In Chapter 4 we discussed several operating modes of *V3i*. The audio modes are extensive enough for their own chapter. The *V3i* Audio menu is as follows:

Audio ~ Coin & Jewelry
⊞Target Volume
⊞Audio Threshold
⊞Tone
⊞Search Audio
⊞Pinpoint Audio
⊡Wireless Headphone
⊞Live controls

This is a little different than the audio menu presented in Chapter 2, which was accessed from the 6-block menu and was limited to several audio settings but did not include audio *modes*. This more extensive Audio menu is accessed by selecting the **Audio level/tone** item (or the **Search Audio** item in some programs) on the Live Control Bar and pressing **VIEW**.
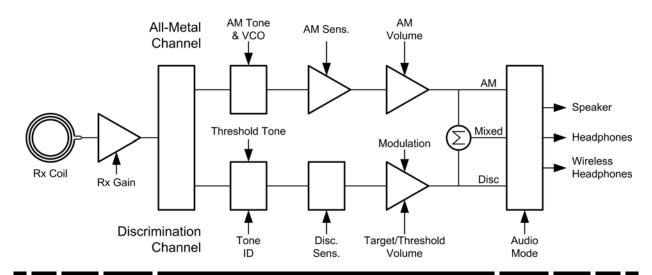
All of the audio modes are accessed through the **Search Audio** selection of this menu. The remaining selections are for setting various user preferences. We will cover the modes first, then proceed through the various settings, not necessarily in the order of the menus.

V3i Audio Response: A Graphical Look

V3i has a lot of audio adjustments, and some of them tie in with other non-audio settings. To help tie together the various settings and better explain them, we'll take a graphical look at what's going on.

Let's start with a block diagram of *V3i*, shown below. The **Rx Gain** setting (in the **Sensitivity** menu) is applied to the raw input signal from the coil. The signal is then split into two processing channels, one for all-metal and one for discrimination, and these channels have their own audio responses. You can listen to the all-metal signal, or the discrimination signal, or both of them combined (*mixed-mode*); the audio can be sent to a standard speaker, a pair of plug-in headphones, or wireless headphones.

Note that the various settings apply only to one or the other processing channels (audio modes). It's important to remember which settings affect which mode, and that's not difficult once you understand what the settings do.

V3i Audio Modes

```
Audio ~ Coin & Jewelry
⊞Target Volume
⊞Audio Threshold
⊞Tone
⊟Search Audio
  ⊙⊞-Discrimination
  ○⊞-All Metal
  ○⊞-Mixed Mode
  ○⊞-Stereo Mixed
⊞Pinpoint Audio
▣Wireless Headphone
⊞Live controls
```

V3i has the following four search audio modes:

• Discrimination

• All-Metal

• Mixed-Mode

• Stereo Mixed-Mode

Discrimination mode produces audio only from the discrimination channel, and All-Metal mode produces audio only from the all-metal channel. The two mixed modes combine audio from both channels, but in slightly different ways:

• Normal mixed-mode puts *both* the all-metal audio and discrimination audio on the left and right channels. However, due to a hardware limitation, both audios cannot sound at the exact same time, so as the discrimination audio comes in, the all-metal audio cuts out.

• Stereo mixed-mode puts the all-metal audio on the left audio channel and the discrimination audio on the right audio channel. This allows both audios to sound continuously.
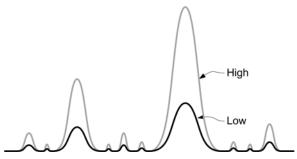
All-Metal Audio

The all-metal channel simply detects and

indicates metal targets. It does not care what those targets are, nor does it attempt to tell you what they are. The all-metal audio channel is also used during pinpointing.

> **Tip:** In the all-metal mode, SAT (self-adjusting threshold) is applied so if you hold the search coil steady over a target, the audio response will fade away on its own. In pinpoint mode, SAT is not applied so you can hold the search coil steady over a target and the response will remain steady.

In this channel, the **All-Metal Sensitivity** setting is basically an additional gain setting applied to the all-metal signal above and beyond the **Rx Gain** setting. The following graph shows a signal with both a low setting (black trace) and a high setting (gray trace).
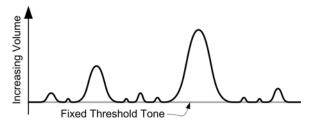

The higher sensitivity setting improves target signals, but it also increases the amount of audio noise and can make *V3i* more "chattery." This is especially true when EMI is present.

All-metal audio can be presented in one of two ways: VCO, and non-VCO. This selection is found at **Audio➔Search Audio➔All Metal ➔VCO**:

```
Audio ~ Coin & Jewelry
⊟Search Audio
  ○⊞-Discrimination
  ⊙⊟-All Metal
    ⊠VCO
  ○⊞-Mixed Mode
  ○⊞-Stereo Mixed
⊞Pinpoint Audio
▣Wireless Headphone
⊞Live controls
```
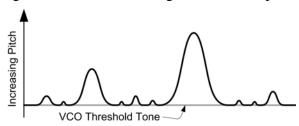
If VCO audio is disabled then the all-metal audio response will be a fixed tone, and an increasing signal level creates an increase in its loudness:

In other words, as the search coil is passed over a target, the all-metal audio will begin at a low volume and progressively rise in loudness as the target signal gets stronger, peaking when the search coil is directly over the target.

If VCO audio is enabled then an increasing signal level creates a rising audio tone or pitch:
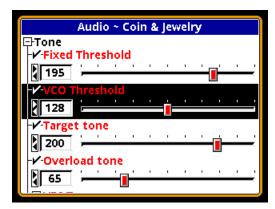

In other words, as the search coil is passed over a target, the all-metal audio will begin at a low tone and progressively rise in pitch as the target signal gets stronger. The highest pitch is achieved when the search coil is directly over the target (strongest target signal) and then the audio falls in pitch as the coil moves off the target. As with non-VCO audio, loudness also rises and falls.

> **Tip:** The human ear is more sensitive to changes in pitch than to changes in loudness. Therefore, deep targets that produce only a very slight all-metal signal will be easier to discern using VCO audio. However, some people just don't like VCO audio or have hearing problems, so the option to turn it off is also provided.

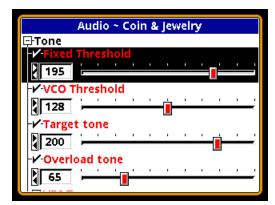Both VCO and non-VCO audio methods have user settings for the tones used. In VCO mode, the threshold tone is the lowest tone at which the VCO response begins; that is, the tone heard when there is no target present. A target signal will then increase the audio above the threshold tone. Its setting is found at **Audio➔Tone➔VCO Threshold**:

In most programs the VCO threshold is set to a mid-level tone of 128.

> **Tip:** A low VCO threshold (such as 50 in the *Mixed-Mode Pro* program) will make the VCO start out at a low growl and somewhat increase its Δf sensitivity to deep targets.

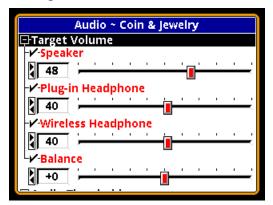Non-VCO audio has a fixed threshold tone found at **Audio➔Tone➔Fixed Threshold**:

This is the same threshold tone that is used for the discrimination channel.

> **Tip:** The VCO Threshold tone does not affect non-VCO audio, and the Fixed Threshold tone does not affect VCO audio.

Finally, the target volume controls move all response levels (both all-metal and discrimination) up and down in loudness:
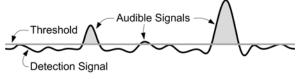

Discrimination Audio

Unlike the all-metal channel, the discrimination channel does not treat all targets alike. Discrimination uses the phase response of the target to determine how to respond. It is possible to assign different tones to different phase responses, or to completely ignore targets with certain phase responses.

Threshold

In this channel, the **Discrimination Sensitivity** setting determines a threshold level above which you will hear target responses. In many detectors, this setting is simply called *Threshold*, but *V3i* has separate adjustments for each channel. The following graph shows the relationship between the threshold level and the detection signal. Only detection signals that
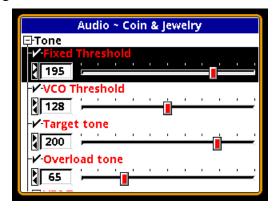

exceed the threshold level (shaded in gray) will become audible target signals. Otherwise, you will only hear the threshold tone.

Increasing the **Discrimination Sensitivity** setting lowers the threshold, making *V3i* more sensitive to weak target signals. Like **All-Metal Sensitivity**, this can also increase the amount of
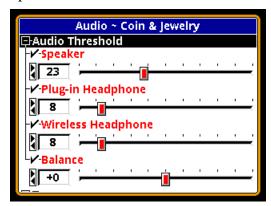
audio noise, and can make *V3i* more chattery, especially when EMI is present.

The discrimination threshold level can have a tone associated with it, so that you can continuously hear the threshold level and listen for perturbations that indicate a target. You can then select the tone for the threshold by accessing **Audio➜Tone➜Fixed Threshold**:

This setting also controls the non-VCO all-metal tone.

The loudness of the discrimination threshold tone is set in the **Audio➜Audio Threshold** menu. The volume can be independently set for speaker, standard headphones, and wireless headphones:

The balance control adjusts the left-right balance in stereo headphones, which allows you to compensate for hearing imbalance. The one control affects both types of headphones.

Setting the threshold volume all the way to zero will result in silent-search (no threshold tone). The **Discrimination** audio selection also

has an option for enabling and disabling the threshold tone:

This selection also affects the all-metal threshold tone (including pinpoint mode).

> **Tip:** Silent search can also be achieved by setting the **Audio→Tone→Fixed Threshold** tone to 0, but this will also kill the non-VCO pinpoint tone, which shares this setting.

Target Volume

Audio→Target Volume adjusts the volume for the target response (that is, the target *beep*) in discrimination mode. *V3i* has separate adjustments for speaker, standard headphones, and wireless headphones:

The Target Volume setting cannot be less than or equal to the Audio Threshold setting or targets will not be heard. *V3i* attempts to maintain a minimum 8dB loudness separation between them. That is, if you try to increase the Audio Threshold setting too close to a corresponding Target Volume setting, the Target Volume will automatically increase in order to maintain an 8dB loudness difference.

As with Audio Threshold, the balance control adjusts the left-right balance in stereo headphones, which allows you to compensate for hearing imbalance. The one control affects both types of headphones. It also can be used as a poor-man's stereo mixed-mode by putting the Target Volume in one ear and the Audio Threshold in the other. However, true Stereo Mixed-Mode audio does a better job of this.
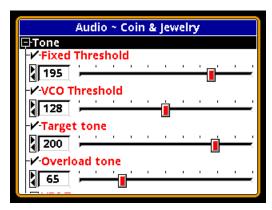
Modulation

Audio→Search Audio→Modulation allows you to enable target audio modulation and to adjust its effect. Modulation is a technique where progressively deeper targets have a progressively weaker audio response (the *beep*). A shallow target produces a loud response, and a deep target produces a soft response. If modulation is disabled, then *V3i* attempts to produce the same response loudness regardless of target depth.

With modulation enabled, you can also adjust the **Range** setting, which affects the strength of the modulation. A low setting makes shallow and deep responses more similar in loudness, and a high setting makes the modulation more pronounced.

> **Tip:** Modulation is most effective when you want to distinguish between deep and shallow targets of similar type. For example, if shallow coins are likely to be clad and deep coins are likely to be silver, then modulation will give you that information in the audio response.

Tone

The **Audio→Tone** selections allow you to set up several common tones. We've already covered two of the tone controls: **Fixed Threshold** and **VCO Threshold**. *V3i* tone settings go from 1 to 255, which roughly corresponds to a frequency range of 5-1000 Hz. A setting of 0

results in no tone.

• **Fixed Threshold**

This setting is the tone that will be used for the background threshold in the discrimination audio, as well as the all-metal threshold when VCO mode is disabled. A value of 195 matches the frequency used in older White's detectors.

• **VCO Threshold**

This is the tone that will be the starting point for the all-metal response when VCO mode is enabled.

> **Tip:** The Mixed-Mode Pro program uses an unusually low threshold tone coupled with an equally low VCO threshold to give it a BFO-like growl response.

• **Target Tone**

This is the frequency that will be used for the discrimination target response when **Tone ID** is disabled (single-tone response). See **Tone ID** below.

• **Overload Tone**

When an unusually strong target response overwhelms the receiver circuitry, *V3i* will emit an overload tone, determined by this setting.
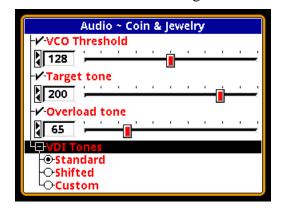
• **VDI Tones**

If **Tone ID** is enabled then this selection specifies how tones are determined for the discrimination target response. See **Tone ID** below.

Tone ID

Any modern discriminating detector has at least a rudimentary audio method of distinguishing accepted targets from rejected ones. This may be as simple as an audio response for accepted targets and no audio response for rejected targets. More advanced detectors have a tonal identification system where different tones represent different target ranges (phase responses).

V3i has the ability to produce a different tone for each VDI number, and it is fully user-customizable. But it can also produce a simple beep/no beep audio for those who want to keep it simple. If the **Audio➔Search Audio➔Tone ID** selection is unchecked, then all accepted targets will respond with the same tone as set in the **Audio➔Tone➔Target tone** control. If it is checked, then the target response will correspond to the tone ID method selected by the **Audio➔Tone➔VDI Tones** setting:

V3i offers three tone ID methods: **Standard**, **Shifted**, and **Custom**.

Setting up a custom tone ID audio is closely related to setting up a custom discrimination mask. All of these will be covered together in Chapter 6.
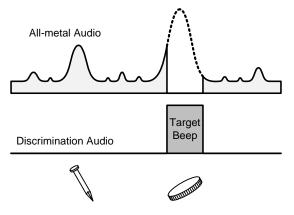
Mixed-Mode Audio

V3i has two mixed-mode options: standard mixed-mode and stereo mixed-mode. Without mixed-mode, you can hear either the all-metal

audio or the discrimination audio. The all-metal channel doesn't tell you anything about the quality of a target; the discrimination channel only signals on accepted targets, and reject targets do not cause an audio response (or cause a null in the audio).

Mixed-mode lets you hear both audio channels. The advantage is that you can hear the responses of all targets, even those that are rejected by the discrimination system. This can help in target separation, especially in trashy areas, and can also help in pinpointing targets. On the other hand, the increased target responses can be overwhelming and create audio fatigue.

Standard Mixed Mode

Standard mixed mode equally applies both the all-metal audio and the discrimination audio to the speaker or headphones. In the absence of targets, or for targets rejected by the discrimination channel, the mixed-mode audio output will be the all-metal response, and you will hear the all-metal threshold plus the all-metal response of rejected targets. When an accepted target is detected, the discrimination audio will take over and you will hear the discrimination tone for the target. Due to a hardware limitation, both audios cannot sound at the exact same time, so as the discrimination audio comes in, the all-metal audio cuts out. This is illustrated below.
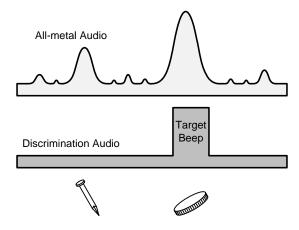

Mixed-mode has several settings that are the same as we have seen in the all-metal and

discrimination modes:

See the previous sections for descriptions of **Tone ID**, **Modulation**, and **VCO**.
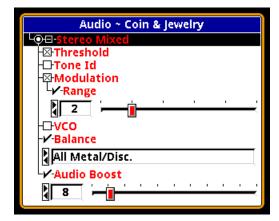
Stereo Mixed-Mode

As the name implies, stereo mixed-mode is only for stereo audio (headphones). It applies the all-metal response to one ear and the discrimination audio to the other ear. This method gets around the hardware limitation mentioned before so that both audios are continuous:

Because the all-metal response is present throughout the discrimination response, target separation and pinpointing is further improved beyond the standard mixed-mode audio.

> **Tip:** In Stereo Mixed-Mode, the **Balance** controls found in **Target Volume** and **Audio Threshold** have no effect.

Stereo mixed-mode has several settings that are largely the same as we have seen in the

all-metal and discrimination modes, with the addition of two new options:

See the previous sections for descriptions of **Tone ID**, **Modulation**, and **VCO**. **Balance** lets you choose which audio goes to which ear. **Audio Boost** compensates for the loss in apparent loudness when a given audio signal is applied to only one ear instead of both ears.
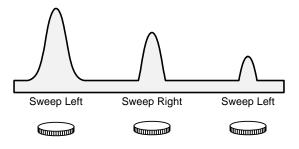
Pinpoint Mode

Although technically not one of the four major search audio modes, pinpoint audio could be used for searching if you pull and hold the pinpoint trigger switch. Pinpoint audio is identical to all-metal audio with one exception: all-metal has SAT applied to it, and pinpoint does not. That means the all-metal channel requires loop motion or the target will get "tuned out," but pinpoint does not require loop motion.

Pinpoint audio has the following options:

VCO is the same as with the all-metal search mode, and shares the same **VCO Threshold** and **Fixed Threshold** settings depending on whether VCO is enabled or disabled.

Rachet is an method whereby the pinpoint audio is automatically narrowed on successive sweeps of the target. Many detectorists do this manually during pinpoint, by resetting the pinpoint trigger switch to desensitize the target response, which has the same effect as creating a narrower audio response as the coil is swept across the target. This significantly helps zero in on the target, especially shallow ones. An illustration of rachet pinpointing is as follows:

Sweep Left   Sweep Right   Sweep Left

Tip: When rachet pinpointing (either manually or automatically), the target can "disappear" if you over-rachet, then slightly raise the loop.

Speaker and Headphones

V3i provides three ways to listen to audio:
• Speaker
• Plug-in headphones
• Wireless headphones

There are obvious limitations in using the speaker. None of the left-right balance controls do anything, and Stereo Mixed-Mode will not work properly. The same is true when using plug-in mono headphones.

Tip: For plug-in headphones, stereo models are recommended. Many headphones are mono/stereo switchable, so if something seems amiss with the audio check that the headphones are in stereo mode.

When you plug in a set of headphones, the speaker is disabled. When wireless headphones are enabled and connected, both the speaker and plug-in headphones are disabled. Basic wireless headphone connection was covered in Chapter 2. We'll cover it again here, with more detail.

Wireless Headphones

V3i is available with optional wireless headphones (WHPs), which are designed to use a world-wide available 2.4GHz ISM band. To enable and connect WHPs, access the WHP menu at **Audio→Wireless Headphones**:
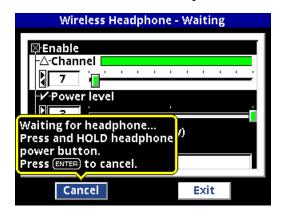

Once you enable WHPs, the menu will expand to include a number of options:
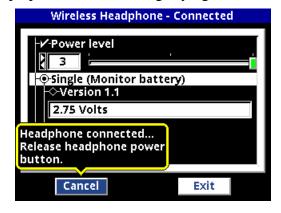

Below the menu of options are two buttons for **Connect** and **Exit**. **Connect** synchronizes the WHPs with *V3i*; press the **TAB** keypad button to highlight the **Connect** button, then press

ENTER. A pop-up balloon will prompt you to press and hold down the WHP power button:

When you follow this procedure, the WHPs will produce a pair of "ta-DA" jingles; the first signifies "power on," the second signifies proper connection. Upon connection, *V3i* will pop up another balloon signifying that:

Why is there a "connect" ritual? It's because the WHPs may need to search for and find the right channel to operate on. With the **Channel** control, *V3i* lets you select one of 76 channels (4-79), allowing multiple V-users to operate in close proximity. By default, channel 4 is selected, both in *V3i* and in the WHPs. So right out of the box, you can probably turn the WHPs on and they will work fine. But if you change the channel in *V3i*, then the WHPs need to know that, hence the connect sequence. If you never change channels, you should never need to "connect," just turn them on and go.

Multiple channels are provided for dealing with noise and interference from other *V3i* users. If the WHP audio seems excessively noisy (cutting in and out) or you seem to be picking up audio from another *V3i*, try a different channel. Pay attention to the reception bar when selecting a channel; choose a channel that has a maximum green and minimal red response.

Tip: If you run the connect sequence at the same time as another nearby *V3/V3i* user, you may inadvertently connect your WHPs to the wrong detector.

The next control is **Power level** which sets the RF transmit power. A high setting may interfere with another *V3/V3i* user on the same channel, and a low setting may cause the signal to drop out, especially in high EMI. We recommend leaving it high, and using different channels to avoid interference.

V3i gives you the option to synchronize to single or multiple WHPs. Multiple is useful for training purposes. Select the **Multiple headphones** option, then **TAB** to the **Connect** button

and press **ENTER**. You will get the usual pop-up balloon prompt to press and hold down the WHP power button. But once the first WHPs are connected, *V3i* will prompt you again:

Continue connecting WHPs until you are done, then press **ENTER** to engage what is now the **STOP** button.

If you are only connecting to a single WHP, then select **Single** and *V3i* will also read back the battery voltage, as well as the version of software in the WHPs. **Single** also has a **Speaker** option which, when selected, automatically switches audio over to the speaker if the WHP battery dies, or the WHPs are turned off.

Summary

A lot of material has been covered, and a summary will help reinforce what we've covered:

Select the **Search Audio** mode you want:

⇨**Discrimination**

- Select **Threshold** if you want an audible threshold, or not for silent-search
  - Use **Fixed Threshold** to set the all-metal tone
- Select **Tone ID** if you want multiple tone responses, or not for single-tone responses
  - Select the **VDI Tones** method to use — see Chapter 6 for details
- Select **Modulation** if you want the target response loudness to vary with signal strength, or not for all loud responses
  - Use **Range** to set the variation in loudness

⇨**All-Metal**

- Select **VCO** mode or not
  - For VCO mode use **VCO Threshold** to set the base VCO tone
  - For non-VCO mode use **Fixed Threshold** to set the all-metal tone

⇨**Mixed Mode**

- Select **Tone ID**, **Modulation**, and **VCO** mode or not
  - See above for options

⇨**Stereo Mixed Mode**

- Select **Threshold**, **Tone ID**, **Modulation**, and **VCO** mode or not
  - See above for options
- Select the Balance method to determine which side is all-metal and which side is disc audio
- Adjust the audio boost to a comfortable level (8 is recommended)