Turbo Tuner

Model ST-122a

Chromatic Strobe Tuner

Owner's Manual

September 22, 2010

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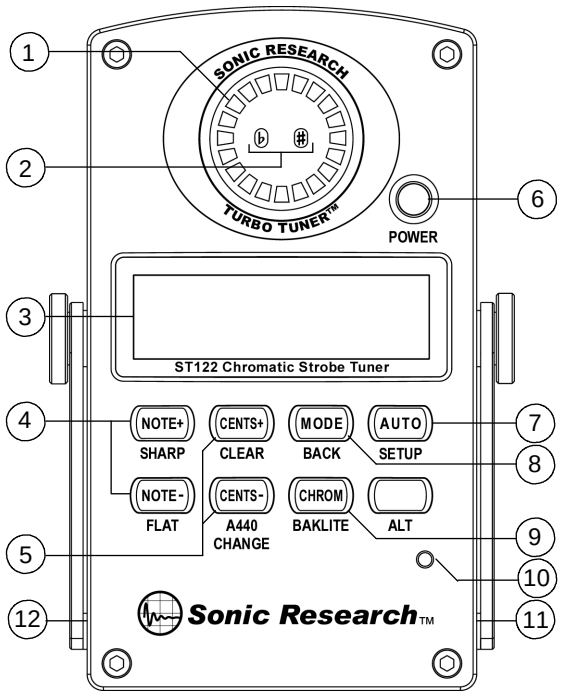
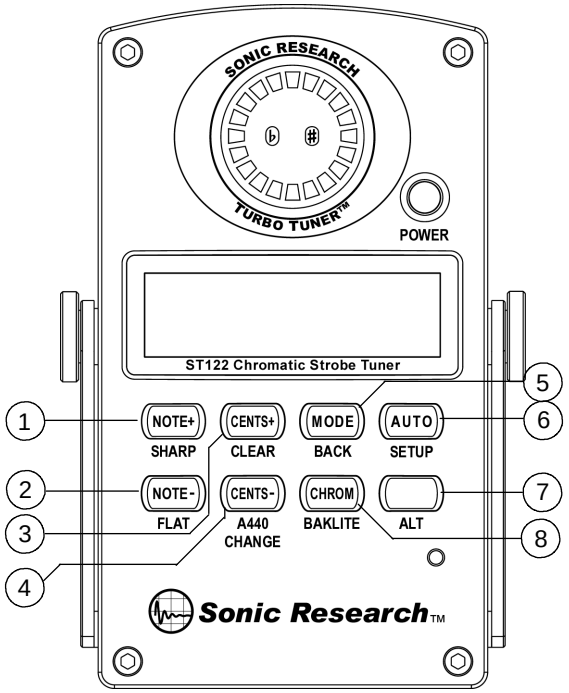
ST-122a Strobe Tuner Front Panel Description



1. **Strobe Display** Pattern in the ring of LEDs rotates left if the note is flat, and rotates right if the note is sharp.
2. **Sharp/Flat LEDs** These activate if the note is more than 50 cents out of tune.
3. **LCD Display** Displays the selected note, mode of operation, etc.
4. **Note Change Buttons** Used to change notes in manual mode.
5. **Cents Change Buttons** Used to offset a note by a precise amount.
6. **Power On/Off Button** Press to turn on or off. The unit also has an auto power down feature that is user selectable. See the section on the setup menu.
7. **Auto/Manual Button** Switches between automatic and manual note selection.
8. **Mode Button** Selects open tunings for stringed instruments. The ST122 comes with a number of tunings for guitar and bass, and the user may easily program custom tunings.
9. **Chromatic Button** Selects the chromatic mode.
10. **Built In Mic** The T122 has a build in microphone for tuning acoustical instruments.
11. **Input Jack** Connect electric instruments here.
12. **Output Jack** Connect to amplifier or effects chain.

Alternate Button Functions



To access these functions, hold the ALT button down while pressing the button.

1. **Sharp Tuning** Raises the pitch of all notes one semitone at a time, up to 6 semitones.
2. **Flat Tuning** Lowers the pitch of all notes one semitone at a time, up to 6 semitones.
3. **Clear** Resets the tuner (zeros out any offsets, flat/sharp tuning and changes to the A4 reference frequency). Also selects equal temperament.
4. **A440 Change** Changes the A4 reference pitch. Default is 440Hz, can be changed in .1Hz increments.
5. **Mode Back** Scrolls backwards through the list of open tunings.
6. **Setup** A variety of functions can be customized by the user. Also used to select different temperaments, define new temperaments, define new open tunings etc.
7. **Alt Key** Hold this key down to access the alternate functions.
8. **Backlight** There are 4 modes of LCD backlighting to choose from.

Using the Tuner - Quick Start

1. Turn on the power (press the Power button).
2. Plug in your electric instrument, or if it's acoustic, position the ST122 close to the instrument.
3. In most cases, the Auto / Chromatic mode is used. You can quickly go to this mode by pressing the Alt and Clear buttons. The LCD will read Chromatic and Auto on the bottom line, and display the note on the first line. In the example below, the note is A4, but this will change to match whatever note is played.

Play a note and observe the pattern in the LEDs. The direction of rotation indicates whether the note is sharp or flat. The farther out of tune, the faster the pattern will rotate. When stationary, the note is perfectly in tune. The note and octave are displayed in the upper left corner of the LCD.

• Notes on the True Strobe Display

The Turbo Tuner's display is driven directly by the input signal, and what you see is the actual waveform of the note made stationary by the stroboscopic action of the display.

If the note is predominantly the fundamental, you will see a continuous pattern that's about a semi-circle.

When a note is rich in harmonics, the pattern will tend to be a series of shorter segments with gaps between them, and these can be spread out around the entire display.

As long as the pattern is stationary or nearly stationary, you are in tune.

In some cases you will may see a pattern where part of the pattern seems to be stationary and part of it seems to be moving. This indicates the overtones are inharmonic, and it means the string is bad and should be replaced. You see this more with old strings on fretted instruments, as the strings wear against the frets and are no longer consistent along their entire length.

Tuning Tips

• The two most important tips:

1. Mute the strings not being tuned by resting your fingers on them. This will eliminate sympathetic vibrations and give a quicker response and a cleaner pattern in the strobe display.
2. When tuning stringed instruments, don't worry about making the pattern come to a complete stop. As the tuning peg is turned, the string tends to move in small increments instead of sliding smoothly across the nut. As long as the pattern is moving slowly you are within a fraction of a cent.

• Fretted Instruments

The Turbo Tuner is designed to respond quickly to the notes from your guitar without resorting to adjusting the volume or plucking the string differently than you normally would when playing.

The Turbo Tuner's true strobe display responds to all the harmonics of the note as well as the fundamental, and the more harmonics, the more complex the display. This does not affect the operation of the tuner. There are several things you can do to reduce the harmonics and get a cleaner looking display:

1. For electric guitars, selecting the pickup closest to the neck will give the clearest pattern. You can also back off the tone control for even greater clarity.
2. Plucking or bowing away from the bridge gives a clearer pattern than right next to the bridge.

Keep in mind that this only affects the complexity of the pattern in the display, and in no way affects the operation of the tuner. We recommend you pluck the string as you do normally when playing.

• Tuning New Strings

When restringing an instrument, switch the tuner to manual mode, and select the desired open tuning (via the Mode key) when first bringing them up to pitch. Use the two Note keys to select the string being tuned.

• Changing Open Tunings

The ST122 has a number of built in open tunings, such as Drop-D, open A, etc. and the user can define his own as well. When re-tuning an instrument, the tuner should be in the manual mode.

• Acoustic Instruments In Noisy Rooms

The ST122 works excellent for tuning up in noisy rooms. If the room is noisy enough that the automatic note selection has trouble picking up the note, simply switch to manual mode.

ST-122 Features

- **True Strobe Display** - easy to read display instantly shows the slightest difference in pitch of the note played from the indicated note.

- **Extreme Accuracy** - the internal timing generator is calibrated at the factory to maintain a precision of ±.02 cents.

- **Chromatic Mode** - permits tuning to any of the 12 notes from C0 to C8, in any temperament.

- **Open Tuning Modes** - tunes to preset or user defined tunings. In this mode the tuner only recognizes notes that are defined for the specified tuning. The tuner displays the string number along with the note. The tuner comes with a number of pre-defined tunings for stringed instruments. These can be added to and/or erased by the user.

- **Open Tunings With Named Strings** - This mode is similar to the Open Tuning Mode, except instead of showing a string number, each note in the tuning has a unique name. This is especially useful for tuning pedal steel guitars. The name of the string will show the string and pedal/lever combination for the selected note.

- **Pedal Steel Guitar Tunings** - The ST-122a comes with two sets of tunings for E9 and C6 ten string necks. These tunings include all the offsets for the open strings and the pedals and levers. The ST-122a is the only tuner that can store separate offsets for the same note, making it ideal for PSG tuning.

- **Tripod Mount Thread** - There is a standard tripod mount thread on the back of the ST-122a, making it easy to attach to pedal steel guitar legs and microphone stands.

- **Auto/Manual Modes** In Auto mode the tuner senses the note being played and adjusts the strobe display to the nearest note of the selected tuning mode. In Manual mode the Note+ and Note- keys select the note. Manual mode is useful when restringing an instrument, changing to a different open tuning, or tuning an acoustical instrument in a very noisy environment.

- **Power On Restore** - by default the ST-122 remembers the settings from the last time it was powered down. This can be changed by the user.

- **Cents Adjustment** - the Cents+ and Cents- keys adjust the cents deviation of the note in increments of 1 cent or .1 cent. Press both keys simultaneously to switch increments, hold both keys for 1 second to clear the cents offset.

- **Flat and Sharp Tuning** - raise or lower all pitches up to six semitones.

- **Reference Pitch Change** - the tuner uses A4=440Hz as the reference pitch. This can be changed in increments of .1Hz

- **Temperaments** - the ST-122 can operate in the equal temperament or any 12 note temperament the user desires. The ST-122 can store a total of 24 different temperaments, in addition to the equal temperament.

- **Temperament Root Change** - The root of any temperament can be set to any of the 12 notes of the chromatic scale.

- **Temperament Base Note** - The base reference of any temperament can be set to either A or the Root of the temperament. When set to A, The A4 note of the temperament will equal the A4 reference frequency. When set to Root, the frequency of the root note of the temperament will equal the frequency of the root note in the equal temperament.

- **Auto Power Off** - after about 5 minutes of no activity the tuner will shut off to prolong battery life. This feature may be disabled by the user via the Setup menu.

- **Low Battery Indication** - when there is about one hour of battery life remaining, a low battery warning is shown on the LCD.

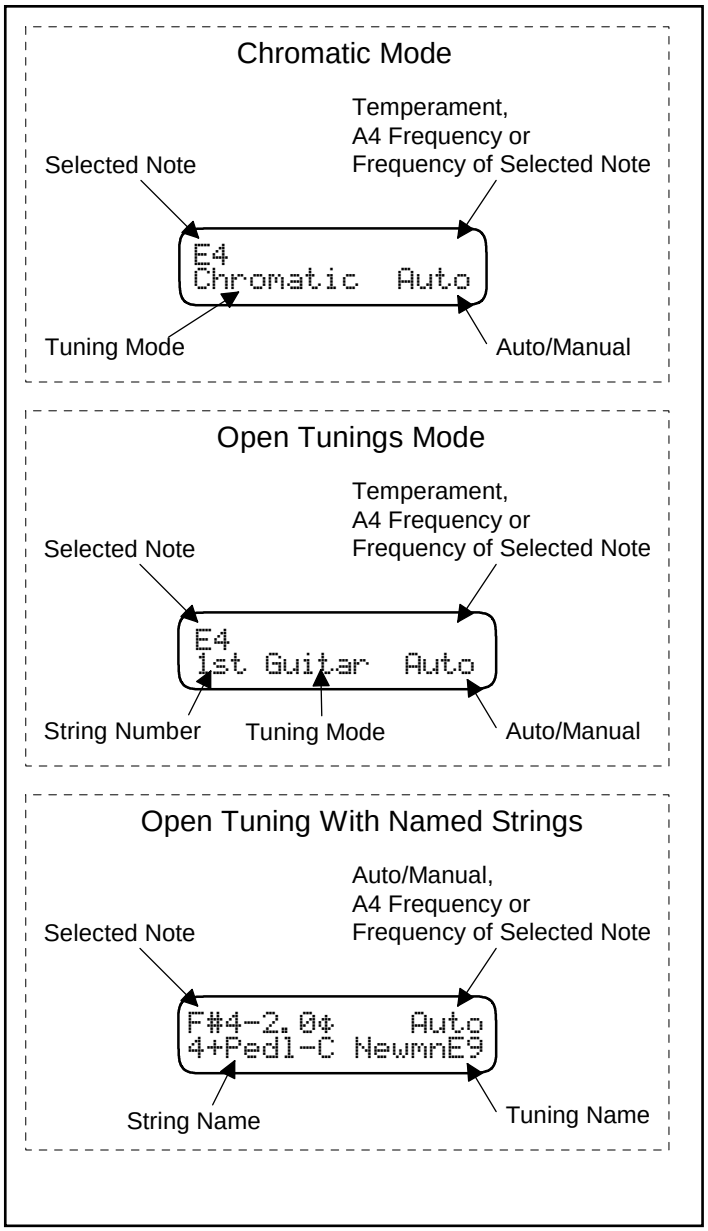
- **Frequency Display** - the frequency of the note in Hertz can be displayed along with the note and octave

LCD Display

The LCD displays information such as the note being tuned, the temperament, open tuning mode etc. The diagram below shows the general layout of the information on the LCD for normal operation.

The ST-122 has many special features, and the LCD configurations for these special features are shown in later sections.

The examples below show the display when using the equal temperament. In this case, the temperament name is not displayed.



Using the Special Features

• Open Tuning Modes

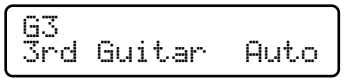
The tuner operates in either chromatic mode, or in a pre-programmed or user defined open tuning mode.

In an open tuning mode, the tuner only selects notes that are defined for the particular tuning. For example, standard guitar tuning has six notes, E4, B3, G3, D3, A2 and E2. Open tunings are very handy when an instrument is way out of tune, such as when putting on new strings or changing from one alternate tuning to another.

The open tuning modes are useful for any stringed instrument. The tuner comes programmed with a number of commonly used open tunings for guitar, bass and bowed instruments and pedal steel guitars. The user may program any desired open tuning for any stringed instrument no matter how many strings it has. See the appendix for a complete list of the pre-programmed tunings.

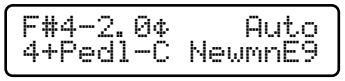
The ST-122a has two different types of open tunings, standard, and open tuning with named strings. The standard open tunings show a string number for each note.

To select an open tuning, press the Mode button. The name of the currently selected tuning along with the string number is shown on the bottom line of the LCD as shown below.



Each time the mode key is pressed the tuner advances to the next open tuning. Holding the Alt key and pressing Mode will backup through the list of available tunings.

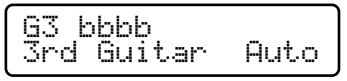
If the open tuning was defined with named strings, each note in the tuning will have a unique name instead of the string number. String names can be edited. The display for a typical open tuning with named strings is shown below:



The example above is for a pedal steel guitar tuning. It shows the note and cents offset, and the note name "4+Pedl-C" tells us this is for the 4th string with pedal C depressed.

• Flat Tuning

Flat tuning lowers the pitch of all notes below the regular tuning from one to six semitones. Hold the Alt key and press the Note- key once for each flat desired. The LCD display will show the number of flats selected. In the example below, four flats have been selected.



To reduce the number of flats, use the Alt-Note+ key combination, or clear them with the Alt-Clear key combination.

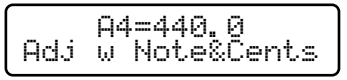
• Sharp Tuning

This is the inverse of flat tuning and operates in the same manner.

• Changing the Reference Pitch

The default reference pitch is A4=440 Hz. This can be changed in .1Hz increments from 220.0 Hz to 880.0 Hz.

To change the reference pitch, press the Alt-A440 Change key combination. The display will then look as shown below:

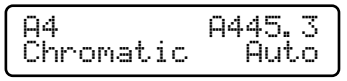


Use the Note keys to change the frequency in 1 Hz increments, and the Cents keys to change it in .1 Hz increments.

Pressing Note+ and Note- simultaneously will set the frequency back to 440.

When finished, press the Alt key by itself to save the new value and return to normal operation.

When the A4 value is anything other than 440Hz, its frequency is shown in the upper right of the LCD display as demonstrated below (A4 is set to 445.3Hz).



To set the pitch back to 440Hz, you can use the Alt-Clear key combination, or Alt-A440 Change then press Note+ and Note- together.

• The Cents Keys

The cents keys adjust the selected note by up to ±50 cents in increments of 1 or .1 cents. This allows you to precisely measure a note, or create a custom tuning for special purposes.

To see how far a note is out of tune, sound a note and use the cents keys to adjust the tuner until the strobe display is stationary. By default the increment is 1 cent. To change to .1 cent, press both keys at the same time.

The cents offset is displayed to the right of the tuning note on the LCD as shown below.

The Cents keys have an auto repeat feature where if you hold the key down for one second the value will automatically increment or decrement.

Pressing and holding both keys for 1 second will reset the cents offset back to zero.

Switching Between 0.1 cent and 1.0 cent Increment: Press and release both Cents keys simultaneously to toggle between 0.1 cent and 1.0 cent increment.

• LCD Backlight

The LCD backlight mode is set using the Alt-Baklite key combination. Hold the Alt key down and repeatedly press the Baklite key to scroll through the four different backlight options:

1. **Off** - the backlight is never used.
2. **On** - the backlight is on all the time. Note that this will greatly reduce the life of the battery.
3. **On Key** - the backlight will illuminate any time a key is pressed, and will remain on for about 5 seconds.
4. **On Sound** - the backlight will illuminate when a note is played.

• The Clear Key

Pressing the Alt-Clear key combination is a quick way to reset any special functions and offsets that have been set. The following happens when Alt-Clear is pressed:

- Cents offset is reset to zero.
- The A4 reference frequency is set to 440Hz.
- Any sharps or flats are cleared.
- The temperament is set to equal temperament.

- The display frequency feature is turned off.
- Auto mode is selected.
- Chromatic mode is selected.
- Temperament root is set to C
- Temperament base is set to A

• The Setup Menu

Pressing the Alt-Setup key combination enters the setup menu. The menu is set up so that pressing the "Auto" key advances to the next menu item without making any changes, and the "Note+" key performs the indicated action.

The Setup Menu is used to perform the following functions. These are covered in detail in later sections:

- **Change Temperament** - the user can select any available temperament.
- **Temperament Root and Base** - the user can set the root of the temperament to any note, and can set the base to A or the root.
- **Auto Power Off** - when on, unit will shut off after about 5 minutes of inactivity.
- **Show Note Frequency** - when selected, the tuning note's frequency in Hertz is shown on the LCD.
- **Power on Settings** - by default the tuner powers up in exactly the same state as when it was shut off. There are several other options, explained in the next section.
- **Enter New Tuning** - allows the user to program custom open tunings.
- **Delete Tuning** - user may delete the currently selected open tuning.
- **Edit Tuning** - the user may edit the notes, the name of to the tuning, and the names of the strings. You cannot change the number of strings in a tuning.
- **Delete Temperament** - self explanatory
- **Edit Temperament** - new temperaments may be defined, and existing ones may be edited.
- **Restore Default**s - this will restore all the factory defaults including the tunings and temperaments. ANY USER DEFINED TUNINGS AND TEMPERAMENTS WILL BE ERASED. You will be prompted to confirm this is what you want to do.
- **Load PSG Tuning** - the ST-122a comes with two pre-defined Pedal Steel Guitar tuning sets. Due to memory restrictions, only one set of E9 and C6 tunings can reside in memory at one time. This menu function selects the desired set of E9 and C6 tuning offsets.

Defining a New Open Tuning

To define a new open tuning, first enter the Setup Menu via the Alt-Setup key combination, then advance through the options using the Auto button until you come to a selection called "Enter New Tuning". Press the Note+ key to get started.

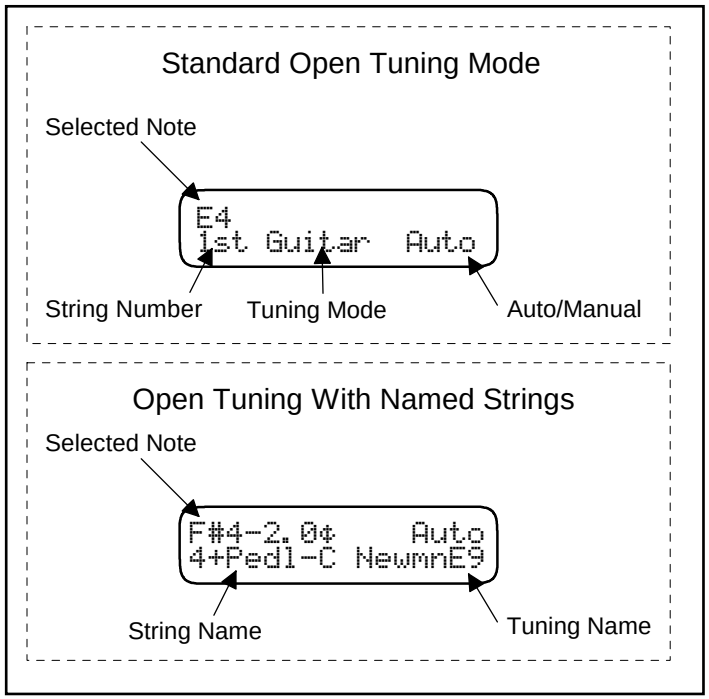
As soon as you enter you will see the following screen, asking if this tuning is to use string names instead of numbers:

```
Named Strings?
  Yes   No
```

In most cases you will respond No (by pressing the Mode key), and the tuner will show a string number for each note. In special cases, such as for pedal steel guitars, you may want to give each note in the tuning a unique name of up to 8 characters. In this case press the CENTS+ key.

Tunings with Named Strings

The ST-122a offers two types of open tunings. The standard is to give each note in the tuning a string number. You can also opt to give each string a name of up to 8 characters. And example of the two types of open tunings is shown below:



Enter the Name for the New Tuning

The first step is to enter a name for the tuning. The name may be any combination of letters and numbers. There can be a maximum of 7 characters in the name. The name is entered as follows:

- Note+/- scrolls through the alphabet
- Cents+ toggles between upper and lower case
- Chrom advances to the next character position
- Cents- backspaces over the previous character
- Auto accepts the name and advances to the next step, entering the notes for each string.

Entering the String Tunings

This starts with string 1.

- The display will show the currently selected note on the first line, and the second line will read "Set str 1 enter"
- Use the NOTE+/- and CENTS+/- keys to select the note. The unit is in manual mode. You can set the note by plucking the desired string and adjusting the note and cents to match it.
- Press the AUTO button (under the word "enter" on the display) to enter the note into memory and proceed to the next string.
- If you selected to enter names for each string, it will now prompt you to enter the string name. Use the same keys as for entering the name of the tuning.
- It will then ask if there are any more strings. Pressing yes will repeat the procedure for entering a new string. No will enter the tuning into memory and return to normal operation.

Canceling a Tuning

If you wish to cancel entering a tuning, simply shut the power off. The tuning is not saved until you tell it there are no more strings.

Editing an Existing Open Tuning

You may edit the notes of any tuning except Guitar. The note values and the name of the tuning may be changed, but the number of notes cannot be changed.

To edit a tuning, first use the MODE key to select the tuning you wish to edit. Then enter the Setup Menu via the Alt-Setup key combination, and advance through the options using the Auto button until you come to a selection called "Edit Tuning?". Press the NOTE+ key to get started.

The first screen you see will let you edit the name of the tuning:

```
Edit Tuning Name
(name)      enter
```

If you wish to edit the name of the tuning, use the keys as shown below:

- Cents- backspaces over the previous character
- Note+/- scrolls through the alphabet
- Cents+ toggles between upper and lower case
- Chrom advances to the next character position
- Auto accepts the name and advances to the next step, entering the notes for each string.

Press the AUTO key (under the word "enter" on the display) to advance to editing the notes.

The display will then show the following message, reminding you that the MODE key is used to exit edit mode.

```
Press MODE when
finished.  Start
```

Press the AUTO key (under the word "Start" on the display) to enter the edit mode. The display will then look similar to this:

```
E4
Set str 1 Scroll
```

The AUTO/ALT keys are used to scroll through the different notes in the tuning. The bottom line shows the "string number" and the upper line shows the note for that string. Simply use the NOTE+/- and CENTS+/- keys to adjust the notes you want to change.

If the tuning you are editing has named strings, you will be prompted to edit the name of the string when you advance to the next note.

When you are finished, press MODE and the tuner reverts to normal operation.

Deleting a Tuning

Any tuning except Guitar and Chromatic may deleted.

- First, use the MODE key to select the tuning you wish to delete.
- Enter the Setup Menu and advance to the option "Delete Tuning?". The second line will have the name of the tuning. Pressing NOTE+ for yes will delete the tuning from memory. Pressing AUTO will return to normal operating mode without erasing the tuning.

Once erased, a user defined tuning can only be restored by entering it again.

The tuner comes from the factory with a number of open tunings build in. These may be erased, and can be restored by selecting the "Restore Defaults" option from the Setup Menu. However, doing so will erase any user defined tunings and temperaments.

Power On Settings

There are three different options for the tuner's settings when it is powered on. As shipped from the factory, it powers on with the exact same settings as the last time it was shut off.

The three options are:

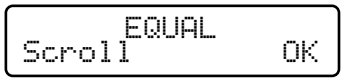
- **From Power Off** - The tuner powers up with the exact same settings as when it was last turned off. This is the default as shipped from the factory.

- **Factory Defaults** - The tuner will always be set as follows when first turned on:
  - Mode is Chromatic / Auto
  - Note is A4
  - LCD Backlight is Off
  - Show Frequency - Off
  - Auto Power Down is On
  - A4 is set to 440.000 Hertz
  - Cents offset is 0
  - No sharps or flats
  - Temperament is Equal
  - Temperament Root is C
  - Temperament Base is A

- **Current Settings** - When this is selected from the Setup Menu, the current settings are saved and the tuner will start with these settings each time it is powered up.

Temperaments

- **Selecting a Temperament** - Enter the Setup Menu (Alt-Setup keys) and advance to the option "Change Tempermnt". Select the "Yes" option by pressing the NOTE+ key. The display will then look something like this:



The top line shows the currently selected temperament, in this case the equal temperament. Use the NOTE+/- keys to scroll through the list of available temperaments. NOTE+ scrolls forward and NOTE- scrolls backward. Press the AUTO key to use the temperament shown on the first line.

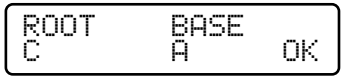
When the temperament is anything other than the equal temperament, the name will appear in the upper right of the display as shown below, where the Pythagorean temperament has been selected. Temperament names are limited to 7 characters.

- **Root and Base (Reference) of a Temperament**

The root is the tonic or starting note in a temperament. This is typically C, but the ST-122a you can set the root to any of the 12 notes of the chromatic scale.

The base or reference note can be set to either A or the Root of the temperament. When set to A, the tuner adjusts the offsets of the temperament so A4 of the temperament will be the A4 reference pitch (typically 440Hz, but you can set it anywhere you like).

To change the Root or the Base, enter the Setup Menu (Alt-Setup keys) and advance to the screen that looks like this:



Pressing the NOTE+ /- keys allows you to set the root to any of the 12 notes of the chromatic scale. Pressing the MODE key toggles the base between A and Root. Press AUTO to continue.

Example of Root and Base Changes

The table below shows the effect of changing the base reference for a temperament. It also shows the ratios used to compute the just intonation offsets used in the ST-122a.

Just Intonation Offsets from Equal Temperament Root=C			
NOTE	**Ratio to Root**	**Cents Offset, Base=Root**	**Cents Offset, Base=A**
C	1/1	0.0	15.6
C#	25/24	-29.3	-13.7
D	9/8	3.9	19.5
D#	6/5	15.6	31.2
E	5/4	-13.7	1.9
F	4/3	-2.0	13.6
F#	45/32	-9.8	5.8
G	3/2	2.0	17.6
G#	25/16	-27.4	-11.8
A	5/3	-15.6	0.0
A#	9/5	17.6	33.2
B	15/8	-11.7	3.9

Note that the notes are all defined as ratios of the root, then were converted to cents offsets from the equal temperament. The column labeled "Cents Offset, Base=Root" shows the offsets that are actually stored in the ST-122a.

Changing the root to D has the following effect:

Just Intonation Offsets from Equal Temperament Root=D			
NOTE	**Ratio to Root**	**Cents Offset, Base=Root**	**Cents Offset, Base=A**
C	9/5	17.6	15.6
C#	15/8	-11.7	-13.7
D	1/1	0.0	-2.0
D#	25/24	-29.3	-31.3
E	9/8	3.9	1.9
F	6/5	15.6	13.6
F#	5/4	-13.7	-15.7
G	4/3	-2.0	-4.0
G#	45/32	-9.8	-11.8
A	3/2	2.0	0.0
A#	25/16	-27.4	-29.4
B	5/3	-15.6	-17.6

Another way of looking at it is like this:

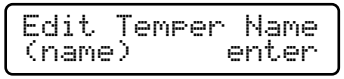
Just Intonation Offsets from Equal Temperament Root=D			
NOTE	**Ratio to Root**	**Cents Offset, Base=Root**	**Cents Offset, Base=A**
D	1/1	0.0	15.6
D#	25/24	-29.3	-13.7
E	9/8	3.9	19.5
F	6/5	15.6	31.2
F#	5/4	-13.7	1.9
G	4/3	-2.0	13.6
G#	45/32	-9.8	5.8
A	3/2	2.0	17.6
A#	25/16	-27.4	-11.8
B	5/3	-15.6	0.0
C	9/5	17.6	33.2
C#	15/8	-11.7	3.9

Editing a Temperament

Temperaments are defined as offsets from the notes of the equal temperament. These offsets may be edited for any temperament.

To edit a temperament, enter the Setup menu (Alt-Setup keys) and advance to the option "Edit Temperament". Select the "Yes" option by pressing the NOTE+ key.

The first screen you see will let you edit the name of the temperament:

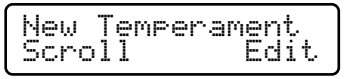


If you wish to edit the name of the tuning, use the keys as shown below:

- Cents- backspaces over the previous character
- Note+/- scrolls through the alphabet
- Cents+ toggles between upper and lower case
- Chrom advances to the next character position
- Auto accepts the name and advances to the next step, entering the notes for each string.

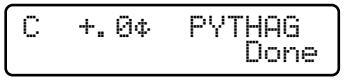
Press the AUTO key (under the word "enter" on the display) to advance to editing the cents offsets for the notes. Here's how the display will look if the tuner was in the Pythagorean temperament:

The top line shows the temperament to be edited. If the tuner was in the equal temperament, the display will look like this.



This is used to create a new temperament, and is covered in the next section.

Use the NOTE+ and NOTE- keys to scroll through the list, and press the AUTO key to edit the temperament. The display will then show the note, the offset in cents and the name of the temperament being edited as shown below.



Use the NOTE keys to scroll through all 12 notes of the scale, the CENTS keys change the offset for the note in increments of .1 cents. Holding one of the CENTS keys down for one second will cause it to auto-repeat. Press the AUTO key when done.

Creating a New Temperament

To create a new temperament, follow the same steps as for editing a temperament, using "New Temperament" as the name of the temperament to edit. You will then be prompted to enter the name for the new temperament. This is done in exactly same manner as entering the name for a new open tuning:

- Note+/- scrolls through the alphabet
- Cents+ toggles between upper and lower case
- Chrom advances to the next character position
- Cents- backspaces over the previous character
- Auto accepts the name and advances to the next step, entering the offsets for each of the 12 notes.

The offsets for each note in the new temperament are set to 0.0, and are changed just as for editing a tuning.

LCD Display - Special Features

The LCD displays information such as the note being tuned, the temperament, Auto/Manual mode, tuning mode (Chromatic or Open Tuning), A4 reference and the frequency of the note. Many of these are options and only displayed if selected.

The diagrams below show the most common display configurations.

The note being tuned is always shown in the upper left of the display. The bottom line always shows the tuning mode, and Auto/Manual, except for open tunings with named strings in which case Auto/Manual is on the top line.

Below is the display when the Guitar mode is selected.

```
G3
3rd Guitar  Auto
```

This tells the user the tuner is in the Guitar mode and currently is tuning the 3rd string which is G3.

The note can consist of as many as 4 elements: The note letter, the octave, any cents offset, and any sharps or flats. The example below shows the note offset by 1.5 cents and two flats:

```
G3 +1.5¢ bb
3rd Guitar  Auto
```

The important thing to remember is the note is always displayed at the start of the first line.

The upper right of the display shows special features. If in a temperament other than equal, it shows the temperament name. Here the Pythagorean temperament has been selected.

```
A4          PYTHAG
Chromatic    Auto
```

The upper right is also used to show the reference pitch if it has been changed from 440 Hz. Here it's been set to 438.7Hz.

```
A4          A438.7
Chromatic    Auto
```

So what happens if there is a conflict and there are two values that by themselves would be in the upper right? The ST122 will configure the display so that all of the information is shown. Certain fields will be abbreviated. The example below shows how the display would look in the Pythagorean temperament with A4 set to 438.7Hz.


```
A4          A438.7
Chromat PYTHAG A
```

Open tuning with named strings is shown below. This is for pedal steel guitars, and the note has a cents offset of -2.0. The name of this string is "4+Pedl-C" which tells us this is for string 4 with Pedal C depressed.

```
F#4-2.0¢     Auto
4+Pedl-C NewmnE9
```

Pedal Steel Guitar Tuning

If you play a pedal steel guitar an use either the Newman or Emmons system, the presets for all the open strings and pedals and levers are built into the ST-122a, for both E9 and C6 10 string necks.

The tuner is shipped with the NewmnE9 and C6 tunings enabled, but you can easily change back and forth using the Setup Menu. Once initialized the tunings are stored in flash memory and can be renamed, edited or deleted just like any other tuning.

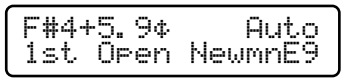
Each set of tunings (Newmn or Emons) consists of four tunings, selected by the MODE button. There are tunings for E9 open strings, E9 pedals and levers, C6 open strings and C6 levers.

The NewmnE9 tunings are shown in the table below.

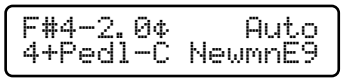
Tuning Name: NewmnE9

Notes on Open Strings			Notes on Pedals				
String	Note	Cents Offset	String Name	Note	Cents Offset	String	
1	F#4	+5.9	1+Levr G	G4	+5.9	1	Lever G
2	D#4	-3.9	2+Levr E	D4	-3.9	2	Lever E
3	G#4	-3.9	3+Pedl B	A4	+3.9	3	Pedal B
4	E4	+9.8	4+Pedl C	F#4	-2.0	4	Pedal C
5	B3	+7.9	4+Levr F	F4	-17.8	4	Lever F
6	G#3	-3.9	4+Levr D	D#4	+2.0	4	Lever D
7	F#3	+5.9	5A/C,2+E	C#4	-5.9	5	Pedal A or Pedal C or Lever E
8	E3	+9.8					
9	D3	+5.9					
10	B2	+7.9	5+Levr X	A#3	+9.8	5	Lever X
			6+Pedl B	A3	+3.9	6	Pedal B
			7+Levr G	G3	+5.9	7	Lever G
			8+Levr F	F3	-17.8	8	Lever F
			8+Levr D	D#3	+2.0	8	Lever D
			10+Pdl A	C#3	-5.9	10	Pedal A
			10+Lvr X	A#2	+9.8	10	Lever X

Example of display for open strings:



Example of display for Pedals & Levers:



Tuning Name: NewmnC6

Notes on Open Strings			Notes on Pedals				
String	Note	Cents Offset	String Name	Note	Cents Offset	String	
1	D4	-5.9	2+Pedl-6	F4	+7.9	2	Pedal 6
2	E4	-3.9	3+Pedl-7	D4	+7.9	3	Pedal 7
3	C4	+9.8	3+Pedl-K	B3	+2.0	3	Pedal K
4	A3	-5.9	4+4 or 7	B3	-9.9	4	Pedal 4 or 7
5	G3	+7.9	5+Pedl-5	F#3	-13.8	5	Pedal 5
6	E3	-3.9	6+Pedl-6	D#3	+9.8	6	Pedal 6
7	C3	+9.8	7+Pedl-8	C#3	-17.8	7	Pedal 8
8	A2	-5.9	8+Pedl-4	B2	-9.9	8	Pedal 4
9	F2	+5.9	9+Pedl-5	F#2	-13.8	9	Pedal 5
10	C2	-5.9	9+Pedl-8	E2	-5.9	9	Pedal 8
			10+Pdl-8	A2	-17.8	10	Pedal 8
			10+Pdl-5	D2	-13.8	10	Pedal 5

NOTE: When tuning the pedals, there is a conflict in that there are two different B3 notes:

String 3 + Pedal K (B3+2.0)
String 4 + Pedal 4 or Pedal 7 (B3-9.9)

In Auto mode the tuner will select the offset for String 3 (because it is first in the list). To tune String 4 + Pedal 4 or 7, switch the tuner to the manual mode and use the NOTE- key to select the appropriate offset.

Tuning Name: EmonsE9							
Notes on Open Strings			Notes on Pedals				
String	Note	Cents Offset	String Name	Note	Cents Offset	String	
1	F#4	+4.0	1+RLK	G4	-15.0	1	RLK
2	D#4	-10.0	2+RKR	D4	-20.0	2	RKR
3	G#4	-11.0	2+RKR	C#4	-10.0	2	RKR
4	E4	0	5+P1orP3	C#4	-17.0	5	Pedal 1or 3
5	B3	0	3+Pedl-2	A4	-7.0	3	Pedal 2
6	G#3	-11.0	4+Pedl-3	F#4	-22.0	4	Pedal 3
7	F#3	-15.0	4+LKL	F4	-26.0	4	LKL
8	E3	0	4+LKR	D#4	-10.0	4	LKR
9	D3	0	5+LKV	A#3	-10.0	5	LKV
10	B2	0	6+Pedl-2	A3	-7.0	6	Pedal 2
			6+RKL	F#3	+4.0	6	RKL
			8+LKL	F3	-26.0	8	LKL
			8+LKR	D#3	-10.0	8	LKR
			10+Pdl-1	C#3	-17.0	10	Pdl 1
			10+LKV	A#2	-10.0	10	LKV

NOTE: When tuning the pedals, there is a conflict in that there are two different C#4 notes:

String 2 + RKR (C#4-10)
String 5 + Pedal 1 or Pedal 3 (C#4-17)

In Auto mode the tuner will select the offset for String 2 (because it is first in the list). To tune String 5 + Pedal 1 or 3, switch the tuner to the manual mode and use the NOTE- key to select the appropriate offset.

Tuning Name: EmonsC6							
Notes on Open Strings			Notes on Pedals				
String	Note	Cents Offset	String Name	Note	Cents Offset	String	
1	G4	+5.0	1+Pedl-5	G#4	-10.0	1	Pedal 5
1	D4	+3.0	2+Pedl-6	F4	0	2	Pedal 6
2	E4	-11.0	3+Pedl-7	D4	+3.0	3	Pedal 7
3	C4	0	3+RKR	B3	-8.0	3	RKR
4	A3	-18.0	4+P4orP7	B3	-14.0	4	P4orP7
5	G3	+5.0	4+RKL	A#3	-5.0	4	RKL
6	E3	-11.0	5+Pedl-5	F#3	-14.0	5	Pedal 5
7	C3	0	6+Pedl-6	F#3	-25.0	6	Pedal 6
8	A2	-18.0	8+Pedl-4	B2	-14.0	8	Pedal 4
9	F2	-5.0	9+Pedl-8	C#3	-22.0	9	Pedal 8
10	C2	0	9+Pedl-5	F#2	-14.0	9	Pedal 5
			9+Pedl-8	E2	-11.0	9	Pedal 8
			10+Pdl-5	D2	-20.0	10	Pedal 5
			10+Pdl-8	A1	-18.0	10	Pedal 8

NOTE: There are two sets of conflicting notes in the pedal tuning:

B3
String 3 + RKR (B3-8)
String 4 + Pedal 4 or Pedal 7 (B3-14)

F#3
String 5 + Pedal 5 (F#3-14)
String 6 + Pedal 6 (F#3-25)

In auto mode the tuner will select the first note in the list. To select the second note, switch to manual mode and select the desired note using the Note+/- keys.

Specifications

General Specifications	
Dimensions	4.75" (12cm) x 2.7" (6.9cm) x 1.4" (3.6cm) HxWxD
Weight	318 g / 11.2 oz (including battery)
Temperaments	Equal plus 24 user defined (20 temperaments are pre-programmed into user defined temperament memory and can be edited or deleted as needed)
Tuning Range	C0 (16.35 Hz) to C8 (4,186.0 Hz)
Accuracy	±.02 Cents (calibrated crystal oscillator)
Reference Pitch	A4 = 220.0 Hz to 880.0 Hz in .1 Hz increments. (440Hz default)
Jacks	Input, Output (1/4") and external 9 VDC
Power Supply	9 Volt Alkaline Battery (included), or external 9 Volt DC adapter (optional).
Power Connector	2.1mm x 5.5mm negative center
Power Consumption	23 mA typ., 50mA with backlight on

Sonic Research Inc. retains a policy of constant product improvement. Therefore, specifications are subject to change without notice.

The ST-122 comes with the following open tunings built in. Any of these may be erased by the user if so desired.

See page 18 for instructions on making your own open tuning. You may define an open tuning for any stringed instrument, with any number of strings.

Drop D	
String #	**Note**
1st	E4
2nd	B3
3rd	G3
4th	D3
5th	A2
6th	D2

DADGAD	
String #	**Note**
1st	D4
2nd	A3
3rd	G3
4th	D3
5th	A2
6th	D2

Open A	
String #	**Note**
1st	E4
2nd	C#4
3rd	A3
4th	E3
5th	A2
6th	E2

Open D	
String #	**Note**
1st	D4
2nd	A3
3rd	F#3
4th	D3
5th	A2
6th	D2

Open E	
String #	**Note**
1st	E4
2nd	B3
3rd	G#3
4th	E3
5th	B2
6th	E2

Open G	
String #	**Note**
1st	D4
2nd	B3
3rd	G3
4th	D3
5th	G2
6th	D2

Bass	
String #	**Note**
1st	G2
2nd	D2
3rd	A1
4th	E1

BASS DD (Bass Drop D)	
String #	**Note**
1st	G2
2nd	D2
3rd	A1
4th	D1

BASS-5 (5 String Bass)	
String #	**Note**
1st	G2
2nd	D2
3rd	A1
4th	E1
5th	B0

BANJO	
String #	**Note**
1st	D4
2nd	B3
3rd	G3
4th	D3
5th	G4

VIOLIN	
String #	**Note**
1st	E5
2nd	A4
3rd	D4
4th	G3

VIOLIN5 (Violin - Pure 5ths)	
String #	**Note**
1st	E5+2.0¢
2nd	A4
3rd	D4-2.0¢
4th	G3-3.9¢

CELLO	
String #	**Note**
1st	A3
2nd	D3
3rd	G2
4th	C2

CELLOp5 (Violin - Pure 5ths)	
String #	**Note**
1st	A3
2nd	D3-2.0¢
3rd	G2-3.9¢
4th	C2-5.9¢

The following three tunings are for True Temperament™ necks. For more information, please visit their website at www.truetemperament.com.

Thidell	
String #	**Note**
1st	E4-1.0¢
2nd	B3-1.0¢
3rd	G3-4.0¢
4th	D3+2.0¢
5th	A2
6th	E2-2.0¢

D.W.G.	
String #	**Note**
1st	E4-2.0¢
2nd	B3
3rd	G3+3.9¢
4th	D3+2.0¢
5th	A2
6th	E2-2.0¢

MeanBlu	
String #	**Note**
1st	E4-2.6¢
2nd	B3-4.0¢
3rd	G3+7.2¢
4th	D3+4.8¢
5th	A2
6th	E2-2.6¢

Appendix B - Temperaments

The list of temperaments shown below are pre-programmed into the ST-122a at the factory, and can be restored at any time using the "Restore Defaults" menu item.

Any temperament can be renamed, deleted, or edited.

List of pre-Programmed Temperaments	
Temperament Name	**Name in ST-122a**
True Temperament Thidell	Thidell
True Temperament D.W.G.	D.W.G.
Just Intonation	JUST
Pythagorean	PYTHAG
1/4 comma meantone	4Comma
6th comma Meantone	6thCMn
1/6 Pythagorean Comma Meantone	6thPCMn
8th comma Meantone	8Comma
Bach (Barnes)	BachBar
Bach (Kellner)	BachKel
Kirnberger III	KirnIII
Lambert (1774)	Lam1774
Rameau	Rameau
Salinas (-1/3)	Salinas
Silbermann	Silber
Valotti	Valotti
van Zwolle	vanZwol
Werckmeister III	WerkIII
Young (1800)	Yng1800
Zarlino (-2/7)	Zarlino

Offsets for Temperaments Pre-Programmed into ST-122a												
Name in ST-122a	**C**	**C#**	**D**	**D#**	**E**	**F**	**F#**	**G**	**G#**	**A**	**A#**	**B**
Thidell	2.0	-4.0	2.0	-4.0	-2.0	0.0	-4.0	4.0	-4.0	0.0	-4.0	-1.0
D.W.G.	5.9	1.4	2.0	0.6	-2.0	7.8	-1.4	3.9	0.2	0.0	3.9	0.0
JUST	0.0	-29.3	3.9	15.6	-13.7	-2.0	-9.8	2.0	-27.4	-15.6	17.6	-11.7
PYTHAG	-5.9	-15.6	-2.0	-11.7	2.0	-7.8	-17.6	-3.9	-13.7	0.0	-9.8	3.9
4Comma	11.7	-15.6	3.9	23.5	-3.9	15.6	-11.7	7.8	-19.6	0.0	19.6	-7.8
6thCMn	5.9	-2.0	2.0	0.0	-2.0	7.8	-5.9	3.9	1.9	0.0	3.9	-3.9
6thPCMn	8.1	-7.8	2.0	11.7	-2.0	7.8	-5.9	3.9	-9.8	0.0	9.8	-3.9
8Comma	3.0	2.0	1.0	0.0	-1.0	3.9	0.0	2.0	1.0	0.0	2.0	-2.0
BachBar	5.9	0.0	2.0	3.9	-2.0	7.8	-2.0	3.9	2.0	0.0	5.9	0.0
BachKel	8.2	-1.6	2.7	2.3	-2.7	6.3	-3.5	5.5	0.4	0.0	4.3	-0.8
KirnIII	10.3	0.5	3.4	4.4	-3.4	8.3	0.4	6.8	2.4	0.0	6.4	-1.5
Lam1774	4.2	-2.2	1.4	1.7	-1.4	5.6	-4.2	2.8	-0.3	0.0	3.6	-2.8
Rameau	11.7	-3.9	3.9	-3.9	-3.9	15.6	-5.9	7.8	-2.0	0.0	5.9	-7.8
Salinas	15.6	-20.9	5.2	31.3	-5.2	20.9	-15.6	10.4	-26.1	0.0	26.1	-10.4
Silber	5.9	-7.8	2.0	11.7	-2.0	7.8	-5.9	3.9	-9.8	0.0	9.8	-3.9
Valotti	5.9	0.0	2.0	3.9	-2.0	7.8	-2.0	3.9	2.0	0.0	5.9	-3.9
vanZwol	-5.9	-15.6	-2.0	-11.7	2.0	-7.8	-17.6	-3.9	-13.7	0.0	-9.8	3.9
WerkIII	11.7	2.0	3.9	5.9	2.0	9.8	0.0	7.8	3.9	0.0	7.8	3.9
Yng1800	5.9	-3.9	2.0	0.0	-2.0	3.9	-5.9	3.9	-2.0	0.0	2.0	-3.9
Zarlino	12.6	-16.8	4.2	25.1	-4.2	16.8	-12.6	8.4	-20.9	0.0	20.9	-8.4

Warranty

Sonic Research Inc. (SRI) warrants the ST-122 to be free from defects in materials or workmanship for a period of one year from the date of purchase. If, during this period, any device in normal use fails to function due to a fault in materials or workmanship, Sonic Research will, at its sole discretion, either repair or replace the device, and will ship the repaired original or reconditioned replacement device back to the original purchaser, free of charge. The cost of shipping any merchandise to Sonic Research for warranty service is the responsibility of the buyer. All returns must be accompanied by a return authorization number. Please contact Sonic Research at 1-800-811-0272 for assistance. This warranty does not cover damage caused by accident, misuse, attempted alterations or repairs, or defective batteries.

SRI reserves the right to make changes in design or make additions to or improvement upon this product without any obligation to install the same on products previously manufactured.

SRI shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some sates do not allow limitation of incidental or consequential damage, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may have other rights which vary from state to state.

FCC Statement of Conformity

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

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

Contact Information

The Turbo Tuner is manufactured in the USA by:

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