Sensitivity Section
The sensitivity section contains settings to adjust the detectors response to weak signals and noise conditions.

The receive gain, RX gain, setting controls the signal gain for the amplifier connected to the loop. This input stage amplifier needs to be adjusted for optimal operation with the detector's hardware.

The transmit boost setting provides additional power to the loop or extra depth but will discharge the battery faster.

Discrimination sensitivity setting controls the detectors response for the discrimination. A low sensitivity value requires a large signal to trigger a target response and higher sensitivity settings respond to weaker signals. V.D.I. readings are interpreted only when the target signal goes over this sensitivity level. The discriminate audio uses this setting to know when a target is registering.

The all metal sensitivity setting controls the detectors audio response for pinpoint and all metal search modes.

In areas where the ground is changing quickly, or an area with a lot of EMI noise, it may be desirable to lower the setting so the audio isn't responding to these background changes. But, the higher the setting the more the detector will respond to the deeper targets.

About Sensitivity
Setting this sensitivity is critical for obtaining the best results. There are four sensitivity settings associated with the sensitivity of the detector: RX gain, TX boost, Discrimination Sensitivity, and All Metal sensitivity. The extremes of the settings were designed to be beyond reasonable to make a detector responsive to a large range of expected and unexpected environments, using maximum or minimum values should be viewed with some skepticism.

RX Gain
The receive signals can be very small and need to be amplified to be seen by the signal processing software. If the ground is very weak, the detector will be able to tolerate larger gains, whereas if the ground is very strong, the ground signal may overwhelm the loop at the higher gains. These settings need to be adjusted based on the input signals to permit as much signal as possible without overloading the loop. External EMI noise may also play a factor in the setting. If there is significant EMI noise that causes the input signals to overload even though the ground is weak, the gain will need to be lowered. The rule of thumb, which may not hold true in all conditions, is that another inch of depth will be obtained when the gain is doubled. This means that increasing the game from 14 to 15 will not improve depth much at all whereas increasing the gain from 2 to 4 should gain another inch in depth. I would back off to no more than 30-40%.

TX Boost
TX boost increases the power of the loop transmitter. In ideal conditions where the ground is mild enough to run RX gain at 15 and there are few targets the use of TX boost may increase the depth response of the detector up to 1 inch. If there

is RF noise limiting the RX gain that can be run, TX boost can be turned on to achieve more depth at a lower RX gain setting. In some conditions, such as very strong ground, TX boost may be unusable or at least unfeasible as increasing RX gain will give the same results and will not decrease the battery life as quickly.

Discrimination Sensitivity
Discrimination sensitivity is a user adjustable control to remove audio responses to the noise from the system. This control is only used in the search modes. The smaller the noise signals and ground fluctuations the higher the sensitivity settings can be. This control sets a threshold that indicates when to trigger on the target. If the input signal is larger than threshold, then the process to identify and report the target is triggered. The higher the sensitivity is set, the deeper the targets that can be seen. If it is set too high the noise will also trigger as targets and make identifying real targets much more difficult.
In this channel, the Discrimination Sensitivity setting deter-mines a threshold level above which you will hear target responses.

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.

All Metal Sensitivity
All metal sensitivity is only used in the all metal modes, pinpoint, all metal search audio or mixed modes. As the sensitivity is increased, changes in the all metal information will generate a louder response. If there is a lot of external noise in the area, it might be desirable to lower the sensitivity settings so the audio is not responding to the noise, but to targets instead. The highest setting that will operate smooth, stable, and predictably, and provides good pinpoint results, is recommended. Reduced levels typically pinpoint better, however, do not detect or pinpoint as deep.

Sensitivity Probe
This function is activated by selecting the Sensitivity Live Control and pressing ZOOM. All the sensitivity options are displayed on the left of the display. On the right side of the screen are two live “signal quality “numbers. The “Signal” number tells you what percent of the total signal range is currently being received; that is, how much “residual” signal is being seen. Ideally, if you hold the loop in the air away from metal targets, this number should be zero. However, it is impossible to make a perfect loop null so this number is usually at least a few percent.
Ground mineralization also creates a residual signal, so as you lower the loop to the ground you may see an increase in the Signal percentage. In most cases you should adjust the Rx Gain to maintain a residual Signal of no more than 30-40%. V3I will overload at 60%, so it’s still possible that large shallow targets will cause an overload. If this shows 100%, the detector will be overloaded.

Residual signal can either be loop null, ground signal, or both. If ground + null are the cause, then this doesn't take away from sensitivity. Instead, it takes away from large/shallow target response, manifested in a signal overload. None of

these are losses, but rather they reduce the available dynamic range. The lower this % number the stronger the signal will come through or be received.

Null is the efficiency of the coil. A perfect null would equal zero noise. While the Spectra coils are "deep nulled", there is still a bit of noise left from a less than perfect null. Some signal could be from outside sources such as EMI and Ground Noise. If the Null Noise was out of phase with the EMI, the signals could conceivably cancel, resulting in a lower "residual signal". If they were in phase, the "residual signal" would be higher due to the additive nature of the signals. The "residual signal" is what remained after the null noise, EMI, and other signals all mixed in the harmonic coil. Another way of looking at the signal% is a percentage of when the detector overloads. This isn't on any specific frequency - the reading is on the incoming signal before it has been separated into the 3 frequencies. The goal is to keep the ground signal under 30 - 40% so that you still get depth and can still see shallow targets without overload.

The Noise% measures the External Interference, 0% or a low number indicates very little external noise and low ground interference, thus allowing for using a higher preamp RX Gain. The Noise number represents the amount of spurious noise; that is, noise that comes and goes, as opposed to the residual signal which is continuous. This is the noise that is often audible, especially in Pinpoint mode, as chatter. A high noise level (more than a few percent) should persuade you to consider different frequency offset, or to try the 5Hz Band pass filter.

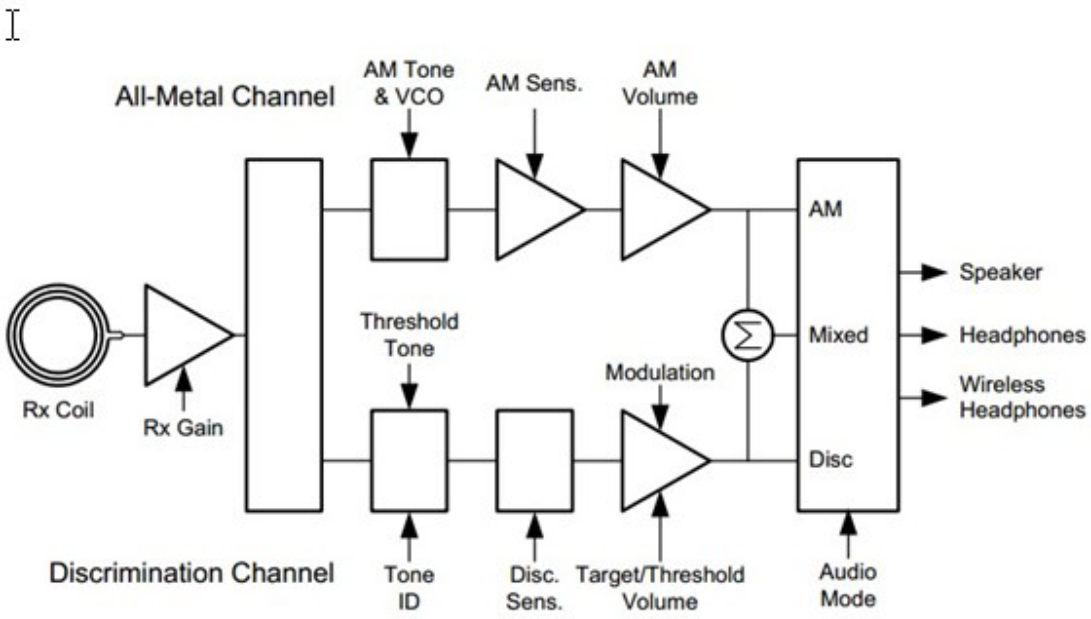
A high Noise% of 50 or more would require you to try:
1) Freq Offset,
2) Decrease RXG,
3) Salt Mode,
4) 22.5 KHz Single frequency,
5) Filter change,
6) Smaller coil.

If your noise is Ground noise you can try;
1) Filter change,
2) Decrease RXG,
3) Salt Soil
4) Salt Mode,
5) Increase BCR,
6) Smaller coil.

Relationship of RXG, AM and DS
The most often adjusted controls are the gain controls. Most guys adjust these every time they go out. Here is how they relate to each other.
The transmit signal is sent from the detector into the ground. Unless you turn on the boost option this signal strength is preset and you cannot adjust it.
RX is the sensitivity control for the signal that returns from the coil to the box. When you adjust this you increase the sensitivity of the signal going to both the all metal and discrimination circuits.

DS is the sensitivity control for the MOTION (Discrimination) circuit.
AM is the sensitivity control for the ALL METAL circuit.

Increasing RXG increases OVERALL sensitivity.
Increasing DS increases MOTION sensitivity only.
Increasing AM increases ALL METAL sensitivity only.



Unless you are using an all metal or mixed mode program, adjusting the all metal gain will have no effect while searching. It will only affect your pinpointing depth.

RX Gain
If V3i continues to have erratic audio with the search coil held in the air, reduce the RX Gain. Usually Discrimination Sensitivity is secondary to Rx Gain to reduce external electrical noise or interference.

Rx Gain (sometimes called preamp gain) sets the gain of the receiver's input amplifier. In most cases, you want to set this as high as possible and still maintain stable operation. If you find the detector is noisy and falses a lot you probably need to turn it down.

The Rx Gain setting 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.

Real Depth
Use the Rx gain to accommodate interference and then utilize the Disc Sensitivity to optimize depth. For real depth, the important setting is the Discrimination or All metal sensitivity settings. These settings are what make the detector more sensitive to deeper and smaller targets. However, if background noise is too loud, you will never hear the deeper and smaller targets. Again, you cannot run the AC beyond where it is stable. Too much Sensitivity will cause noise and obscure targets and destroy the benefits of a higher level of Sensitivity. I found that in moderate soil the 5Hz band pass gave better depth. I just run the RX up till I get interference then I back off. Then I try to adjust my Disc Sensitivity up till I get interference and back off.

The Disc Sensitivity is where you get the depth. The RX Gain is really how loud the signal gets, not the sensitivity to the target. You need it high enough to hear a good signal but not so high as to hear ground interference or outside electrical interference.

Cranking up the Gain or Sensitivity can obliterate a good signal with an increase in noise. Particularly small and deep targets get the worse treatment. EMI shows up as chatter and reduces the low end, the minimum detectable signals. Ground causes overload or makes GB difficult and the reduction is on the high end, large/shallow target overload.

When to use TX Boost
1) Mild ground where I can generally run the RX gain up to 15, AND where there are very few targets. That is, a hunted out area where I really want to punch deeper.

2) Where RF noise is limiting the RX gain that I can run. If Ground Filters, Frequency Offset and / or Salt Comp Mode, by themselves or in combination won't eliminate enough EMI to facilitate a successful hunt, or you wish to remain in a 3 Freq mode, try the following:

1. Drop RXG until the EMI effect is negated
2. Turn TXB = ON.

Remember that RXG brings in ground noise too, so you're better off dropping RXG a bit and bumping up Discrimination Sensitivity. Since the transmitted frequency has nothing to do with EMI signal strength, this technique will improve the target signal return w/o increasing the EMI effect. What you're doing is improving the Target to Noise signal ratio (Increasing target return strength without increasing EMI effect). Carl

Diminishing Rewards
The rule of thumb is that, to gain another inch of depth the gain must be doubled. This means that increasing the gain from 14 to 15 will not improve depth much at all whereas increasing the gain from 2 to 4 should gain another inch. So 4 to 8 gains another inch, and 8 to 16, oops, there is no RX16 to gain another inch. So don't get crazy on setting the RX at the upper levels because it provides diminishing rewards.

In some cases the added noise will actually negate the increase. So in my opinion, higher RX and more noise and signal loss would be about the same as lower RX with less signal loss. If you are hunting in a clean area with only deep targets, then run the gain just below the overload point for max depth. But if there are a lot of shallow targets, then this will result in a lot of audio overload signals which might be annoying. The bottom line is, with any coil, run the gain as high as you can for stable operation, just as you'd do with any detector. The Rx gain control is done in hardware which is done at the Preamp or where the signal from the receive coil goes into the instrument. The Discrimination gain is done in the software after the signal from the coil has gone through all the analog hardware (circuitry).

Rob (IL) Finds Treasure Forum