WithStrings Guitar Tuner Manual

1. Description

The WithStrings Guitar Tuner is an Android application that runs on your smart phone or tablet. It uses the microphone input, audio output, and touch screen to give you many functions found on a stand-alone tuner: listening, analyzing the notes played, providing graphical displays, and generating tones.

FretBoard Graph

Fine Tune Meter and Reference Shift Button

Spectrum Display (XY Graph)

Input Level

Controls

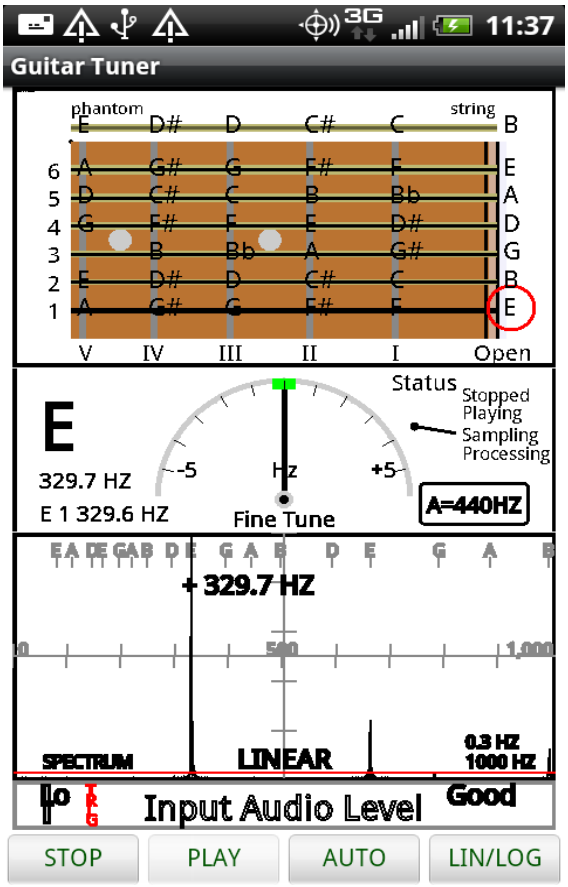

Figure 1. WithStings User Interface (tuning the E string)

2. Operation

Start the application from your Android device. The WithStrings Guitar Tuner user interface is divided into 5 sections: a FretBoard graph modeled after a guitar neck, an analog meter with a reference shift button (A=440 in figure 1), a XY graph, an input audio level indicator, and a row of buttons. The buttons provide the controls for the tuner. Buttons on from left to right: TUNE for listening, PLAY, to generate tones, AUTO to specify a string to listen for or a tone to play, and LIN/LOG to change the scale mode for the XY graph. See Figure 1 for a screen-shot of the display. Pushing the reference will change the reference frequency from 435Hz to 445Hz in 1Hz increments.

a. Tune

(1) Auto

Press the TUNE button (note, the PLAY button is disabled until the STOP is pressed). The tuner will begin listening for tones from your guitar. There is a minimal audio level needed for tuning so please place the microphone on your phone about a foot from your guitar's body. The Input Audio Level meter will give you an indication of the audio level applied to the microphone. The meter will move to the right past the trigger “trig” point when enough audio power is present. Pluck the string starting with string 6 (the thickest string).Press the TUNE button (note, the PLAY button is disabled until the STOP is pressed). The tuner will begin listening for tones from your guitar. There is a minimal audio level needed for tuning so please place the microphone on your phone about a foot from your guitar's body. The Input Audio Level meter will give you an indication of the audio level applied to the microphone. The meter will move to the right past the trigger “trig” point when enough audio power is present. Pluck the string starting with string 6 (the thickest string). If your string is close enough to its assigned note, continue tuning with the FineTune meter, otherwise get the string in range with the FretBoard graph. A note lower than E on string 6 will show with a circle around D# or lower on the phantom string (a virtual string B). A higher note than E may appear with F# circled. An open A string that is tuned too low will appear on the FretBoard graph with a circle on G# on string 6. . (see Figure 2).

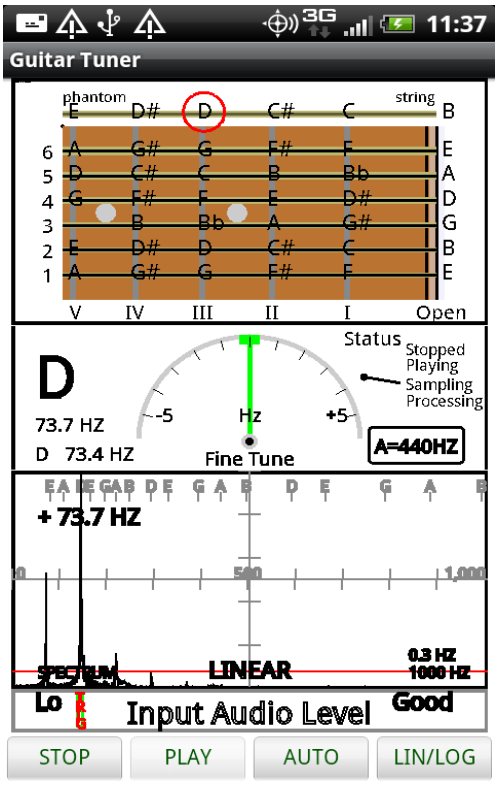

Figure 2. Bar Graph Display indicating Dropped D tuning

(2) Manual

Press the AUTO button until the desired string note combination appears. The bar graph will remain fixed at this selection. Use the meter to fine tune the selected string. If the tone is too high, the needle will remain pointing to the right. If the string tone is too low, the needle will point to the left.

(3) XY Graph

The XY Graph will display the spectrum of the sampled audio data. This will be seen as a series of peaks that represent the individual frequencies that make up the sample. Notes played on the guitar (depending where on the neck) will consist of a peak that indicates the primary frequency of the note and other frequencies produced by the complex interactions of the strings, neck, wood, and player. The frequency of the strongest peaks will be displayed on the graph. This will often be the harmonic of the note frequency. Peaks often occur on the fifth of the selected note (three times the frequency of the note). The XY graph is a good tool to 'see' the sound generated by your guitar and practice technique (compare plucking techniques or plucking at the 12th fret versus near the bridge). The x-axis is scaled from 0 to 1000HZ. The y-axis is auto-scaled to the highest peak. The red line on the x-axis indicates the threshold for capturing a peak. There are two scaling modes for the y-axis, linear or logarithmic. One of these modes can be selected by pressing the LIN/LOG button. The XY Graph will display which mode is in use on the lower center of the graph. Figure 3 gives a rough idea of the component sine waves that make up the “sound” produced by the A-5 string and how these components are shown on the XY Graph as a Spectrum.

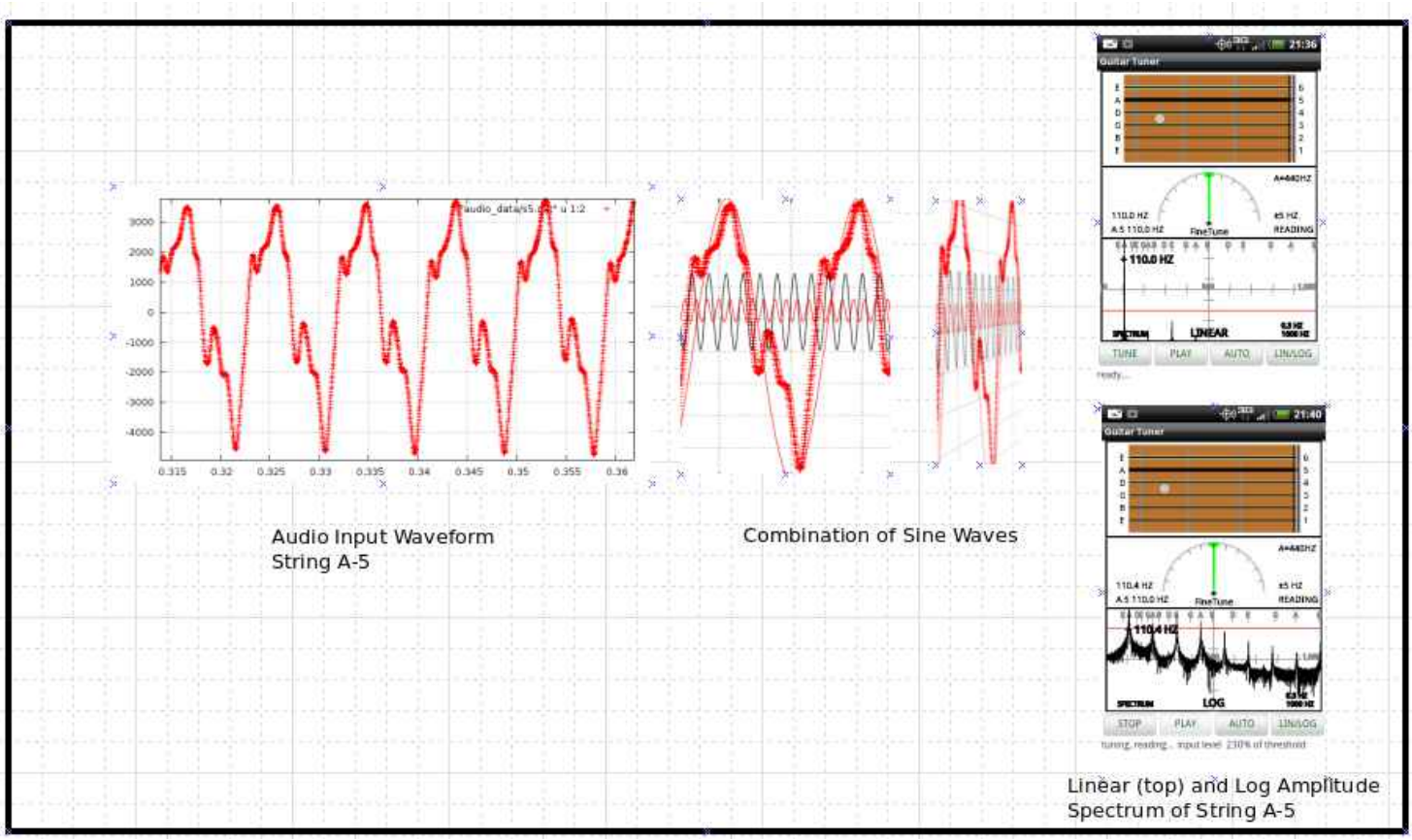

Figure 3. Breakdown of signal produced by the string A-5 into sine waves.

(4) Quirks

Small guitars (backpackers, babies) and electrics (depending on amplifiers, settings, etc) may not show on the bar graph at the low E string, but will instead show E on the octave above. In this case the bar graph will show a red bar between the D and G strings. In this case, manual operation on the E-6 string will not work.

b. Tones

Press the PLAY button (note, the TUNE button is disabled until STOP is pressed). In AUTO mode the Android device will begin play tones E, A, D, G, B, E in one second intervals. Headphones will allow better response of the lower strings. Pluck the same string as shown on the bar graph. Match the tones.

Using the Auto/Manual button a single tone can be selected. It will repeat at about 1 second intervals. Tuning by ear usually involves listening for beat frequency. If two notes are slightly different in frequency, a low frequency beat will be heard. This sound will dissolve as the two notes converge.

It is standard practice to loosen the string and tighten it to bring the string in tune. This will remove slack from the tuning gear.

The reference shift button will affect the tone played as indicated on the fine tune meter display.

c. Exit

Press the back button on the android device to exit the program.

3. Characteristics

Operating System: Android: Minimum API 9, Gingerbread
Permissions: RECORD_AUDIO
Input Frequency Range: 65 to 1000HZ
Notes Recognized: C at 65.40 HZ (Octave 1) to B at 987.80 HZ (Octave 5)
Reference Frequency: Default A-440 (Standard Concert Pitch)
Adjustable from 435Hz to 445Hz
Resolution: 0.25 HZ. Multiple readings will improve accuracy.
Sensitivity: dependent on the microphone on the device.
Identity: $\sin(u)\sin(v) = 1/2[\sin(u-v) + \sin(u+v)]$
Graphics Design: N. Dynamite

4. Tips

a. The microphone for an android phone is probably near the bottom. Tablets may have the microphone on the side of the phone.
b. Hold the tuner about 1 foot or less from the guitar body.
c. If the tuner gets confused finding the note , pluck the open string at the 12th fret.
d. Pluck the string cleanly repeating at about a 1 second interval.