance

During our testing, we found varying performances from high-street battery brands. Even two of the same battery from the same pack lasted different amounts of times! In our research we found that all batteries exhibit different behaviors when it comes to power delivery over time.

Some maintain close to 9v for a long time and then drop suddenly, others drop quickly at the start and then maintain performance for a long time below the 6.8v Battery Low indicator threshold. This means that predicting actual battery life performance is very difficult!

Rechargeable batteries didn't offer the longest battery life, however they were by far the most predictable in terms voltage drop off over time so these may be a good option if battery power is a common requirement

# Technical Specifications

All specifications are typical performance unless otherwise noted. All specifications are subject to change at any time. Tested with Audio Precision APx555.

## Headphone Amplifier (High Power Mode)

Test Signal Path	APx555 (Line Out) - Input 1-2 - Headphone Output - APx555 (Line In)
Max Input Level	+28dBu
Input Impedance	44 kOhms
Frequency Response	-0.5dB, <1.2Hz to >200kHz
	-1dB, <0.8Hz to >250kHz
THD	<0.0017% (-95dB) @ +20dBu, 1kHz, A-weighted, 300 Ohm load
	<0.0005% (-105dB) @ +6dBu, 1kHz, A-weighted, 100 kOhm load
THD+N	<0.0018% (-94.8dB) @ +20dBu, 1kHz, A-weighted, 300 Ohm load
	<0.0012% (-98.4dB) @ +14dBu, 1kHz, A-weighted, 100 kOhm load
	<0.0009% (-100.4dB) @ +6dBu, 1kHz, A-weighted, 100 kOhm load
Output Impedance	0.33 Ohms
Output Wattage	252mW x 2 @ 600 Ohms, 1kHz
	502mW x2 @ 300 Ohms, 1kHz
	950mW x 2 @ 100 Ohms, 1kHz
	470mW x 2 @ 32 Ohms, 1kHz
Dynamic Range	114.7dB A-weighted, AES17 method, 20Hz - 20kHz, 600 Ohm load
	116.5dB A-weighted, AES17 method, 20Hz - 20kHz, 100 kOhm load
Noise Floor	-97.5dBu A-weighted, 20Hz - 20kHz, 32-100 kOhm load
	-99.9dBV A-weighted, 20Hz - 20kHz, 32-100 kOhm load

## Headphone Amplifier (Low Power Mode)

Test Signal Path	APx555 (Line Out) - Input 1-2 - Headphone Output - APx555 (Line In)
Max Input Level	+21.7dBu
Input Impedance	44 kOhms
Frequency Response	-0.5dB, <1.2Hz to >200kHz
	-1dB, <0.8Hz to >250kHz
THD	<0.0002% (-114dB) @ +6dBu, 1kHz, A-weighted, 100 kOhm load
THD+N	<0.00045% (-107dB) @ +14dBu, 1kHz, A-weighted, 100 kOhm load
	<0.0008% (-102dB) @ +6dBu, 1kHz, A-weighted, 100 kOhm load
Output Impedance	1 Ohms
Output Wattage	46mW x 2 @ 600 Ohms, 1kHz
	73mW x2 @ 300 Ohms, 1kHz
	112W x 2 @ 100 Ohms, 1kHz
	71mW x 2 @ 32 Ohms, 1kHz
Dynamic Range	110.1dB A-weighted, AES17 method, 20Hz - 20kHz, 600 Ohm load
	112.9dB A-weighted, AES17 method, 20Hz - 20kHz, 100 kOhm load
Noise Floor	-100dBu A-weighted, 20Hz - 20kHz, 32-100 kOhm load
	-102.3dBV A-weighted, 20Hz - 20kHz, 32-100 kOhm load

## Power Consumption

All power consumption measurements are estimates. Actual power consumption will vary depending on headphone impedance/sensitivity, source material and it's frequency content, as well as overall headphone volume.

Current Consumption	110 mA idle, 390 mA peak, High Power
	30 mA idle, 80 mA peak, Low Power
Average Battery Life	~ 2h (High Power)
	~ 9h 30m (Low Power)
Battery Low Indicator Threshold	6.8v
Unit Off Threshold	3v

## Real-World Battery Life Tests

Actual battery life will vary depending on battery type being used, headphone impedance/sensitivity, source material and it's frequency content, as well as overall headphone volume.

Test Signal Path	500ADAT C.A.S.T. Input - N22H C.A.S.T. Output - Headphone Output
Audio Technica ATH-M50x (38Ω)	1h = Battery Low Indicator, 2h = Unit Off (High Power Mode, Max Volume, Energizer Max Battery)
	8h 10m = Battery Low Indicator, 10h 25m = Unit Off (Low Power Mode, Max Volume, Energizer Max Battery)
Shure SE215 (17Ω)	45m = Battery Low Indicator, 1h 44m = Unit Off (High Power Mode, Max Volume, Duracell Plus Battery)
	7h = Battery Low Indicator On, 9h = Unit Off (Low Power Mode, Max Volume, Duracell Plus Battery)

## Power Adapter Requirements

AC Requirements	100V - 240V AC, 50 - 60 Hz
Adapter Requirements	9v, 500mA, DC (Centre Negative), (Included Supply)
	9v, 1000mA, DC (Centre Negative), (3rd Party Supply)

## Environmental

Operating Temperature	+1 to 35 degrees Celsius
Storage Conditions	-20 to 50 degrees Celsius

## Dims/Weights

<b>Unit</b>	
Width	150mm (5.9")
Height	46mm (2.2")
Depth	120mm (4.7")
Unit Weight	0.91kg (2lb)
<b>Shipping Carton</b>	
Width	250mm (9.8")
Height	120mm (4.7")
Depth	200mm (7.9")
Carton Weight	1.4kg (3.1lb)

# Safety Information

## General Safety

- Read these instructions carefully
- Keep these instructions
- Heed all warnings
- Follow all instructions
- Do not use this apparatus near water
- Clean only with a dry cloth
- Do not block any ventilation openings and install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves or other apparatus (including amplifiers) that produce heat.
- Do not defeat the safety purpose or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades with a third grounding prong. The wide blade or the 3rd prong are provided for your safety. If the provided plug does not fit your outlet, consult an electrician for replacement of the obsolete outlet.
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- Only use attachments/accessories recommended by the manufacturer.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- Do NOT modify this unit, alterations may affect performance, safety and/or international compliance standards.
- Cranborne Audio does not accept liability for damage caused by maintenance, repair or modification by unauthorized personnel.

## Installation notes

- Ensure that no strain is placed on any cables connected to this apparatus. Ensure that all such cables are not placed where they can be stepped on, pulled, or tripped over.



**WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.**  
**ATTENTION: Afin de réduire les risques de choc électrique, ne pas exposer cet appareil à l'humidité ou à la pluie.**

## Power Safety

- The unit is supplied with an external power supply and suitable mains lead. Only use the supplied external power supply, however if you decide to use a mains lead of your choice, bear in mind the following:
  - Refer to the rating label of the unit and always use a suitable mains cords.
  - The unit should ALWAYS be earthed with the earth on the IEC socket.
  - Please use compliant 60320 C13 TYPE SOCKET. When connecting to supply outlets ensure that appropriate sized conductors and plugs are used to suit local electrical requirements.
  - Maximum cord length should be 4.5m (15')
  - The cord should bear the approval mark of the country it is to be used.
- Connect only to an AC power source that contains a protective earthing (PE) conductor.
- Only connect unit to single phase supplies with the neutral conductor at earth potential.

**GB** The apparatus shall be connected to mains socket outlets with a protective earthing connection.

**DEN** Apparatets stikprop skal tilsluttes en stikkontakt med jord, som giver forbindelse til stikproppens jord.

**FIN** Laite on liitettävä sojamaadoituskoskettimilla varustettuun pistorasiaan.

**NOR** Apparatet må tilkoples jordet stikkontakt.

**SWE** Apparaten skall anslutas till jordat uttag.



**ATTENTION: Un-earthed metal parts may be present inside the enclosure. No user serviceable parts inside - to be serviced only by qualified personnel. When servicing, disconnect all power sources before removing any panels.**

## CE Certification



This unit is CE compliant. Note that any cables supplied with Cranborne Audio equipment may be fitted with ferrite rings at each end. This is to comply with the current regulations and these ferrites should not be removed.

## FCC Certification

- Do not modify this unit! This product, when installed as indicated in the instructions contained in the installation manual, meets FCC requirements.
- Important: this product satisfies FCC regulations when high quality shielded cables are used to connect with other equipment. Failure to use high quality shielded cables or to follow the installation instructions may cause magnetic interference appliances such as radios televisions and will void your FCC authorisation to use this product in the USA.
- This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

## RoHS Notice

Cranborne Audio complies with and this product conforms to European Union's directive 2011/165/EU on Restrictions of Hazardous Substances (RoHS) as well as the following sections of California law which refer to RoHS, namely sections 25214.10, 25214.10.2, and 58012, Health and Safety Code Section 42475.2, Public Resources Code.

## Instructions for disposal of WEEE by end users in the European Union



The symbol shown here, which is on the product or on its packaging indicates that this product must not be disposed of with other waste. It is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for recycling waste electrical equipment and electronic equipment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the product.

**WARNING: cancer and reproductive harm - [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)**



Evaluation of apparatus based on altitude not exceeding 2000m. There may be some potential safety hazard if the apparatus is operated at altitude exceeding 2000m.



Evaluation of apparatus based on the temperate climate conditions only. There may be some potential safety hazard if the apparatus is operated in tropical climate conditions.

## Electromagnetic Compatibility

EN 55032:2015, Class B, EN 55016-2-1:2009 A1 2011, EN 55016-2-3:2010 A1 2010, EN 55035:2017, EN 61000-4-2:2009, EN 61000-4-3:2006 A1 2008 A2 2010, EN 61000-4-4:2012, EN 61000-4-5:2014 A1 2017, EN 61000-4-6:2014, EN 6100-4-11:2004 A1 2017, EN 61000-3-2:2014, EN 61000-3-2:2013, FCC Part 15B Class B, ANSI C63.4:2014, ICES-003 Issue 6: Class B

Audio input and output ports are screened cable ports and any connections to them should be made using braid-screened cable and metal conductor shells in order to provide a low impedance connection between the cable screen and the equipment.

**WARNING: Operation of this equipment in a residential environment could cause radio interference.**

## Environmental

- Operating Temperature: +1 to 30 degrees Celsius.
- Storage: -20 to 50 degrees Celsius.