

**The CAT™  
COMPUTER ACTIVATED  
TUNING SYSTEM**

**Users Manual**

*Featuring Smart Bridge™ Technology*

**TransPerformance**

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2526 Courtland Court  
Fort Collins, Colorado 80526 - 1324  
970-482-9132

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# The Computer Activated Tuning System for Guitar

## Introduction

Congratulations! You have just purchased one of the most technically advanced, state of the art guitar accessories ever built! Ever since the first musical instruments were played, musicians the world over have been imagining the day when their instruments could be tuned automatically. With the CAT™, and its Smart Bridge™ technology, this dream has become a reality. The CAT will revolutionize the way you write and play music.

Whether you do your best creative work at home, on stage, in the studio, or with paper and pen, the CAT will add new dimensions to your creative abilities. If you own ten guitars, it's possible to play a song in ten tunings. But try playing rhythm in open-G, switching to standard tuning for your solo, transposing down a whole step for the bridge, then back to open-G for the next verse. With the CAT it's not only possible, but fast, easy and precise. You can switch tunings at the touch of a button and access hundreds more while you play.

The CAT is loaded with useful features. With the CAT you can tune up with a single strum and change tunings while you play. Well-temper your tunings, explore chord inversions, transpose pitch to match pre-recorded sources or vocal ranges, and adjust the speed of your tuning changes to match the tempo of a song. Install a capo and be in tune in seconds. Use any of the 144 popular alternate tunings stored in permanent memory, or create your own tunings. There's room for 240 more. You can copy any tuning, insert it wherever you want it, and adjust the speed for that tuning change. You name your own menus and tunings, and set them up in whatever way you like. You can also change tunings with a Footswitch and go wireless with battery operation.

The Smart Bridge™ system in the CAT is designed to be an exceptional tool for composing, recording and performing. The initial factory preset tunings (Chord Library) are intended not only for instant use, but also as a starting point for creating your own innovative tuning patterns. The ability to create and access literally thousands of tunings so easily is truly a phenomenal songwriting tool. Not only can you explore tunings that you probably never would without the CAT, you can put them together in any way you desire. Write songs in one tuning, or with multiple tunings in the same song. In the studio, you'll find that the CAT saves so much time that it will pay for itself relatively quickly. Not to mention how having to stop and retune takes the wind right out of your sails. On stage, having the CAT is like having a hundred guitars in one. There's no need to haul so many guitars to shows, and no need to switch guitars to play in different tunings. And of course now you can change tunings *live* while you play. Plus you're always in tune! The CAT is designed, manufactured and installed with the finest craftsmanship and built to last. The low maintenance, worry-free design allows maximum playing time. Using Smart Bridge™ technology, the CAT is designed with the player in mind.

You will soon experience the thrill of Touching Up and changing tunings during a song. Get ready to experiment with different tunings and fingerings and the many new worlds to open up with them. You'll be playing new riffs you've never before dreamed of, and be able to put them together within a song in ways never before possible. The CAT is so packed with useful features, and yet so easy to operate that the sky is the limit. Let your imagination run wild and enjoy.

# How to Use this Manual

This manual is designed as a guide to enable you to start running your new CAT quickly, and after a little experience, to be used as a reference for learning to use the CAT's many advanced capabilities. We recommend that you have your CAT with you and powered up as you progress through this manual. A brief introduction is first, followed by a Quick Start section. The next sections describe all features and operations of the CAT in detail. Maintenance and Trouble-Shooting sections follow, with other information, Appendices and Glossary last.

The Quick Start section is a step by step tutorial to familiarize you with some of the terminology used while allowing you to begin using the CAT right away. This will be helpful to first time users. When you first begin to operate your new CAT, follow the instructions in this Quick Start section.

After you complete the Quick Start tutorial, use the following sections as a guide in learning to use the CAT's many advanced capabilities, and how to keep the system operating trouble-free. Each Menu feature and Pushbutton has its own section in the manual with complete details and instructions for how to perform each particular operation. Other sections explain how to run the system and keep it operating properly. In the Appendices, Block Diagrams are provided detailing the Menu Structure and processes involved in operating the

CAT. Find whatever section you need, and learn the system as you go. Once you have read and understand these sections you will be able to fully utilize the many capabilities of your CAT and keep the system operating trouble-free.

Should you ever experience any problems operating the system, a Troubleshooting section is provided to guide you to a solution. Whenever necessary, refer to this Troubleshooting section and it will help you identify the problem and send you to the appropriate section(s) of the manual to solve it.

A Glossary is provided at the end of this manual to help familiarize you with some of the terminology associated with the CAT, and as a reference source to aid in reading the manual.

The Smart Bridge™ system is designed to require no computer programming skills and is set up logically for ease of use. Don't be intimidated. Start off with the Quick Start section and then reference the desired sections of this manual to learn more about your new CAT at your own pace. Feel free to experiment. There are built in safeguards to prevent any accidental harm to the system. As you gain experience, you will find that the CAT is simple to operate and understand, yet incredibly powerful. Enjoy!

# Chapter 1 - System Overview

## Theory of Operation

The CAT brings state-of-the-art Smart Bridge™ technology to the performing arts. A computer mounted inside your guitar controls six small motors, each connected to one guitar string. At the push of a button or Footswitch, motors are activated and string tensions are adjusted, with approximately 150,000 distinct tuning possibilities. Current status of the system as well as instructions are displayed on the LCD mounted along the top edge of the guitar body. The CAT is operated using pushbuttons mounted in the guitar face, and some operations can also be controlled with a Footswitch. The system is designed to quickly and accurately change the tuning of the guitar, and to bring the guitar back into tune after a humidity or temperature change, strings stretching, or anything else that puts a guitar out of tune.

Smart Bridge™ technology is designed to be user-friendly and efficient. The menu structure and processes involved are set up in a logical, practical, usable way and from the guitar player's point of view. The back-lit LCD will instruct and/or prompt you for certain actions at times, and the most frequently used features have their own pushbuttons for easy use. Arrow buttons move you through the menus and Select brings you into the menus. It's all right there on the LCD and pushbuttons and is fairly self-explanatory. With a little help getting started you'll be able to run the system within minutes. Over time you will become familiar with the many features and capabilities that are literally at your fingertips. So let's get started (if you haven't already). The following Quick Start section will get you going and you'll be ready to run with it in no time.

## Chapter 2 - Quick Start

### Instructions

Use the following steps as a quick guide to get up and running with your new CAT. This section will explain how to perform some of the basic functions of the CAT and enable you to begin selecting and changing tunings right away. Use the rest of the manual to learn to use the many other advanced features of the system at your own pace.

1. Plug in the power cord and turn on the power supply.
2. After four “Startup Screen messages”, PLAY will be flashing.
3. Press the SEL (select) Pushbutton while PLAY is highlighted (flashing).
4. Notice that there are two Libraries in this Menu (Play Menu), the *User Library*, and the *Chord Library*. All tunings are in these two libraries. Use the Arrow pushbuttons to get **ChordLib** highlighted (flashing), then hit the SEL (select) Pushbutton.
5. You now are in a *Tuning Menu* and have four groups to choose from on the LCD display.
6. Use the Arrow keys to scroll through the menu structure to choose a Tuning Menu to explore. (See “Chord Library Listing”, Appendix F if desired.)
7. With any Tuning Menu highlighted (flashing), hit SEL.
8. You are now in a *Tuning Window* and have six tunings to choose from on the LCD screen. **Use the bottom row of pushbuttons (closest to the LCD display) to choose the tunings.** The bottom row of pushbuttons has a separate function while choosing the tunings in any Tuning Window. **One Press on the first button (to the left) along the bottom row of the keypad selects the first tuning in the Tuning Window; the second button selects the second tuning, and so on.** All tunings in the CAT are accessed in this way. Choose any tuning in this Window.
9. While in any tuning within this Tuning Window, press the TCH (Touch Up) button. Follow the instructions on the screen. The system will ask you to Mute the strings and then prompt you for a Strum. Complete the Touch Up. See the following note.

Note: Since this is the first Touch Up, the system will require two strums, one at Standard Tuning and one at your chosen Tuning if other than STD. After the Strum(s), the system automatically updates the tuning and brings it into tune. During Touch Up, after you strum you will see alphabetical characters scrolling on the LCD as the system processes the frequencies. When the signal

for each string settles, the respective String Number 1-6 replaces the alphabetical characters. The system requires a certain level of precision in its measurement of frequency, and will display a dot next to the String Number when it gets a good reading of the signal for that string. If the dot does not appear, you will need to re-strum that string. When all six strings have a dot, the system Touches Up the tuning and returns to the Tuning Window. All tunings in the CAT are Touched Up in this way.

10. Your current tuning should now be Touched Up and in tune. Strum the guitar to hear if it indeed sounds in tune. If this is the first time you have played the guitar after receiving it, it is possible that a Nut Adjust may be necessary due to string stretch, temperature change, rough handling, etc. during shipping. If the system Touches Up accurately, a Nut Adjust is not necessary at this time. If it does *not* Touch Up accurately, see the “Nut Adjust” section in Chapter 8 to perform a Nut Adjust.
11. If desired, use the bottom row of pushbuttons (closest to the LCD) to select any of the other tunings in this Tuning Window.
12. If desired, Touch Up the tuning(s) as above.
13. To leave this Tuning Window, press the END Pushbutton.
14. Hitting END again takes you back to the Play Menu, and hitting END one more time takes you back to the Main Menu where you started. That’s all there is to it. All tunings in the CAT are accessed and Touched up in this way.
15. The system can be unplugged at any time, no matter what is on the LCD screen or where you are within the Menu Structure, without affecting computer memory. However, *if power is removed while the motors are moving (during a tuning change), or if a string breaks while the motors are moving, you will need to perform a Nut Adjust to re-align the Mechanical Device.* (See “Nut Adjust” in Chapter 8 if necessary, or “Changing/Replacing Strings” in Chapter 9 in case of a broken string.)

Note: All tunings in the CAT are kept within two Libraries, the User Library and the Chord Library. You have been selecting tunings in the *Chord Library*. All tunings in the *User Library* are accessed in the same way.

## Chapter 3 - Setting Up the System

### Connecting the Power Supply

The CAT is powered with a 12 Volt Power Supply that plugs into a wall outlet and converts 120 VAC to 12 VDC. The system can also be powered with a 12 VDC Lead Acid Battery (optional). A 7 pin DIN jack is located on the edge of the guitar next to the audio jack, and a 7 pin DIN jack is located on the rear of the Power Supply. Connect either end of the 20' power cord to the guitar and the other end to the power supply. Notice that the 20' power cord has a different shaped connector on each end to accommodate different preferences. Either way is fine.

### Connecting the Footswitch

Plug the Footswitch cable into the 1/4" jack located on the rear of the power supply. In order to use the Footswitch, the system must be powered with the power supply. The Footswitch is programmed in Edit Mode. (See "Editing", Chapter 7.)

### Connecting the Battery

The 18 inch long power cord with the 7 pin DIN connector on one end is for use with the 12 volt Lead Acid Battery (optional). Plug one end of this cable into the Battery, the other into the guitar. While running on a Battery, plugging the Battery and Cable into the guitar turns power on, unplugging turns power off.

### Powering the System

You can turn the system on and off by using the on/off switch on the Power Supply, plugging in or unplugging any of the Power Cords, or unplugging the Power Cord to the Power Supply from the wall outlet. To turn off while on Battery power, simply unplug the Battery. See below.

**Do not shut off power while the motors are moving (during a tuning change).** If you do, a Nut Adjust is needed to realign the Mechanical Device to the computer. (See "Nut Adjust" in Chapter 8 if necessary.)

### Startup Screens

When the system is powered up, the LCD will display the following message for 1 second:

TransPerformance  
Automatic Tuning System

This message is followed by displays identifying the version, date and time the system firmware was produced, and string gages for this guitar.

Version 3.12-R2V1.12-000  
42 32 24 16 11 09

Version 3.12-R2V1.12-000  
04/14/96 22:00

If you ever call us with a question about the CAT in your guitar, the version, date, and time of your system will help us to provide you with the best up to the minute support. If you forget what string gages to use, they are conveniently listed for you on the Startup Screen.

MAIN MENU  
\*\*\*\*\*

Play                      IndivString  
Maint                     Service

At the end of the Startup process you are automatically put into the Main Menu (shown above).

### Bypassing and Freezing the Startup Screens

You can bypass the four Startup Screens to go immediately into the Main Menu if you like. Or you can freeze the Startup Screen in any stage throughout the Startup process.

#### Bypassing the Startup Screens

To bypass all Startup Screens, press the END button at any time during the Startup Screen progression and you will go directly to the Main Menu.

#### Freezing the Startup Screens

To freeze the LCD display during Startup, the SEL (select) button is used. Pressing SEL freezes the display until you press END or SEL again. END will take you right to the Main Menu, and SEL takes you to the next

startup screen and freezes it, and so on until you reach the Main Menu.

Freezing the display is helpful when you need the information on a particular Startup Screen, and bypassing comes in handy when you are in a hurry.

## Chapter 4 - Navigating the Menu Structure

### About the Menus

See the “Menu Organization” diagram in Appendix A.

The **Main Menu** is the starting point for the CAT’s Menu Structure. When you power up the system, four Startup Screens progress and you are automatically put into the Main Menu. From the Main Menu you choose from the four choices, or menus within the Main Menu. The four components of the Main Menu are the **Play** Menu, **IndivStr** (Individual String), **Maint** (Maintenance), and **Service**. All menu features are accessed within these four components of the Main Menu. See Chapter 8 for complete instructions on how to use all menu features in the CAT.

### Arrow, Select and End Buttons

Use the up, down, and sideways Arrow buttons to move through the menu structure to highlight your desired selection. With your desired selection highlighted (flashing), press the SEL (select) button. This takes you one layer (step) deeper into the highlighted Menu. *At any point*, you can press the END button to back out of the current menu feature to the previous one, all the way back to the Main Menu if desired. All Menu features are accessed and enabled in this way.

Note: All of the menus in the CAT allow “wrapping”. For example: When in the User Library, you can get from the first Tuning Menu to the last Tuning Menu by pressing repetitive “Down” Arrows or by simply pressing one “Up” Arrow.

### LCD

A backlit Liquid Crystal Display (LCD) is located along the top edge of the guitar for easy viewing. Menus, information, instructions, questions and prompts for actions are displayed on the LCD while operating the system.

### Accessing Tunings

All tunings in the CAT are kept within the **Play Menu**. The Play Menu is divided into two tuning Libraries, the **User Library** and the **Chord Library**. The User Library is completely programmable, and is where you create and use your own custom tunings. The Chord Library is permanent memory set at the factory, and cannot be changed by the user.

To select tunings you enter the desired library, either the User Library, or the Chord Library. Then select your desired Tuning Menu from which you select your tuning(s). The following illustrates this process.

From the Main Menu, select **Play**.

Play	IndivString
Maint	Service

The Play Menu is displayed on the LCD, shown below.

UserLib	ChrdLib
StrTemper	TuneTemper

For this example, select the Chord Library.

STANDARD	EGDAC
A-C	D-E

The first four **Tuning Menus** in this library are displayed on the LCD, as shown above. All tunings in the CAT are kept within Tuning Menus consisting of six tunings apiece. To see more Tuning Menus simply use the up, down and sideways Arrow buttons to scroll through the menu structure.

Highlight the Tuning Menu “EGDAC” and press the SEL button.

opE	opG	opD	opA	opC	STD
Select ...					

You now are in this particular Tuning Menu’s **Tuning Window**, as shown above. Each *Tuning Menu* has its own corresponding *Tuning Window* where you access the six tunings in that menu. All tunings in the CAT are accessed in this way, in both the User and Chord Libraries.

To select tunings from a Tuning Window you use the bottom row of Pushbuttons, as discussed in the following section.

**Bottom Row of Pushbuttons While In a Tuning Window**

TCH	OST	EDT	CPY	INS	END
↓	↑	←	→	DEL	SEL

The bottom row of Pushbuttons (the four Arrows, DEL, and SEL buttons) have a separate function while in a Tuning Window. In this case, they are used to *select the tunings* in the Tuning Windows. This is explained below.

opE	opG	opD	opA	opC	STD
Select ...					

While in a Tuning Window, the first button on the bottom row (closest to the LCD) selects the first tuning in the Window, the second button selects the second, and so on. In the Tuning Window pictured above, **opD** (the third tuning in this Window) would be selected by hitting the third Arrow button (the third button on the bottom row); **opC** would be selected with the DEL button, and so on.

Select any tuning(s) from this window by using the bottom row of Pushbuttons.

opE	opG	opD	opA	opC	STD
moving to opE ...					

opE	opG	opD	opA	opC	STD
E	B	E	G#	B	E

For this example, the first tuning, opE is selected (by pressing the first button on the bottom row). The system changes to this tuning, and the notes of the tuning are displayed on the LCD, as shown above. All tunings in the CAT are accessed in this way.

Note: If you press buttons faster than the system can change, it will remember the buttons pressed and execute the commands in that order.

In addition to the particular tunings in each Window, Standard Tuning is *always* available as well. See the next section on Background Tuning.

**Background Tuning**

With Smart Bridge™ technology, Standard Tuning (STD) is “behind” every tuning in the CAT. No matter what alternate tuning you are in, Standard Tuning is available with a single button hit, even if STD is not programmed into that Window. This allows the artist to go immediately to STD from *any* other tuning. It also effectively makes each Tuning Window capable of holding 7 different tunings. Since STD is always accessible, you don’t need to program STD into a Tuning Window to be able to use it with those tunings.

**Accessing the Background Tuning (STD)**

Accessing the Background Tuning (STD) is easy and fast. All it takes is a single hit on the button corresponding to the tuning you are currently in.

opE	opG	opD	opA	opC	opB
E	B	E	G#	B	E

In the Tuning Window pictured above, the system is in **opE**. The first Pushbutton was used to select this tuning. Hit this same button again and the tuning changes to STD (Standard).

STD	opG	opD	opA	opC	opB
E	A	D	G	B	E

opE	opG	opD	opA	opC	opB
E	A	D	G	B	E

Notice that the name of the Foreground Tuning (opE) and the name of the Background Tuning (STD) alternate flashing on the LCD screen while the notes of STD are displayed.

Press the same button again and you return to the Foreground Tuning. Another hit on this same button will take you back to STD, and so on. That’s all there is to it. No matter what alternate tuning you’re in, in both the *User* and *Chord* Libraries, changing to STD is this easy.

**Accessing the Background Tuning with a Footswitch**

The Background Tuning (STD) is accessed just as easily while using a Footswitch. (See “Editing”, Chapter 7 for complete instructions.)

## Chapter 5 - Pushbuttons

Two rows of six Pushbuttons are mounted in the face of the guitar above the Rhythm Pickup. All operations of the CAT are enabled with these Pushbuttons.

TCH	OST	EDT	CPY	INS	END
↓	↑	←	→	DEL	SEL

### Select (SEL)

While moving through the Menu Structure, the SEL button enables whatever is highlighted on the LCD and brings you one level deeper into that Menu. At other times, SEL represents a “yes” answer to a question on the LCD display. During Editing, SEL selects whatever is on the screen and moves you to the next stage in the process. When you first power up the guitar, SEL can be used to freeze the LCD display to view a particular Startup Screen. Finally, while in a Tuning Window, where all tunings are accessed, SEL corresponds to the sixth tuning in the Window, as described in the preceding chapter.

### End (END)

The END button quits actions, exits Menus or Tuning Windows and basically performs the opposite functions as the SEL button. While navigating the Menu Structure, END brings you back one layer at a time ending up in the Main Menu. During power-up, hitting END bypasses the Startup Screens and brings you immediately into the Main Menu. At other times END is a “no” answer to a question on the LCD.

Hint: Since the computer memorizes up to 50 consecutive presses of any button, several repetitive hits of the END button will quickly bring you back to the Main Menu from anywhere within the Menu Structure.

### Touch Up (TCH)

The Touch Up feature, enabled by pressing the TCH button, imposes adjustments to the calibration equations which compensate for strings stretching, temperature and humidity changes, etc., to bring the guitar into tune whenever you deem necessary. Each time the system is Touched Up, the calibration equations are updated and corrections are stored in memory.

All tunings are relative to Touch Up at Standard Tuning. Any Touch Up at *Standard* tuning brings

Standard into tune and also makes those adjustments to *all* the other tunings as well. This relieves the necessity to Touch Up *every* tuning if a string stretches, the temperature changes, etc. A Touch Up at Standard adjusts all tunings in the CAT. However, **a Touch Up may be performed on any tuning at any time you deem necessary.** Touch Ups to any tunings other than Standard affect only that tuning.

### STD Touch Up Requirement

The first Touch Up in each Library (Chord Library, or User Library) requires a Touch Up at STD first, for a point of reference, and then a Touch Up in whatever tuning you selected TCH in. This mandatory touch up of STD tuning is used to maintain a balance between the system calibration equations and their relation to STD tuning on an ongoing basis. After the first Touch Up in each Library, when you select TCH, only the current tuning is Touched Up as long as you remain in that Library.

For example: When you have just entered either the Chord Library or the User Library and select a Touch Up for the first time, Standard Tuning (STD) is Touched Up, and then the tuning for which you selected TCH is Touched Up. From this point on, TCH Touches Up only the current tuning, unless and until you actually leave the entire Library (back to the Play Menu).

Note: You can leave any Tuning Window within either Library (Chord Library or User Library) to enter any other Tuning Window within that same Library without necessitating the STD Touch Up Requirement.

### Hex Pickups

The 6 small pickups in the bracket mounted to the bridge are used only during Touch Up, On Screen Tuner (OST), and Calibration. They have no effect on the guitar’s sound. During a Touch Up, these pickups are turned on, the strings are strummed, the frequencies are recorded and analyzed, and the motors are activated to bring the guitar immediately into tune.

**Important:**The Hex Pickups are set at a specific depth below the strings and the computer is set up accordingly. Do not depress these pickups any deeper. (See “R2V1 System Specifications”, Appendix H for depth and tolerance specifications.)

### Strumming technique

During a Touch Up, the harder the strum, the longer it takes to read the strings. Strumming too softly makes it difficult for the system to read the strings. The main thing to remember about strumming technique is to strum evenly and consistently during Touch Ups. For example, don't strum hard on string 6 and softly on the other strings. An "uneven" strum can result in an inaccurate Touch Up.

### Executing a Touch Up

Whenever your guitar sounds out of tune, press the TCH button. Follow the instructions on the LCD screen. The system will ask you to Mute the strings and then prompt you for a Strum. After you Strum, the system reads the strings, and automatically updates the tuning.

```
1   Touch Up STD Tuning   1
A * Mute **** Mute * Q
```

```
1   Touch Up STD Tuning   1
A * Strum **** Strum * Q
```

After you strum, you will see alphabetical characters scrolling as the system processes the frequencies (shown below). When the signal for each string settles, the respective String Number 1-6 replaces the alphabetical characters. The system requires a certain level of precision in its measurement of frequency, and will display a **dot next to the string number** once it meets this requirement. (See the following diagrams of the LCD display representing a Touch Up of Standard Tuning.)

If the dot does not appear, you will need to re-strum that string.

```
1   Touch Up STD Tuning   1
1 * * * * * * * 1
```

```
1   Touch Up STD Tuning   1
1 6. 5. f c * 1 1
```

```
1   Touch Up STD Tuning   1
1 6. 5. 4. 3. 2. 1. 1
```

When all six strings have a dot, the system Touches Up the tuning and returns to wherever you selected TCH from.

### Aborting a Touch Up

The Touch Up sequence can be aborted at any time during the Touch Up process by pressing the **END** button. The system will immediately return to the tuning that was selected prior to the Touch Up request without Touching Up.

Note: If a Touch Up operation is aborted, that tuning will require a Touch Up the next time it is accessed.

## **On Screen Tuner (OST)**

The CAT has a built in tuner that displays the tunings of all six strings on the LCD at the same time. The notes of the respective strings are displayed followed by the number of cents sharp or flat. An asterisk appears next to the note for each string when that string has stopped vibrating. On Screen Tuner (OST) eliminates the need to carry a tuner around with you. Of course you can use a normal tuner in the normal fashion as well.

### Using OST

To use the On Screen Tuner, press the OST button and strum.

```
---*--- ---*--- ---*---
---*--- ---*--- ---*---
```

The strings are read (after you strum) and displayed simultaneously on the LCD screen. String 6 is displayed in the upper left corner; string 5 is the next to the right, down to string 1 in the bottom right corner.

```
E 2 -03   A 2 +00   D 3 +00
G 3 -02   B 3 +02   E 4 -02
```

To exit OST, press END and you are returned to wherever you entered OST from.

Note: During a Nut Adjust, after two Pushbutton hits, the system automatically puts you into OST when it is time to unlock the Lock Nut (if necessary) and manually retune the strings. (See "Nut Adjust" in Chapter 8.)

Note: OST only reads the strings; the system will *not* make any tuning adjustments as in a Touch Up. Moreover, OST continues to read the strings much longer than they are read during the Touch Up procedure. As the strings ring down, frequency also drops and, like any tuner, OST reflects this.

Hint: OST can be used to find out what tuning the system is in at any time. If, for example, you first pick up the

guitar to begin playing and wish to find out what tuning the system is in, you can use OST to quickly find out. On occasion, this may also come in handy when you are going to change the strings. You can use OST to find out what tuning the system is in before removing the old strings to see what notes to tune the new strings to. (See “Changing/Replacing Strings” in Chapter 9.)

## Edit (EDT)

Use the Edit (EDT) button to program tunings, create names and set the Footswitch. (See “Editing”, Chapter 7 for complete instructions.)

## Copy (CPY)

Use the Copy (CPY) button to copy any tuning in either Library. All tunings in the CAT can be Copied and Inserted anywhere within the *User Library*.

### To copy any tuning

To copy any tuning, simply press the CPY button while *in* the tuning you wish to copy. The LCD will briefly notify you that the tuning is “copied”.

opE opG opD opA opC STD  
opE copied

This tuning is now in the clipboard and can be taken anywhere in the User Library and Inserted.

The clipboard holds only one copied tuning at a time and any copied tuning remains in the clipboard until some other tuning is copied in its place. Copied tunings can be inserted in as many places and as many times as you like in the User Library. See the next section on Insert.

## Insert (INS)

Copied Tunings can be inserted into the **User Library** only. With your desired tuning copied (in the clipboard), use the Arrow and SEL buttons to move to the desired destination for your tuning anywhere within the User Library.

While *in* the particular tuning you wish to replace, press the INS button. The LCD displays the Insert Tuning Now? Prompt.

INSERT TUNING NOW?  
yes: SEL                      no: END

Press SEL (“yes”) to insert. That’s it.

The tuning, with its notes and name displayed, is now in that particular Tuning Window (Tuning Menu) where it is ready to be used along with the other tunings in this Window. As mentioned in the preceding section, this or any copied tuning (in the clipboard) can be inserted in as many places within the User Library as desired.

Note: When Copying and Inserting Tunings from the *Chord Library*, you must exit the Chord Library and Enter the *User Library* to be able to Insert the Tuning. After your Chord Library Tuning is copied, hit END twice to back out to the Play Menu. Then use a Sideways Arrow button to highlight the User Library. Enter (SEL) the User Library and proceed to the desired destination for your copied tuning and Insert.

Note: The Insert button is also used to insert spaces while naming menus or tunings. (See “Editing”, Chapter 7.)

## Delete (DEL)

The Delete (DEL) button is used only during the Editing process and to select tunings in a Tuning Window. DEL makes it easy to erase unwanted characters while naming Tunings and Tuning Menus (Tuning Windows), and while programming the Footswitch.

### Using Delete

To use DEL, use the sideways Arrow buttons to move the cursor (underline) to beneath the character you wish to delete and press the DEL button. Whatever character the cursor is beneath is erased.

Hint: To erase an entire line (all characters), move the cursor to the far left and then press the DEL button as many times as necessary.

While in a Tuning Window, where tunings are accessed, DEL corresponds to the fifth tuning in the Window, as described in the “Bottom Row of Pushbuttons While in a Tuning Window” section in Chapter 4.

## Arrow Pushbuttons

The Arrow buttons are used to scroll (move) through the Menu Structure to highlight a particular selection. While in a Tuning Window, the Arrow buttons select their respective tunings. (See “Bottom Row of Pushbuttons While in a Tuning Window” in Chapter 4.) During Editing, the Arrow buttons perform a variety of functions. (See “Editing”, Chapter 7.)

## Chapter 6 - Other Features

### Capo Mode

With the CAT, Smart Bridge™ technology makes capo use easy. **Capo Mode** is automatically turned on during Touch Up when the system detects that a capo is installed. Capo Mode is unique in that it is not accessed within any menus and does not have its own Pushbutton. **Simply install your capo anywhere up to the 7th fret, Touch Up and you are in tune and ready to play.**

#### Using a Capo

While in any tuning in the CAT, install a capo at any fret position up to and including the seventh fret. Press the TCH (Touch Up) button. (See “Touch Up” in Chapter 5 if necessary.) Complete the Touch Up as instructed on the LCD screen. It may require more than one strum on certain strings the higher up you place the capo. (See “Touch Up” in Chapter 5 regarding the scrolling characters and dots during Touch Up.)

Once the system reads every string, it recognizes that a capo is installed, Touches Up accordingly, and displays the correct notes for the capoed fret on the LCD. You are now back in normal Play Mode and all system operations function the same as when playing without a capo.

Note: If you move the capo to a different fret position, a Touch Up will be required at the new fret position.

#### Quitting Capo Mode

When you are done using a capo and wish to operate the CAT without a capo, just remove the capo and Touch Up (TCH). *The system thinks the capo is still on and will operate as such, until a TCH is executed without the capo installed.*

Note: You can change tunings and perform most other operations normally while a capo is installed on the guitar.

Note: Partial capos cannot be Touched Up with the CAT. Of course you can install a partial capo exactly the same as on any guitar but you will not be able to Touch it Up using the system.

Reminder: In Capo Mode, the CAT can only Touch Up with a capo installed at the 7th fret or lower. If a capo is placed at the 8th fret or higher, when a Touch Up is attempted, the system will not Touch Up and will display the “Capo Fret Too High” message on the LCD.

Reminder: Always Touch Up after removing the capo. Capo Mode is *turned on* automatically by executing a

Touch Up with the capo installed, and it is *turned off* automatically by executing a Touch Up with *no* capo installed. The system thinks the capo is still on *until* a Touch Up is performed with *no* capo installed. This can be done while in any tuning.

### Battery Operation

#### *Powering the CAT with a Battery*

The 18 inch long Power Cord with the 7 pin DIN connector on one end is for use with the rechargeable 12 Volt Lead Acid Battery (optional). Plug one end into the Battery, the other into the guitar. While running on a Battery, plugging the Battery and Cord into the guitar turns power on, unplugging turns power off. (See “External Battery”, Chapter 12 for information regarding recharging and maintenance.)

Note: **Do Not unplug the battery while the motors are moving (during a tuning change).** If power is removed during a motor move, the system requires a Nut Adjust be executed to enable proper operation again. (See “Nut Adjust” in Chapter 8 if necessary.)

#### *Operating Time*

Battery operating time will vary depending on the condition of the battery, the number of tuning changes exercised, and the length of time the LCD backlight has been on. On a fully charged battery that is in excellent condition, and with the LCD Timeout mode set to 15 seconds (see “LCD Timeout” below), the artist can expect approximately two hours of battery operation with 120 tuning changes. With a lesser number of tuning changes the operation time will increase, and vice versa.

#### *LCD Timeout*

To conserve battery power, the LCD backlight can be programmed to turn off after a set period of time following the last hit on any Pushbutton. (See “LCD Timeout” in Chapter 8.)

## Low Battery Indicator

The battery is monitored for voltage by the computer. When the system senses that the battery is beginning to wear down, an asterisk is displayed in the *upper right hand corner* of the LCD.

MENU 1	MENU 2	*
MENU 3	MENU 4	

This means (one asterisk) that the battery has enough power left to run the system only for approximately 15 minutes more.

MENU 1	MENU 2	*
MENU 3	MENU 4	*

When a second asterisk is displayed in the *lower right hand corner* of the display, the Battery has only 5 minutes left. *It is recommended that the battery be replaced and recharged when the second asterisk appears.*

If the battery is not changed before it becomes too weak, the system will display a message that the battery must be changed before proceeding.

<b>BATTERY EMPTY: POWERDOWN</b>
<b>REPLACE BATTERY NOW</b>

This protects the system from losing position if power to the motors fails during a tuning change. At this point, you *must* either replace the Battery with a fresh one, or power the system with the Power Supply.

Note: When running the CAT on a battery while playing live, it is recommended that you have at least two batteries to be safe. This way, you can always have at least one fully charged spare battery in case the first battery loses charge.

## Footswitch Operation

The Footswitch plugs into the 1/4" jack in the rear of the Power Supply. Footswitch operation is designed so you can change tunings without using your hands. Instead of using the Pushbuttons to change tunings, just step on the Footswitch. While in any **Tuning Window** within the User Library or Chord Library, the Footswitch can be programmed to select the tunings in that Window in any order you wish. The Footswitch is programmed in the User Library *only*, using Edit (EDT) Mode. (See "Footswitch" in Chapter 7 for a full discussion of Footswitch operation.)

Note: The Footswitch can be used *only* while using the Power Supply. Footswitch operation is not possible while using a battery to power the system.

## Using the Footswitch in the Chord Library

The Footswitch is designed primarily for use in the *User Library*. However, if desired, the Footswitch can be used in the **Chord Library** as well. The Footswitch operates normally in the Chord Library but cannot be Edited (programmed) in the Chord Library. As mentioned earlier, *the Chord Library cannot be Edited or changed*. All Editing is done in the User Library.

The Footswitch Sequence for a Tuning Window in the User Library controls that window, and also controls the corresponding window (in the Menu Structure) in the Chord Library. In other words, the Footswitch Sequence for first Tuning Menu (Tuning Window) in the *User Library* controls the first Tuning Menu in the *Chord Library*, the second controls the second, and so on.

Example: If the *fourth* Tuning Window in the *User Library* (Menu 4) has the Footswitch Sequence 1-3-5, the *fourth* Tuning Window in the *Chord Library* (D-E) will use this same sequence (1,3,5) when you change tunings with a Footswitch.

If you wish to program the Footswitch for the tunings in any Tuning Window (Tuning Menu) in the Chord Library, you must go to the corresponding Window (Menu) in the User Library and program the Footswitch Sequence using Edit Mode. (See "Footswitch" in Chapter 7.)

Hint: Once you have a song written in the Chord Library, Copy and Insert the tunings into the User Library where they can be used however you like. (See "Copy" and "Insert" in Chapter 5.)

# Chapter 7 - Editing

## Overview

With Smart Bridge™ technology, to Edit, or create a tuning in the CAT is easy. The process is logical and fairly self-explanatory. After a few times you'll have it down. The Edit process involves setting the particular notes of the tuning, any temperament desired, naming both the Tuning and the Tuning Menu containing the tuning, the speed for that tuning change, and any Footswitch programming desired. That sounds complicated but it's not so hard, and it makes it possible to use the CAT to do truly phenomenal things with your music.

To use **Edit Mode** you must be *in* the **User Library**. The *Chord* Library is permanent memory set at the factory and cannot be edited or changed while *in* the Chord Library. Tunings in the Chord Library can however, be copied and brought over to the User Library where you can customize and use them however you wish. (See "Copy" and "Insert" in Chapter 5.)

The following will demonstrate the Editing process. **Don't be nervous, if you think you have made a mistake, just hit the END button at any time, follow any instructions on the LCD, if any, and then start over again.**

See Appendix D, "Edit Sequence Block Diagram" if desired.

## Naming a Tuning Menu

Each Tuning Menu consists of 6 tunings, with a total of 40 Menus in the User Library. Naming a Tuning Menu and its corresponding Tuning Window is very simple.

### To Name a Tuning Menu

Select the **User Library** from the Play Menu, and highlight the Tuning Menu you wish to rename.

UserLib	ChrdLib
StrTemper	TuneTemper

MENU 1	MENU 2
MENU 3	MENU 4

Press EDT (Edit). The "Edit Character Field" screen is displayed on the LCD.

<p><b>EDIT CHARACTER FIELD</b></p> <p>&lt;Menu 1&gt;</p>
--

Name your Tuning Menu using the sideways Arrow buttons to move the cursor, and the up and down Arrow buttons to set the characters. Up to 11 characters may be used. When the correct character is set above the cursor, hit the sideways Arrow button to move one space to the right or left and set the next character, and so on. The characters available are as follows:

SPACE Aa Bb Cc ... Zz <>=+ - / !  
A B C D E F G # b 1 2 3 ... 0

Hint: Hold down the up or down button to scroll quickly through the characters. Hit either the up or down button once to see one character at a time.

Hint: You can use the INS (Insert) button to insert a blank space within the name if desired. While the cursor is positioned where you want the blank space to be, press INS. A blank space is inserted and the cursor moves one space to the right to allow you to set the next character in the name.

When you have the name all set, press SEL. That's it.

You are back in the User Library with your newly named set of 6 tunings flashing (highlighted). All Tuning Menus in the User Library are named in this way.

To access these tunings simply press SEL. You are now in this Tuning Menu's corresponding Tuning Window where each button on the bottom row of Pushbuttons (closest to the LCD) selects its particular tuning. If you wish to Edit any *tunings* in this Window, simply select the desired tuning and press EDT. The following discusses the process of Editing a *tuning*.

## Editing a Tuning

To Edit any tuning in the User Library, you must be *in* the particular tuning you wish to Edit. Enter the User Library (**UserLib**) in the Play Menu and select the tuning in the normal way. The following will take you through the editing process step by step.

UserLib	ChrdLib
---------	---------

StrTemper	TuneTemper
-----------	------------

yes: SEL	no: END
----------	---------

MENU 1	MENU 2
MENU 3	MENU 4

For this example, select the first Tuning Menu in the User Library. Unless you have already changed the name (preceding section), this Tuning Menu is named Menu 1 as shown above. Press SEL with the first Menu highlighted.

STD STD STD STD STD STD
Select ...

You are now in a Tuning Window with the names of the six tunings in this Window displayed on the LCD. (Each Tuning Window has six tunings in it plus STD in the Background.) At this point, unless you have already changed something, all tunings in this Window are set to STD (standard tuning), but you can set them up any way you like.

STD STD STD STD STD STD
Select ...

Press any button on the bottom row of Pushbuttons (closest to the LCD) to choose its respective tuning. The first button selects the first tuning in the Window; the second button selects the second tuning, and so on. (See “Bottom Row of Pushbuttons While in a Tuning Window” in Chapter 4 if necessary.)

STD STD STD STD STD STD
E A D G B E

After selecting a tuning, the guitar changes to that tuning, and the name and notes of that tuning are displayed on the LCD. In this particular example shown above, the second tuning was selected.

### Entering Edit Mode

While in the **User Library** and *in* the particular tuning you wish to Edit, press the EDT button.

opE opG opD opA opC STD
E B E G# B E

Edit Tuning 1: opE?
---------------------

You are now in Edit Mode.

Press SEL (“yes”) when prompted by the “Edit Tuning ...?” message on the LCD. (Press END to abort or to set the Footswitch.)

Note: In this example you would be Editing the tuning Open E (opE). Since this is the first tuning in this Tuning Window, it is represented as “Tuning 1”, as shown above.

### Naming a Tuning

Now you see the “Edit Character Field” screen displayed on the LCD.

EDIT CHARACTER FIELD
< opE >

This is where you **name your tuning** with up to three characters. Use the Arrow buttons. As in naming a Tuning Menu, sideways Arrows control which character you are setting, as evidenced by the cursor (underline), and the up and down Arrows scroll through the characters. When the correct character is set above the cursor, hit the sideways Arrow button to move one space to the right or left to set the next character, and so on. The characters available are as follows:

**SPACE Aa Bb Cc ... Zz <=>+ - / !**  
**A B C D E F G # b 1 2 3 ... 0**

Hint: Hold down the up or down button to scroll quickly through the characters. Hit either the up or down button once to see one character at a time.

Note: You can use the INS (Insert) button to insert a blank space within the name if desired. While the cursor is positioned where you want the blank space to be, press INS. A blank space is inserted and the cursor moves one space to the right to allow you to set the next character in the name.

When you are done naming your tuning, hit the SEL button. This saves the name and brings you to the next stage in the Editing process, setting the particular notes of the tuning.

Note: Whenever you do *not* wish to change a name, pressing SEL will send you to the next stage in the Edit process immediately. Pressing the END button saves any changes made, immediately exits you from the Edit

process, and requests a Touch Up if you have changed any of the notes or temperaments in the tuning.

## Setting the Notes of a Tuning

opE					
E	B	E	G#	B	E

Now you are ready to set the particular notes for each string plus any temperament of any string, sharp or flat if desired. The LCD now displays the name of the tuning, and the notes of the tuning. The first note of the tuning (string 6) should be flashing. In the example above (opE) this string is tuned to E. Whichever note is flashing (highlighted) is the one that you have Edit control over. The up Arrow moves the note up, and the down Arrow moves the note down. Once you have the proper note set for that string, use the sideways Arrows to move to any other string you wish to Edit.

When your tuning is all set, if no temperament is desired and no motor speed adjustment is desired, press the END button. (You can also exit the Edit process by pressing SEL three times, which takes you through the rest of the Edit process without changing any more settings). See the following section on “How to Temper Notes” for any string in any tuning you Edit.

Note: As mentioned above, when you exit Edit Mode, the system requires a Touch Up in your new tuning if you have changed any notes or temperament in the tuning.

Note: While setting the notes of a tuning, it is impossible to program a note that is not within the operating range of your CAT. The scrolling stops at the highest and lowest possible notes for each string. In this instance, the Menu does not “wrap” around from the highest to lowest notes. (See "System Operating Ranges", Appendix E for the range of possible notes for each string relative to your particular gage of strings and software version.)

Important: Write down your tunings set in Edit Mode in Appendix A, “Tuning and Temperament Records”.

## How to Temper Notes

opE					
E	B	E	G#	B	E

Setting temperament sharp or flat is possible on any or all string(s) in any tuning. While you have the proper note

set and flashing on the screen, instead of using one of the sideways Arrows to move to the next string, press SEL. After pressing SEL, the note is replaced by the number 0, (as shown for string 6 in the diagram below).

opE	opG	opD	opA	opC	STD
0	B	E	G#	B	E

Use the up and down Arrows to temper this note in this tuning (E, in the above example) sharp or flat. Minus 3 equals 3 cents flat, plus 1 equals 1 cent sharp, and so on. Each note can be tempered down to 25 cents flat, and up to 10 cents sharp.

Once you have your proper temperament set, use the sideways Arrows to get the next string you wish to change flashing (highlighted). When your notes and temperaments (if any) are all set, press SEL to go to the next stage in the Edit process, or hit END to leave Edit.

Note: Hitting END at this point, or at any point throughout the Edit process, will keep any changes you have made and exit you from Edit Mode, skipping the next stage(s) in the Edit process. (Again, a Touch Up will be required when leaving Edit after changing any notes or temperaments.) To move through the Edit process without changing anything, simply use the SEL button to proceed through the various stages of the Edit process.

Important: Write down your tunings and temperaments set in Edit Mode in Appendix I, “Tuning and Temperament Records”.

## Setting the Speed of a Tuning Change

After the notes of your tuning and any temperaments are set, the last stage in the process of Editing a Tuning is setting the Tuning Change Speed. The speed you select (Full Speed or Custom Speed) sets the rate of change *from* any other tuning *to* the tuning you are Editing.

Speed of Tuning Change is completely adjustable up to Full Speed, and every tuning in the User Library can have its own unique speed setting. Use it as a part of your creative process. Use the same speed for all tuning changes, or customize the speed for the change *to* any particular tuning. This allows you to sync the *time* it takes to make tuning changes with the tempo of a song, and use the tuning change as an effect in itself.

## Full Speed

By using the SEL button to move through the Edit process, the “Full Speed?” prompt is displayed on the LCD, as shown below. Pressing SEL automatically sets the speed (or time) the system will change *to* this tuning *from* any other tuning at Full Speed. For any and all tunings in the User Library, Full Speed is the fastest speed, or quickest way to change tunings.

**FULL SPEED ?**  
yes: SEL                      no: END

Press the SEL button for Full Speed. (Press END to set a Custom Speed for this tuning.)

Note: All tunings in the *Chord Library* operate at Full Speed and cannot be changed in the Chord Library. However, they can be Copied and Inserted into the User Library where they can be fully Edited and used however you like.

## Custom Speed

Custom Speed is used to set the speed, or time for a particular tuning change to something slower than Full Speed.

### Setting Custom Speed

**FULL SPEED ?**  
yes: SEL                      no: END

With the Full Speed? prompt displayed on the LCD, press the END button (instead of SEL for Full Speed).

The LCD now displays the *Beats Per Minute*.

**Custom Speed**  
beats per minute: 120

Use the up and down Arrows to set the number of Beats per Minute. Remember, you can hold down the up or down Arrow buttons to scroll quickly. Beats per Minute can be set from 40 to 208. (60 beats per minute would be one beat per second, and so on.)

When you have your Beats per Minute set, press SEL.

**Custom Speed**  
beats for change: 4

Now the LCD display shows “*Beats For Change*”. This sets the number of beats (defined in the previous step) it will take to complete this tuning change. Use the up or

down Arrows to set the number of beats for this tuning change. Beats for Change can be set from 1 to 32.

When you have your Custom Speed set, press SEL or END. The process is complete and you are now back in the original Tuning Window you entered Edit Mode from, and in your newly Edited tuning. Again, a Touch Up will be required when leaving Edit after changing any notes or temperaments.

Important: Write down your tunings, temperaments, and tuning change speeds set in Edit Mode in Appendix I, “Tuning and Temperament Records”.

See the next section regarding Understanding Custom Speed.

### Understanding Custom Speed

Custom Speed is best understood by relating it to time. In fact, when you set a Custom Speed you are essentially setting the exact *time* it takes for the system to change *to* this particular tuning *from any other tuning*. Because of this, the actual speed that the Arms are moving during this tuning change is entirely dependent upon how *far* the Arms must move *to* this tuning *from* the previous tuning. The system adjusts the motor (Arm) speed to arrive at the selected tuning in the specified period of time set in Custom Speed, considering how far the Arms must travel to reach this tuning. Therefore, the actual speed the Arms (motors) move during a tuning change is different each time you change *to* this particular tuning *from* different tunings. The following example demonstrates this principle.

Example: With Beats Per Minute set at 60 (one beat per second), and Beats For Change set at 4, the system will take 4 seconds to change to this tuning. (4 Beats during the tuning change, with each Beat taking one second.) No matter what tuning the system is in when you select this particular tuning it will take 4 seconds to arrive at this tuning. If the system only needs to change one string one half-step to reach this tuning, it will take 4 seconds to do it. If the system needs to move all strings four half-steps, it will also take exactly 4 seconds, and so on.

### Speed Limit

If you program the Custom Speed to be too fast (faster than Full Speed), the system will automatically make this tuning change at Full Speed when selected and will briefly display the following message on the LCD:

**Too Fast,  
Slow Down !**

Whenever you see this message, you have programmed the Custom Speed for *this* tuning change to be faster than the system allows.

To correct this, re-enter Edit Mode while in *this* particular tuning in this same Tuning Menu. Use the SEL button to proceed through the Edit process until reaching the “Full Speed? Screen on the LCD. Either select Full Speed (the fastest possible speed), or correct the Custom Speed for *this* tuning. To correct the Custom Speed, either *decrease* the number of Beats per Minute, or *increase* the number of Beats for Change.

Note: Selecting Full Speed at the Full Speed? prompt overrides any settings for this tuning in the Custom Speed section described above, no matter what those settings are.

It should be noted that it is possible to set a Custom Speed that is O.K. when changing *from* certain tunings and “*Too Fast*” when changing *from* other tunings. This depends on how far the Arms must travel *from* the current tuning to the selected tuning relative to the Custom Speed (time for change) you have set for the selected tuning. If you experience any problems in this area, simply correct as described above.

Reminder: There are six individual speed settings in each Tuning Window, one for each tuning cell. In other words, each and every tuning in all Tuning Menus in the User Library can have its own unique speed setting if desired.

## Footswitch

The CAT can be programmed to choose the order in which tunings in a particular Tuning Window are selected with a Footswitch. This allows you to keep your hands free while you change tunings. Programming the Footswitch is simple and provides complete flexibility in how you use the tunings in each Tuning Window.

### The Footswitch Sequence

The Footswitch Sequence controls the order that tunings are selected with each press on the Footswitch. Upon receipt, all Tuning Menus are set with the Footswitch Sequence 1,2,3,4,5,6. However, you can set this sequence to whatever you like, and each Tuning Menu can have its own unique sequence with up to 20 characters. The Footswitch Sequence is programmed in Edit Mode.

All Tuning Windows in the *User Library* can have their own unique Footswitch programming. Each Window has only one Footswitch Sequence and the sequence can be set while Editing any one of the six tunings in each Window.

### Entering Edit Footswitch Sequence Mode

Press the Edit button while in any tuning in the *User Library*, the “Edit Tuning?” Prompt, shown below, is displayed on the LCD.

```
          Edit Tuning 1: opE
yes: SEL                               no: END
```

Choose “no” by pressing END. This brings you to the “Edit Footswitch Seq.?” prompt, shown below.

```
          Edit Foot Switch Seq ?
yes: SEL                               no: END
```

Choose “yes” by pressing SEL. Now the six tunings in this Window are displayed across the top row of the LCD, with SEQ: 1 2 3 4 5 6 displayed on the bottom row as shown below.

```
          DAD opG GAD ADE RNS opD
          SEQ: 1 2 3 4 5 6
```

You are now ready to Edit (program) the Footswitch Sequence to set the order in which the tunings in this Window will be selected with each press on the Footswitch.

### Editing the Footswitch Sequence

```
          opE opG opD opA opC STD
          SEQ:: 1 2 3 4 5 6
```

Use the Arrow, Delete, and Insert buttons to program the Footswitch Sequence. Use the sideways Arrow buttons to move the cursor to beneath the cell (number) you wish to set, and the up and down Arrows to set the number from 1 to 6.

Example: For the Window shown above, opE, being the first tuning in the Window, is tuning #1, opG is 2, opD is 3 and so on up to STD being tuning #6. The above sequence, since it is 1,2,3,4,5,6, would select these tunings in sequential order from tuning #1 (opE) up to #6 (STD) and then start over again at 1. The sequence can be 20 characters long, and in any order you desire.

## Delete

To delete (erase) a character (tuning) in the Footswitch Sequence, use the sideways Arrows to move the cursor and press the DEL button to erase the number in the cell that the cursor is beneath.

When your Footswitch Sequence is all set, hit SEL or END. The sequence is saved, you return to the Tuning Window, *and the system changes to the tuning in the sequence that the cursor is currently beneath.*

Important: Write down your tunings and temperaments, tuning change speeds, and Footswitch Sequences set in Edit Mode in Appendix I, “Tuning and Temperament Records”.

Important: Notice when you exit Edit Mode that the system changes to the tuning that the cursor is beneath in the Footswitch Sequence. This knowledge is key in understanding how to successfully operate the Footswitch while playing the guitar. (This is explained below in “Using the Footswitch”.)

## ***Accessing the Background Tuning (STD) with the Footswitch***

As described in the section on the Background Tuning, Standard Tuning is “behind” every tuning in the CAT.

Programming the Footswitch Sequence to use the Background Tuning (STD) is very simple as well. Simply repeat the number of any tuning twice in a row within the Footswitch Sequence. The system will recognize the second successive occurrence of the same number as a call for STD tuning (Background Tuning).

The following example shows how to incorporate STD tuning into the Footswitch Sequence, even though it does not appear as a tuning in the Window.

<b>DAD opG GAD ADE RNS opD</b>
<b>SEQ: <u>1</u> 2 2 4 5 5 3</b>

The first press on the Footswitch selects **DAD**, the second hit selects **opG**, the third selects **STD** (Background Tuning), the fourth selects **ADE**, the fifth selects **RNS**, the sixth selects **STD** (Background Tuning), and the seventh hit selects **GAD**. The next hit on the Footswitch starts the sequence all over again.

## ***Using the Footswitch***

Once your Footswitch Sequence is set, the CAT allows complete flexibility in how the Footswitch can be used. A few principles (rules) must be understood to be able to

use the Footswitch to match your particular needs in different situations. A discussion of these principles follows.

## ***Understanding the Cursor***

Understanding the operation of the cursor is key to effective Footswitch operation. The cursor serves important functions both while editing the Footswitch Sequence, and when using the Footswitch to change tunings while playing the guitar. The following discusses the function of the cursor and how to use the cursor to correctly operate the Footswitch to change tunings once your Footswitch Sequence is set.

### Cursor Rules

1. When you exit Edit Mode from the “Footswitch Sequence” screen, the system changes to the tuning that the Cursor is beneath in the Footswitch Sequence, and returns you to the appropriate Tuning Window.
2. Each time the Footswitch is pressed, the Cursor *advances* one cell to the right, and the tuning *changes* to the tuning corresponding to the number in that cell.
3. When a Pushbutton is pressed while using the Footswitch, the system performs that button’s current function, and the Cursor *does not* change position in the Footswitch Sequence.
4. When you exit a Tuning Window, the Cursor *does not* change position in the Footswitch Sequence.
5. When you first enter a Tuning Window using the Pushbuttons, the Cursor *does not* change position within the sequence.
6. The sideways Arrow buttons are used (using Edit Mode) to move the Cursor within the sequence.

## ***Setting the Cursor***

As defined in the above Cursor Rules, the position of the Cursor within the Footswitch Sequence is what determines which tuning in the sequence will be selected with the next press on the Footswitch. Before you begin to play any song for which you intend to use the Footswitch, use Edit Mode to set the position of the Cursor in order to begin Footswitch operation at the desired position within the sequence. The following two sections discuss how to set the Cursor to start Footswitch operation at the beginning of the Footswitch Sequence, or anywhere else within the sequence.

### To Start at the Beginning of the Footswitch Sequence

Most likely, once your song is written and arranged, and your Footswitch Sequence is all set, when you play your song, you will want to start at the beginning and play the song through to the end. Use Edit Mode to set

the Cursor to achieve this. Before beginning to play the song, quickly go into “Edit Footswitch” Mode and ensure that the Cursor is set properly (beneath the first tuning in the sequence). See below.

In the **User Library**, enter *any* tuning in the desired Tuning Menu (Tuning Window) in the normal way.

```
DAD opG GAD ADE RNS opD
Select ...
```

```
DAD opG GAD ADE RNS opD
D A D G A D
```

Before beginning to play the song, ensure that the Cursor is beneath the first tuning in the Footswitch Sequence using Edit as described below.

Press the EDT (Edit) button.

```
Edit Tuning 3: GAD?
yes: SEL          no: END
```

Press END to access the “Edit Footswitch” screen in the normal way.

```
Edit Foot Switch Seq ?
yes: SEL          no: END
```

Press SEL to access the Footswitch Sequence in the normal way.

```
DAD opG GAD ADE RNS opD
SEQ: 1 2 2 4 5 3
```

Notice in the above example that the Cursor is beneath the last tuning in the Footswitch Sequence. (This is where it is *always* positioned *whenever* you play a song completely through to its end while using the Footswitch to change tunings.)

Use the sideways Arrow buttons to position the cursor properly within the Footswitch Sequence. **To start at the beginning of the sequence, simply move the Cursor to beneath the first character (tuning) in the sequence**, as shown below.

```
DAD opG GAD ADE RNS opD
SEQ: 1 2 2 4 5 3
```

With the Cursor positioned beneath the first tuning in the Footswitch Sequence, hit SEL or END. This exits Edit Mode, the system changes to the first tuning in the Footswitch Sequence (because the Cursor is beneath it), and you are ready to play. The first press on the Footswitch will select the second tuning in the sequence; the next selects the third in the sequence, and so on.

**Important:** It is strongly advised that you get in the habit of ensuring your Cursor is properly set for correct Footswitch operation. Especially when performing live. See next note.

**Important:** There is one other way to ensure you are starting at the first tuning in the Footswitch Sequence. If desired, while in any tuning within the appropriate Window, you can simply press the Footswitch the required number of times to move to the first tuning in the Footswitch Sequence. However, this requires that you have the sequence memorized, and may be undesirable while playing live. The above method is usually the easiest and most reliable.

#### To Start Anywhere Within the Footswitch Sequence

While practicing, recording, writing, or whenever, you may wish to start Footswitch operation somewhere other than at the first tuning in the Footswitch Sequence. This is done in much the same way as above.

While in *any* tuning in the appropriate Tuning Window in the User Library, use “Edit Footswitch” Mode to move the cursor to beneath the tuning you wish to start in. Then press SEL or END. You are back in the Tuning Window, in the tuning you set the Cursor beneath, and ready to play. Each press on the Footswitch progresses through the Footswitch Sequence from there.

Note: If desired, while in any tuning within the appropriate Window, you can simply press the Footswitch the required number of times to move to the appropriate tuning in the Footswitch Sequence. However, this requires that you have the sequence memorized, and may be undesirable while playing live. The above method is usually the easiest and most reliable.

### **Footswitch Operation Hints**

Hint: The Footswitch does not operate when you first enter a Tuning Window and see the “select ...” screen. A tuning must be selected using the Pushbuttons first.

Hint: The computer does not recognize a press of the Footswitch until the last tuning change has finished.

Hint: If the Footswitch Sequence is left blank (no Footswitch Sequence), the Footswitch will not operate in that Window.

Hint: The Footswitch Sequence for each Tuning Window in the User Library also controls Footswitch operation in the corresponding Tuning Window of the Chord Library. (See “Using the Footswitch in the Chord Library in Chapter 6.)

### ***Connecting the Footswitch***

The Footswitch plugs into the 1/4” jack on the back of the CAT’s Power Supply.

Note: It is not possible to use the Footswitch while running on the external Battery.

# Chapter 8 - The Menus

See the “Menu Organization” Diagram in Appendix A for a complete block diagram of the Menu Structure.

## Main Menu

The Main Menu is the starting point for all operations of the CAT. The Main Menu contains the **Play Menu**, **Individual String Mode**, **Maintenance Menu**, and the **Service Menu**. All Menu features in the CAT are within these four components of the Main Menu. A detailed description of each follows. (See “Navigating the Menu Structure” in Chapter 4.)

## Play Menu

The Play Menu is where you will spend the bulk of your time with the CAT. It contains *all* of your tunings and much more. The Play Menu has more than 4 possible selections to choose from. In fact it has 6. In other words, since only 4 choices are shown on the LCD at a time, you must use the up or down Arrow buttons to scroll up or down to access the fifth and sixth selections in the Play Menu. Notice how the Menu wraps around so you can scroll up, down, and sideways in any direction endlessly.

To enter the Play Menu simply highlight Play in the Main Menu and press SEL.

<b>Play</b>	IndivString
Maint	Service

The six components of the Play Menu are the **User Library** (UserLib), **Chord Library** (ChrdLib), **String Temper** (StrTemper), **Tuning Temper** (TuneTemper), **Stage**, and **LCD Timeout**. (LCDTimeout). A discussion of each follows.

---

### User Library (UserLib)

This is where you create, arrange and use your own tunings in any way you like. The User Library is designed to allow complete customization. The User Library has 40 Tuning Menus, corresponding to 40 respective Tuning Windows containing 6 tunings each, plus Standard in the Background. (See “Background Tuning” in Chapter 4.)

To enter the User Library select **UserLib** in the Play Menu.

<b>UserLib</b>	ChrdLib
StrTemper	TuneTemper

<b>MENU 1</b>	<b>MENU 2</b>
<b>MENU 3</b>	<b>MENU 4</b>

The tunings in the User Library are initially set at the factory with most of them set to STD (standard), and other tunings at the end of the library. However, you can change and move these tunings around as you see fit. (See “Editing”, Chapter 7. See also “Copy” and “Insert” in Chapter 5.)

The User Library is where all customization of tunings (Editing) is done, and where you use those tunings to play your songs. Once you begin writing songs using different tunings, the User Library is *most likely*, but not necessarily, where you will mainly dwell.

---

### Chord Library (ChrdLib)

The Chord Library is permanent memory set at the factory and cannot be changed. There are 24 Tuning Menus corresponding to 24 Tuning Windows with 6 tunings in each, plus standard in the Background. (See “Background Tuning” in Chapter 4.) These Tuning Menus are set in various ways grouping certain related tunings.

To enter the Chord Library select **ChrdLib** in the Play Menu.

UserLib	<b>ChrdLib</b>
StrTemper	TuneTemper

<b>STANDARD</b>	<b>EGDAC</b>
<b>A-C</b>	<b>D-E</b>

The Chord Library is intended to be a source for ideas, as well as to enable the artist to begin changing tunings quickly while learning to use the CAT. All tunings in the Chord Library *can* be copied and inserted into the User Library where they can be Edited (customized) to use however you wish. (See “Editing”, Chapter 7, and “Copy” and “Insert” in Chapter 5.)

(See “Bottom Row of Pushbuttons While in a Tuning Window” in Chapter 4 for how to access tunings.)

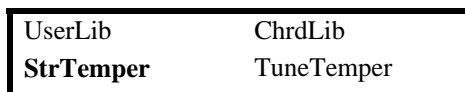
### ***String Temper (StrTemper)***

If desired, String Temper can be used to temper any string(s) sharp or flat in *all* tunings. The artist may find that for his or her particular style of play, one or more of the strings in *all* tunings seem a bit sharp or flat. This is chiefly due to each performers playing style and attack. Strings tend to drift higher in frequency while being played. This effect is most noticeable on the larger strings when they are tuned to lower notes and played very hard. For an artist who plays very hard, he or she may temper the string to as much as 10 cents flat on string six.

String Temper (StrTemper) Mode allows each string to be tempered in *all* tunings by a selected number of cents. Again, setting String Temper on any string will temper that string in *all* tunings. Use Edit Mode to achieve more individualized temperament if desired.

#### **Setting String Temper**

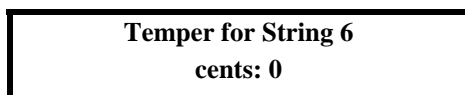
Select **String Temper** in the Play Menu.



The “Reset String Temper” screen is on the LCD.



Press END for no. (Press SEL to reset to “0”)

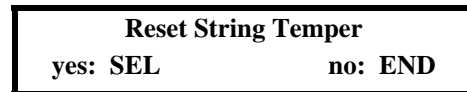


Now the “Temper for String 6” screen appears. Use the Up or Down Arrows to set the desired number of cents sharp or flat for string 6. Hit SEL to save the setting for string 6 and move to string 5, and so on. SEL will scroll through each string and END will immediately save any

new settings and exit String Temper. Each string can be set from 10 cents sharp to 10 cents flat using this feature.

#### **Resetting String Temper to 0**

Resetting String Temper to “0” is very easy. Enter String Temper as above, but at the “Reset String Temper” prompt press SEL. That’s it. This resets all settings on each string to zero.



Important: **All temperaments in the CAT are cumulative.** Temperament set in String Temper will add to or subtract from any temperament set in Edit Mode, as well as in Tune Temper. For example, if string 6 is tempered 3 cents flat in Edit Mode for a particular tuning, and String Temper is set at minus 2 on string 6, that string will be 5 cents flat for this tuning.

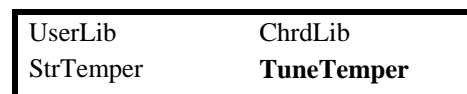
### ***Tune Temper***

You may wish to adjust the temper of *all* strings for *all* tunings sharp or flat. This is most useful when playing along with prerecorded material which is sharp or flat or when adjusting your tunings to match someone’s particular vocal range. The Tune Temper mode allows the entire tuning system to be tempered by plus or minus 50 cents.

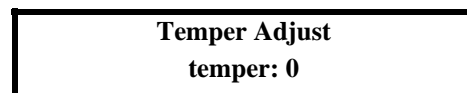
As mentioned above, any temperament set in Tune Temper will *add to* or *subtract from* any temperament set in Edit or String Temper.

#### **Setting Tune Temper**

Select **Tune Temper** in the Play Menu.



The “Temper Adjust” screen is displayed on the LCD.



Use the up or down Arrows to set the entire tuning sharp or flat, up to 50 cents each way.

Hit SEL or END when done.

Remember, any temperament set in Tune Temper works on *all* tunings in the CAT.

### **Resetting Tune Temper to 0**

To reset Tune Temper to zero, just do the opposite as above. Select Tune Temper in the Play Menu, and set the Tune Temper to “0” using the up or down Arrow buttons. Hit SEL or END when done.

<b>Temper Adjust</b> <b>temper: 0</b>
--

Reminder: All temperaments in the CAT are cumulative. Temperament set in Edit Mode will *add to* or *subtract from* any temperament in String Temper, as well as in Tune Temper.

---

### ***Stage Mode (Stage)***

Stage Mode is strictly a safety feature designed to avoid hitting any pushbuttons by mistake while playing live on stage. You can set Stage Mode to disable the top row of pushbuttons while in a Tuning Window, and set the END button on a timer. This is a handy feature if you have problems hitting buttons by mistake while playing your guitar.

### **Setting Stage Mode**

Use the up or down Arrow buttons to highlight **Stage** in the Play Menu and press SEL.

UserLib	ChrdLib
StrTemper	TuneTemper
<b>Stage</b>	LCDDTimeout

The “Enable Stage Mode?” screen is displayed on the LCD.

<b>Enable Stage Mode?</b>	
<b>yes: SEL</b>	<b>no: END</b>

Press SEL.

<b>Stage Mode</b> <b>END KEY delay: 2</b>
--

The “Stage Mode END KEY delay:” screen is displayed on the LCD. Use the up and down Arrow buttons to set the number of seconds for which you wish to set the END KEY delay. (2 seconds is a good place to start.) Press SEL or END when done. Stage Mode is now on in all tunings. (See next note.)

**Important:** Stage Mode operates *only* while you are in a Tuning Window. It turns off the top row of Pushbuttons, puts the END button on a timer (requiring you to *hold down* the END button for the set number of seconds for it to take effect), yet leaves the bottom row of buttons operating normally. This allows you to access all of your tunings in a Tuning Window while shutting off all unwanted Pushbuttons. Remember, you must hold the END button down for the set period of time to leave a Tuning Window when Stage Mode is on.

### **Turning Off Stage Mode**

To turn off Stage Mode, enter Stage in the Play Menu.

UserLib	ChrdLib
StrTemper	TuneTemper
<b>Stage</b>	LCDDTimeout

At the “Enable Stage Mode?” prompt press END.

<b>Enable Stage Mode?</b>	
<b>yes: SEL</b>	<b>no: END</b>

Stage Mode is now off and all pushbuttons are back to normal function.

Hint: If at any time you find that the END button, or any of the Pushbuttons along the top row do not work, Stage Mode is probably on. If this is not desired, hold down the END button until it registers, enter Stage again (in Play Menu) and turn Stage Mode off as above.

---

### ***LCD Timeout***

LCD Timeout applies to battery operation only (optional). It allows you to save battery power by controlling how long the LCD backlight stays on after pressing a Pushbutton. When any button is pressed, the LCD backlight comes on for the set period of time and then automatically turns off. All other operations function normally. LCD Timeout is designed to save battery power and extend the operating time while running the CAT on a battery. It should be noted that the initial button hit which turns the LCD backlight on also executes whatever is that button's current function.

### Setting LCD Timeout

To set the LCD Timeout, enter **LCDDTimeout** in the Play Menu.

UserLib	ChrdLib
StrTemper	TuneTemper
Stage	<b>LCDDTimeout</b>

The following screen is displayed on the LCD.

<b>Select LCD Timeout ...</b>
<b>Continuous</b>

Time can be set from Continuous (backlight always on) down to 15 seconds. Use the up and down Arrow buttons to set the desired time. Press SEL when done.

Example: With LCD Timeout set at 15 seconds, while running on a battery the LCD backlight will stay on for 15 seconds after the last Pushbutton was pressed. While the backlight is off, the next press on a Pushbutton performs the function of that Pushbutton and turns the backlight on for another 15 seconds.

Recommendation: Start out by setting the LCD Timeout to 30 seconds initially, and then lower it to 15 seconds after you become more familiar with your CAT. The lower you have it set, the longer your battery will last before needing recharging.

Note: The LCD backlight is lit continuously when the system is powered from the 12 VDC power supply.

### **Individual String (IndivStr)**

Individual String Mode is very helpful in experimenting with different tunings to find just the right one. In this mode you have individual control of each string, enabling you to easily change the notes (tuning) of each string while the system tunes to your selected notes and displays them on the LCD. All of this and more is also possible in Edit Mode, but it is simplified in Individual String Mode for ease of use. You should find Individual String Mode to be a very useful feature throughout the creative process.

### Using Individual String Mode

In the Main Menu, scroll over to **IndivStr** and hit SEL.

Play	<b>IndivString</b>
Maint	Service

The LCD displays the “Individual String” screen with the notes of the tuning across the bottom of the LCD.

<b>Individual String</b>
<b>D A D G A D</b>

The first note of the tuning (string 6) is highlighted (flashing). The up and down Arrow buttons move the note up or down throughout its range, one half-step at a time. Use the sideways Arrow buttons to highlight whichever string you wish to adjust.

### Copying from Individual String Mode

All tunings set in Individual String Mode can be copied and inserted into the User Library where they can be Edited and used however you like.

When you have your tuning established, press the Copy (CPY) button. That tuning is now in the *clipboard* and can be Inserted anywhere in the User Library in as many places and as many times as you like. (See “Copy”, and “Insert” in Chapter 5.)

Once the tuning is in the User Library, like all tunings in the User Library, it can be Edited. You can name the Tuning, name the Tuning Menu, change any of the notes, temper any notes of the tuning, set the speed the system will change to that tuning, and set it up to work with a Footswitch. (See “Editing”, Chapter 7.)

Hint: The tuning in the clipboard *is* the tuning in Individual String Mode when you first select it. In other words, when you copy a tuning, that tuning automatically becomes the tuning in Individual String Mode. This is a useful feature when you have found a tuning that’s close to what you want, but needs a little changing. You can copy that tuning, go into Individual String and adjust it without changing the original tuning. Then, when it is all set, copy it again and use it in the User Library.

### **Maintenance Menu (Maint)**

The Maintenance Menu (Maint) is where the most commonly used maintenance features are enabled. **Nut Adjust, Stretch, Adjust Strings** (AdjStrs) and **Battery** make up the Maintenance Menu. A discussion of each follows.

To Enter the Maintenance Menu, use the Arrow buttons to highlight **Maint** in the Main Menu and press SEL.

Play	IndivString
<b>Maint</b>	Service

---

## ***Nut Adjust***

Nut Adjust is definitely the most important feature in the Maintenance Menu. Your ability to keep your CAT running properly and virtually problem-free is largely dependent upon your understanding and proper use of Nut Adjust. **Proper use of Nut Adjust, always using the correct gage strings, and installing the strings correctly is about all that is necessary to keep from ever having any operational problems with the CAT.**

### **What Nut Adjust Does**

Quite simply put, Nut Adjust keeps the CAT in its proper mechanical adjustment. The springs in the Mechanical Device must be properly balanced with the tensions of the strings to enable the Mechanical Device to run its full range, and be accurate within that range. Nut Adjust is used to accomplish this alignment.

During Nut Adjust, messages on the LCD prompt you for each action. Ultimately, if necessary, you unlock the Lock Nut, manually tune the guitar to standard, re-tighten the Lock Nut, and perform a Touch Up.

When the strings are not manually tuned correctly, two types of problems can arise.

1. *Firstly*, a requested operation may not be within the possible range of the Mechanical Device. When the system detects that any string's (manual) tuning is outside the allowable boundary, and you request a tuning in which at least one string would need to adjust to a point that is unreachable, an "Out of Limits" message and a prompt to execute Nut Adjust is displayed on the LCD. In this case, Nut Adjust enables the CAT to reach its full tuning range by centering each Arm within its range.

2. *Secondly*, the balance between the force of the springs in the Mechanical Device and the tensions of the strings can be thrown off. If this balance is off by too much in either direction it can cause the motor to stall or miss steps during a motor move (tuning change). This causes the system to be out of tune, or causes a motor to get stuck at either end of its range. In fact, any number of problems can result from this balance being off. In this case, Nut Adjust brings the forces in the Mechanical Device into correct balance.

### **How Nut Adjust Works**

Nut Adjust runs all of the motors to motor position "0", where each Arm touches its Limit Switch, and then runs the motors (Arms) up to the exact motor position of Standard Tuning. At this point, when you loosen the Lock Nut, manually adjust all strings to Standard, and

then tighten the Lock Nut, all forces within the Mechanical Device are in equilibrium. Specifically, the balance between the force of the springs and the tension of the strings is correct, and the Arms are centered within their operating range. When this is not the case, the Mechanical Device may not run correctly, and/or you may get an "Out of Limits" message prompting you to perform a Nut Adjust.

**Important:** Your CAT is set up for a particular gage of strings both in the Mechanical Device and in its software. Changing string gages or using an incorrect string could make it impossible for the CAT to run properly. The correct string gages are displayed on the LCD at Startup. (See "Installing and Replacing Strings" in Chapter 9.)

### **More about Nut Adjust**

While Touch Up performs relatively minor adjustments to bring the guitar into tune, Nut Adjust performs major adjustments to bring the system into alignment. Therefore, it is not necessary to execute Nut Adjust until a major adjustment is needed. Nut Adjust will most often be required when replacing string(s) or after prolonged periods of string stretching.

### **Nut Adjust is needed when:**

1. Strings have stretched significantly. Touch Up will compensate for this to a point. However, a string can stretch so much that the Mechanical Device does not have enough room within its range to make the necessary adjustment. In this case, when the system detects this problem it will display an "Out of Limits" message on the screen and prompt you to execute a Nut Adjust.

Note: You should always **stretch** new strings completely when installing them on the CAT. As with all guitars, the fat strings can stretch up to three or four half-steps below standard while the smaller strings stretch less. We recommend that, when installing new strings on the CAT, you manually stretch the strings completely along their full lengths, and then run the Stretch Mode also. (See "Installing and Replacing Strings" in Chapter 9.) This significantly reduces the number of Touch Ups and Nut Adjusts needed while new strings settle in.

2. Whenever the guitar has not been played in a while. Over time, temperature and humidity changes can have a large effect. The strings can stretch; the strings can slip through the Lock Nut, the machine heads (tuning pegs) can be turned accidentally, etc. If your CAT has been in storage or if you just haven't played it for a month or so, it is a good idea to start off with a Nut Adjust.

3. Whenever you replace strings. (See "Installing and Replacing Strings" in Chapter 9.) Whether replacing one or all strings, a Nut Adjust should be performed as soon

as possible after the string(s) is (are) installed and stretched.

4. After replacing a broken string. (See “Replacing a Broken String” in Chapter 9.)

5. Whenever you ship the guitar. (See “Shipping” in Chapter 9.) Shipping exposes guitars to heat fluctuations, rough rides and rough handling. It is always a good idea to do a Nut Adjust after shipping.

Note: You should always loosen the strings a bit on any guitar that is to be shipped. With the CAT, S-3 (STD minus 3 half-steps) found in the Standard Menu in the Chord Library works well for shipping. (See “Shipping” in Chapter 9.)

6. After any problem solving caused by incorrect string gages, incorrect string tension relative to the position of STD, a stuck Arm, or anything else that causes the system to cease operating correctly. A *successful* Nut Adjust will bring the system into line. (See the end of this Nut Adjust section.)

7. Whenever you want to. With experience you will get a “feel” for when to do a Nut Adjust. While not absolutely necessary, you may prefer to execute a Nut Adjust before every live show, recording session, practice session or whatever. After the strings have settled in and completely stretched, you can go quite a while before needing a Nut Adjust. However, it is O.K. to perform Nut Adjust as often as you like. There is a certain feeling of security in knowing that you have just executed a Nut Adjust and your CAT is completely aligned.

**Note:** Nut Adjust affects tunings that were Touched Up prior to that Nut Adjust. For example: If the (manual) tuning was way out relative to the exact motor position of STD prior to executing a Nut Adjust, any tunings that were Touched Up under that state may need to be Touched Up again. This is because the system continues to use the adjustments recorded during the last Touch Up(s) until another TCH is performed in that tuning, or until reset with a Reset Touch. The more frequently you perform Nut Adjust, the less this effect will be. As mentioned, you can use **Reset Touch** to quickly correct this. See “Reset Touch” later in this chapter.

**Executing a Nut Adjust**

See Appendix C for a complete block diagram of the Nut Adjust process.

1. Select **Maint** (Maintenance Menu) in the Main Menu, and highlight **NutAdjust**. With Nut Adjust highlighted (flashing), hit SEL.

<b>Nut Adjust</b>	Stretch
Adjust Strs	Battery

2. The LCD displays the “Positioning Strings” screen.

<b>Positioning Strings</b>					
6	5	<b>4</b>	3	2	1

The system is now sending each Arm (motor) to zero (0), *one at a time*. Each Arm touches zero, moves 100 motor steps above 0, then all six proceed to the exact motor position of Standard Tuning *simultaneously*.

<b>Moving back to point of Standard Tuning</b>
--

3. Read the instructions on the screen. The next *two* LCD displays prompt you to open the Lock Nut and manually tune the guitar to Standard Tuning. At this point, do not execute the instructions yet, just read and understand them.

<b>Open NUT to set STD tune OST instructions next</b>
---

4. Press SEL or END (or any button) to see the next LCD display which continues your instructions. This screen instructs you to manually set Standard Tuning (using the machine heads) to within plus or minus 20 cents, then re-tighten the Lock Nut. As in the previous step, do not execute the instructions quite yet.

<b>Using OST, set STD +/- 20 cents, Lock NUT</b>
--

5. Press SEL or END (or any button). You are now in On Screen Tuner (OST). The LCD display should look as follows:

- - - * - - -	- - - * - - -	- - - * - - -
- - - * - - -	- - - * - - -	- - - * - - -

6. Strum the guitar. Each string is read simultaneously and displayed on the LCD. The notes of each string are displayed, followed by the number of cents sharp or flat. (See “On Screen Tuner” in Chapter 5.)

E 2 -03	A 2 +00	D 3 +00
G 3 -02	B 3 -02	E 4 +00

7.Unlock the Lock Nut and manually tune the guitar to Standard Tuning. (See next note.) Then re-lock the Lock Nut snug. (Do not crush the strings.) After locking the Lock Nut, the tuning should be within +/- 20 cents of Standard A-440 guitar tuning E A D G B E. On some models, a 3/32" Allen Wrench is supplied with the guitar for use with the Lock Nut. Other models are designed to work with a quarter, or some other coin. When the guitar is tuned to within 20 cents of Standard and the Lock Nut is tight, press END.

Note: Many times, depending on how frequently you perform Nut Adjusts, it may not be necessary to unlock the Lock Nut and retune. If you are in a hurry, and each string is within 20 cents of the proper note, then you can skip right to the next step without unlocking the Lock Nut and re-tuning. *However*, although not absolutely necessary, it is *best* that you get each string as close to standard as possible after locking the Lock Nut. (See next note.)

Note: Notice that the system requires that STD be within plus or minus 20 cents. The system will run fine this way. However, the closer the strings are tuned to the exact theoretical position of STD, after locking the Lock Nut, the more room for adjustments to be made down the line. This gives you more time before another Nut Adjust is needed. Plus the system has a little easier time Touching Up accurately.

8. This screen reminds you to ensure that the Lock Nut is locked. At this point you can go back to On Screen Tuner (OST) by pressing SEL. Pressing END takes you to the next step. Press END.

**Be sure NUT is locked**  
**SEL: Return to OST**

9.The last step in the Nut Adjust process is the Touch Up. Follow the instructions on the screen. You will mute the strings and then strum. (See "Touch Up" in Chapter 5.) **Always perform this Touch Up at the end of a Nut Adjust even if you did not unlock the Lock Nut and retune.**

**1 Touch Up STD Tuning 1**  
**A \* Strum \*\*\*\* Strum \* Q**

**Important:** In a Nut Adjust, as mentioned above, the Arms (motors) touch off at "0" and move to their exact motor positions of Standard Tuning where the artist manually tunes to STD and locks the Lock Nut. The motors must be *physically able* to do this to execute Nut Adjust *successfully*. For example: If string 1 breaks and the user replaces that string with either the wrong gage

string or tunes that string to an improper note (any note other than the note corresponding to the position of the motor at this point), the Mechanical Device may not be physically able to move that arm to the exact motor position of STD during the Nut Adjust process. In which case, if you manually tune to STD while the Arms (motors) are at some position other than the exact position of STD, the system is *not* properly aligned. See next section.

**Successfully executing a Nut Adjust**

To ensure you execute a successful Nut Adjust, simply watch the Arms move to their Limit Switches (0) and touch off, move 100 steps off of "0", and then move to the position of STD. **Each Arm (motor) should move smoothly without missing any motor steps, and all Arms should stop in the position of STD at exactly the same time.** After which you manually tune to Standard and lock the Lock Nut. If any Arm gets stuck or any motor misses steps during this process, the corresponding string is tuned incorrectly or is an improper gage. Make the necessary corrections by manually tuning the offending string(s) up or down, or by installing the proper string(s) *until the Mechanical Device is able to run the range necessary to execute a successful Nut Adjust.* (See following note regarding "Adjust Strings" if necessary.) Then try another Nut Adjust, manually tune to STD, lock the Lock Nut and you're ready to play. Repeat if necessary.

Note: It is O.K. to try Nut Adjust as many times as needed to achieve a successful Nut Adjust. If the motors stall or get stuck during a move, simply use the END button as many times as necessary to abort the Touch Up at the end of Nut Adjust. Then make the necessary adjustments to the offending string(s) and select (SEL) Nut Adjust again. Repeat as many times as necessary. (See following note regarding "Adjust Strings" if necessary.)

Hint: Whenever you are unsure if a Nut Adjust was successful, simply select Nut Adjust again to double check. If the preceding Nut Adjust was indeed successful, the following Nut Adjust will verify this. When the arms stop at the position of STD, they will be the same notes as in the preceding Nut Adjust, prior to the Touch Up at the end of the Nut Adjust process. When this is the case, you know the preceding Nut Adjust *was* successful. Unlocking the Lock Nut and manually retuning may not be necessary at this point, but be sure to complete the Touch Up at the end of the Nut Adjust process.

Note: With experience, you will be able to estimate what note to manually tune a string to by visually looking at the position of the Arm(s). If you can be within approximately a half-step in this estimation, that will

probably be close enough for the Mechanical Device to execute its part of the Nut Adjust process.

Note: If needed, **Adjust Strings** can be used to bring a string into proper tension to enable the Mechanical Device to run a Nut Adjust. (See the following section.)

### Adjust Strings

**Adjust Strings** mode allows the user to move the Arms individually in a maintenance capacity. Adjust Strings is not intended for any other use. If an Arm (motor) gets stuck and executing a Nut Adjust will not solve the problem, Adjust Strings is used to get the system aligned to enable the motors to execute their part of the Nut Adjust process.

#### Operating Adjust Strings

In the Maintenance Menu (**Maint**), select **AdjStrs**.

Nut Adjust	Stretch
<b>Adjust Strs</b>	Battery

The numbers of each string are displayed on the LCD with string 6 highlighted (flashing).

<b>adjust strings</b>					
<b>6</b>	5	4	3	2	1

The highlighted string is the string (Arm) you presently have control over.

#### Adjust Strings Operation Rules

1. The Sideways Arrow buttons select which string you wish to control.
2. The Up and Down Arrows send the Arm (string) up or down. The furthest Arrow button to the left is Down; the second Arrow button from the left is Up.
3. SEL stops a moving Arm (motor).
4. The motors have four speeds in this mode. The first hit on the (up or down) Arrow button is the slowest, the second hit is the next fastest, the third hit is the next fastest, and the fourth hit is the fastest. The motors have the *most power at the slowest speed*, and the *least power at the fastest*. Therefore, the slowest speed is used to free an Arm that is stuck. (One press on the up or down Arrow.)
5. If an Arm touches its Limit Switch (motor position zero), it stops and moves 100 steps up.

6. Remember; hit the SEL button to stop a moving Arm (motor).

Note: Try to avoid slamming an Arm into the upper wall while using Adjust Strings. Hitting the upper wall can cause the Arm to get stuck, while hitting the bottom wall (0) stops the motor, and quickly sends the Arm 100 motor steps above 0.

#### Freeing a Stuck Arm

An Arm can be jammed up against the top wall, the bottom wall (Limit Switch), or get stuck anywhere in between. This is almost always due to incorrect string installation. Either the wrong gage or Brand of string is installed, or the string(s) is (are) manually tuned incorrectly. This can also be caused by performing a Nut Adjust too infrequently. The following two sections discuss the two main situations encountered when an Arm is stuck, and how to use Adjust Strings to correct each situation.

##### 1. Arm Jammed at the Top Wall or Stuck Within its Operating Range.

First, ensure the correct gage and Brand of strings are installed on the guitar. If not, install the correct string(s). (See “Changing/Replacing Strings” in Chapter 9.) Correct string gages are displayed on the LCD during Startup.

With the correct strings installed, Use Adjust Strings to free the stuck Arm. (See “Operating Adjust Strings” above for how to operate.) **The goal here is to free the stuck Arm, move it down to just above the Limit Switch (Motor Position 100), and manually tune the string to the appropriate note for the position of the Arm at that point.** After which you perform a Nut Adjust.

##### To free a Stuck Arm

In **Adjust Strings**, following the operating rules described above, highlight the *appropriate* string and press the Down Arrow button (furthest Arrow button to the left) *one time*. Check to see if the stuck Arm is indeed now moving. If so, let it continue moving down (toward the Limit Switch) until it touches the Limit Switch, stops, quickly moves 100 steps above, and stops there. If it is not moving (still stuck), with Adjust Strings still working to move the Arm down, push lightly on the Arm as described in the hint below.

Hint: You can use your finger to lightly push up and down on the Arm to help free it. After pressing the Down Arrow one time, if the Arm is still stuck, press up and down lightly on the offending Arm to help get it started moving. Once it starts moving, let it continue as described above.

If the Arm is still not moving, *most likely* the string is (manually) tuned too tight. Unlock the Lock Nut and slowly loosen the problem string while using Adjust Strings to move the Arm down at the slowest speed (one hit on the Down Arrow button). When the Arm starts moving, immediately stop loosening the string, and let the Arm go down to the Limit Switch, touch off, proceed to Motor Position 100 and stop.

Once the stuck Arm is free, and positioned 100 motor steps above “0” (Motor Position 100), manually tune the string to the appropriate note specified in the following chart.

**Notes at Motor Position 100**

Notes at Motor Position 100						
String	6	5	4	3	2	1
Note	A#1	E2	A#2	C#3	F#3	C4

Repeat the above process for any other stuck Arms.

With all Arms free, and tuned correctly, the system should be able to execute a *successful* Nut Adjust.

Press END to exit Adjust Strings. Then scroll up to Nut Adjust and press SEL to perform a Nut Adjust. (See “Nut Adjust” earlier in this chapter.)

**2. Arm Stuck at the Limit Switch (“0”)**

When any Arm gets stuck on the Limit Switch (motor position zero and the lowest string tension), the system freezes up and no system operations are possible until the offending Arm(s) is (are) moved off the Limit Switch. At this point, you must reboot the system by turning power off, and then back on again.

Turn *off* the power to the system, wait a few seconds, and then turn power back *on*.

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<b>04/14/96</b>	<b>22:00</b>

During Startup, the system recognizes that an Arm is touching the Limit Switch and attempts to move the offending(s) Arm(s) up 100 motor steps. The above screen is displayed on the LCD and the LCD Backlight is *alternately flashing bright and dim*. If mechanically possible, the system will automatically correct this problem by moving the offending string(s) off the Limit Switch (“0”). The system will continue this process until the Arm is indeed moved off the Limit Switch.

If necessary, you can use your finger to lightly push down (toward the face of the guitar) on the Arm that is

protruding up the furthest from the face of the guitar. This helps the motor free the stuck Arm to move it off the Limit Switch.

If pushing on the Arm does not suffice, loosen the Lock Nut and manually tune the problem string to the appropriate note in the chart below.

Notes at Motor Position 100						
String	6	5	4	3	2	1
Note	A#1	E2	A#2	C#3	F#3	C4

When successful, the system puts you into the Main Menu, shown below.

Play	IndivString
<b>Maint</b>	Service

Enter the Maintenance Menu (**Maint**) and perform a Nut Adjust. (See “Nut Adjust” earlier in this chapter.)

<b>Nut Adjust</b>	Stretch
Adjust Strs	Battery

Once a successful Nut Adjust is complete, the system is aligned and ready for play.

**Important: Always execute a Nut Adjust after using Adjust Strings.** After you have successfully used Adjust Strings to solve your particular problem, you must execute a Nut Adjust. This is because the motors most likely have missed steps at some point either when your problem surfaced, or while fixing that problem using Adjust Strings. Whenever a motor misses steps, the computer in your CAT thinks the motor (Arm) is somewhere that it is not. A successful Nut Adjust corrects this.

---

***Stretch***

**Stretch** mode is provided as a method to stretch a new set of strings and work them in before beginning to play the guitar. This helps to settle and seat the strings around the nut, bridge and tailpiece. Stretch mode does not replace the manual stretch normally given to new strings. However, new strings do tend to behave more predictably after Stretch has been executed, leading to more accurate tuning changes. It is recommended that the Stretch cycles be set to 5 or more to work new strings in *after* manual stretching.

**Using Stretch Mode**

In Stretch mode you are asked to set the number of cycles. One complete cycle consists of the Arms moving

to the full down position, up to the full up position, and finally returning to the position of STD tuning.

Play	IndivString
<b>Maint</b>	Service

In the Maintenance Menu (Maint) select **Stretch**.

Nut Adjust	<b>Stretch</b>
Adjust Strs	Battery

The “Stretch Strings cycles: 1” screen is displayed on the LCD.

<b>Stretch Strings cycles: 1</b>
--------------------------------------

Use the Up and Down Arrows to set the number of cycles. (After manually stretching the new string(s), around 5 cycles is usually enough.)

Once your number of cycles is set, press SEL or END. The Arms begin moving through the number of Stretch cycles programmed, and the status of the moves is displayed on the LCD.

**Aborting Stretch**

To abort Stretch Mode simply press any button on the keypad during the stretch process. The system will stop the motors at the end of the current stretch cycle.

***Battery***

The last mode in the Maintenance Menu is Battery. *(This mode is currently involved in hardware and software development and is not yet of any particular use to the user.)* This allows you to check the charge of your External Battery (optional) to see if it is sufficient to run your CAT. Battery Mode measures the voltage coming into the guitar while running on the External Battery or Power Supply.

Note: Battery Mode is primarily intended for use while running on an External Battery. While powering your CAT with the 12 VDC power supply, Battery Mode is of no significant use.

**To Check Battery**

Select Battery in the Maintenance Menu. The unloaded voltage coming into the guitar from your power source

(110 VAC to 12 VDC power supply, or 12 VDC lead acid battery) is displayed quickly on the LCD.

**Service Menu**

The Service Menu was created to manage functions and modes that are not used during normal play. These modes are used for system setup and software maintenance. Use the Service Menu in conjunction with the Maintenance and Trouble-Shooting sections of this manual, or as directed by a qualified service technician. The four components of the Service Menu are **Reset User, Reset Touch, Calibration, and ROM CAL.**

For protection, a Pass Code (password) is required to enter the Service Menu. This protects the user from getting into the Service Menu by mistake and executing any unwanted operations. Since the operations in the Service Menu perform major software adjustments, you only want to enter the Service Menu when you really need to.

**Entering the Service Menu (Pass Code)**

In the Main Menu, select Service.

Play	IndivString
Maint	<b>Service</b>

The “Enter Pass Code” screen is displayed on the LCD. The Pass Code is **1-2-3-4.**

<b>Enter Pass Code code:</b>
----------------------------------

<b>Enter Pass Code code: 1234 Hit SEL</b>
---

Press the first four Arrow buttons left to right (buttons 1,2,3, and 4) and hit SEL. You’re in! The following screen is displayed on the LCD.

<b>Reset User</b>	<b>Reset Touch</b>
<b>Calibration</b>	<b>RomCal</b>

Note: At any time, as in all menus in the CAT, hitting END will back you out one step at a time, all the way back to the Main Menu if desired. If you get into the Service Menu and *do not* wish to perform any of the functions, simply use the END button to exit instead of selecting any of the choices in the Menu.

---

## Reset User

The first selection in the Service Menu is **Reset User**. This one is a biggie, so select it only when you are sure you need to. Reset User is provided to enable the user to reset all *User Library* tunings and system parameters to their default values. Reset User *does not* affect the tunings in the *Chord Library*. Execute a Reset User *only* when directed by the Maintenance and Trouble-Shooting sections of this manual, or when instructed by a qualified repair technician.

Caution: Selecting **Reset User** initializes all user created menu names, tuning names, their notes and temperaments to their default settings. It is strongly advised that you **write down your tunings and other User Library data** in Appendix I provided at the end of this manual **before executing a Reset User**. Reset User will reset *all* tuning data in the User Library. You will need to Edit (reprogram) all of your tunings and related settings back into the User Library. Write them down!

### What Reset User Does

The following lists the parameters reset (defaults) during a Reset User:

1. All User Library Menus are renamed MENU 1 through MENU 40.
2. All User Library Tunings are reset to Standard Tuning.
3. All Footswitch programming is cleared.
4. All tuning changes are set to Full Speed.
5. Beats per Minute is reset to 120, and Beats for Change is set to 4.
6. All tuning temperaments are cleared (set to 0).
7. All string temperaments are cleared (set to 0).
8. Reset Touch is performed in both Chord and User Libraries.
9. The Individual Strings Mode tuning is set to STD.
10. Stage Mode delay is set to 2 seconds and Stage Mode is disabled (turned off).

### Executing a Reset User

First, be sure a Reset User is necessary. Reset User should only be performed when directed by the Maintenance and Trouble-Shooting sections of this manual, or by a qualified repair technician. When **Reset User** is selected, the LCD will ask "Reset the User Area?" followed by "Are You Sure?". By answering "no" (END) to either question, Reset User is aborted and the system is *not* reset. By answering both "yes" (SEL), the User Library is reset to the tunings and values (defaults)

described above. The following illustrates the Reset User process.

After selecting **Service** in the Main Menu, and entering the Pass Code (1,2,3,4,SEL) you are in the Service Menu.

<b>Reset User</b>	Reset Touch
Calibration	RomCal

With Reset User highlighted (flashing), press SEL.

The "Reset User Area?" prompt is displayed on the LCD.

<b>Reset User Area?</b>	
<b>yes: SEL</b>	<b>no: END</b>

Press SEL for "yes". (Pressing END will abort the Reset User, preserving the current settings in the User Library.)

The "Are You Sure?" prompt is displayed.

<b>Are You Sure?</b>	
<b>yes: SEL</b>	<b>no: END</b>

Press SEL for "yes". (Press END to abort.)

After answering "yes" (SEL) to both questions, Reset User is executed and all User Library tunings and values are set to their defaults.

Press END to exit the Service Menu if desired.

---

## Reset Touch

Reset Touch resets (to "0") the Tuning Touch Up Registers for all tunings in either or both the User Library and Chord Library. Each time a tuning is Touched Up, the Hex Pickups are turned on, the system reads the strings, calculates the proper adjustment, and moves the motors accordingly. (See "Touch Up" in Chapter 5 if desired.) The corresponding Touch Up numbers are stored for this tuning until the next Touch Up in this tuning, or until reset by a Reset Touch.

### Executing a Reset Touch

After selecting Service in the Main Menu, and entering the Pass Code (1,2,3,4,SEL) you are in the Service Menu.

<b>Reset User</b>	<b>Reset Touch</b>
Calibration	RomCal

With **ResetTouch** highlighted, press SEL. The “Reset ChordLib?” prompt is displayed on the LCD.

**Reset ChrdLib?**  
yes: SEL                      no: END

Press SEL. (Press END to avoid resetting the Touch Up registers in the Chord Library and proceed to the User Library screen.)

The “Are You Sure” prompt is next.

**Are You Sure?**  
yes: SEL                      no: END

Press SEL. (Press END for “no” as above.)

Then the same two questions are asked regarding the User Library.

**Reset UserLib?**  
yes: SEL                      no: END

Press SEL. (Press END for “no” as above.)

**Are You Sure?**  
yes: SEL                      no: END

Press SEL. (Press END for “no” as above.)

After answering “yes” to both questions in either Library, Touch Up registers are cleared in that Library.

Press END to exit the Service Menu if desired.

---

## **Calibration**

### **Overview**

Smart Bridge™ technology employs a calibrated type system. Calibration involves a repetition of strums accompanied by data analysis while the Arms (motors) move throughout their operating ranges. During the calibration process, equations are generated and stored in memory which characterize neck warp, strings and other variables. These equations allow the guitar to accurately move from tuning to tuning *without* needing to listen to the strings. The computer holds the last information about the guitar’s status in memory until a tuning change is requested. Upon request of a tuning change, the computer processes the calibration equations to determine

the new frequencies and moves the motors the appropriate numbers of steps in the appropriate directions.

When you first receive your guitar, this System Calibration procedure will have been completed by factory technicians and burned into *Rom Cal*. (See next section.) This Calibration remains valid unless and until certain major changes are made to the instrument. Among the changes that **can** affect the calibration are:

1. Replacement of strings with other than the recommended brand or gages,
2. Adjustment of the neck, and:
3. Bridge adjustments, including height and intonation.

If you have made any such adjustments since receiving your CAT, check to see if it still runs properly. In other words, make sure it still runs its entire range and is in tune. Other than changing string gages, if your adjustments were minor, the CAT may still operate normally. If you have any problems after any such adjustments, see “Troubleshooting, Chapter 13, or “Testing Calibration” in Chapter 11.

### **Executing a Calibration**

First, be sure you need to perform a Calibration. Perform a Calibration *only* when directed by the Maintenance and Trouble-Shooting sections of this manual, or by a qualified repair technician. Most often, RomCal will suffice. (See next section on “Rom Cal”.)

Important: If *both* Reset User and Calibration are needed, you must perform Reset User prior to performing Calibration.

1. When you are sure you need to perform a Calibration, select **Calibration** from the Service Menu.

Reset User                      Reset Touch  
**Calibration**                      RomCal

2. The LCD displays the message “**System Calibration**” for 1 second, then asks the question “**Destroy Calibration?**”

**DESTROY CALIBRATION ?**  
yes: SEL                      no: END

When you answer “yes” to the “Destroy Calibration?” prompt, the old Calibration is erased. (This necessitates either a RomCal or hand strummed Calibration be performed before the CAT will operate again.) If at any time you enter System

Calibration Mode in error, pressing **END** in answer to this question will preserve the current system calibration. If the Calibration is already invalid (corrupted), this question is not asked.

*If you want to Calibrate the system now, press **SEL** to begin the process. If you are not sure, press **END** and double check.*

- The system goes through a standard Nut Adjust sequence to align the system relative to the exact motor position of STD. (See "Nut Adjust" in Chapter 8 if necessary.)

<b>Positioning Strings</b>					
6	5	4	3	2	1

Each motor goes to its Limit Switch (motor position zero).

<b>Moving back to point of Standard Tuning</b>
--

After touching off at "0", the motors (Arms) move to the exact motor position of Standard Tuning.

<b>Open NUT to set STD tune OST instructions next</b>
---

Use the **END** or **SEL** buttons to proceed through the next two instruction screens.

<b>Using OST, set STD +/- 20 cents, Lock NUT</b>
--

Unlock the Lock Nut (if necessary) and use OST or a normal external tuner to tune all strings to STD (E A D G B E).

E 2 -03	A 2 +00	D 3 +00
G 3 -02	B 3 -02	E 4 +00

Ensure all strings are as close to standard as possible *after locking the Lock Nut*. Take the time to get this right. During Calibration, the closer the strings are (manually) tuned to the exact motor position of Standard Tuning *after* locking the Lock Nut, the better the Calibration.

When in tune, with Lock Nut locked, hit any button to quit OST and see the following screen.

<b>Be sure NUT is locked SEL: Return to OST</b>
---

At this point, hitting SEL returns you to OST (if needed) to check the tuning after locking the Lock Nut. Hit any other button to proceed.

- After finishing the Nut Adjust procedure, the LCD displays the message "**Moving motors to initial position**" followed by the "**System Calibration**" screen. There are 31 points in the Calibration. The numbers in the upper left and right corners of this screen indicate the calibration point (1 to 31). Most calibration points will require only two strums. The numbers in the lower left and right corners indicate the strum count at the current point (1, 2, ...).

<b>Moving motors to initial position</b>
--

1	<b>System Calibration</b>	1
A * Strum	****	Strum * Q

- When it is time to mute the strings, the LCD flashes **\*mute\*\*\*\*\*mute\***. When it is time to strum, the LCD flashes **\*strum\*\*\*\*strum\***. It is not necessary to do anything beyond muting and strumming the strings to complete the calibration. Watching the LCD display, especially the numbers in the corners, will help you understand where you are in the calibration process.

**Important:** Your strumming technique will affect the outcome of the calibration. It is suggested that you use the fleshy part of your thumb (no thumb nail) and strum as uniformly, and consistently as possible. We find it best to strum at the 12th fret each time, although it is usually O.K. to strum anywhere as long as your strums are consistent.

- After the strum, the lower part of the LCD displays the now familiar stars, letters, numbers and dots you have encountered already during a Touch Up operation. (See "Touch Up" in Chapter 5 if necessary.)
- When a point in the calibration has been determined, the LCD displays the message "**Moving to next point in calibration**". The upper left and right corner numbers increase by one and the lower left and right corner numbers return to one.
- After 31 calibration points have been acquired, the system moves to STD tuning and requests **Touch-Up**

**STD Tuning** to set the STD tuning reference point. The **\*mute\*\*\*\*\*mute\*** and **\*strum\*\*\*\*\*strum\*** requests are handled in the same way.

9. At the end of the calibration, the LCD displays the message **“Touch-Up STD Tuning Complete”** and the Service Menu reappears. The Calibration is complete and the CAT is now ready for play.

---

## **ROM CAL (RomCal)**

### **Overview**

The hand strummed Calibration described in the preceding section is performed professionally at the factory on every individual CAT. Each guitar’s unique characteristics relative to neck warp, wood, string gage, etc. are thusly incorporated into each CAT’s individual Calibration. This custom Calibration is permanently burned into **RomCal**. In the event that the system’s memory is lost, or the calibration is corrupted, executing a Rom Cal brings the original factory calibration back into the ROM and you’re ready to go.

Execute Rom Cal only when directed by the Maintenance and Troubleshooting sections of this manual, or by a qualified service technician.

Note: Unless you have had relatively major changes made to your guitar’s setup (truss rod, bridge height, or intonation) your RomCal remains valid. (See preceding section on “Calibration” for more details about this.)

Important: If both Reset User and Rom Cal are needed, you must perform Reset User prior to performing Rom Cal.

### **Executing a Rom Cal (RomCal)**

When directed by the Maintenance and Troubleshooting sections of this manual, or by a qualified service technician, select (SEL) **RomCal** in the Service Menu.

Reset User Calibration	Reset Touch <b>RomCal</b>
---------------------------	------------------------------

The calibration in Rom Cal is dumped into the Rom and the system performs a Nut Adjust.

Complete the Nut Adjust procedure. (See “Nut Adjust” in Chapter 8 if necessary.) That’s it.

You now have the original factory calibration intact within the system software and the mechanical system is aligned properly. The CAT should be ready for play.

# Chapter 9 - Guitar System

## Optimizing System Operation

Read and understand this manual to keep your CAT running trouble-free. (Feel free to call us at any time for one on one instruction.) Proper use of Nut Adjust, always using the correct gage strings and installing the strings correctly is about all that is necessary to keep from ever having any operational problems with the CAT. (See “Nut Adjust” in Chapter 8 and “Installing and Replacing Strings” in Chapter 9.)

Never leave the guitar without a string on it for extended periods of time. When any string is missing, the force of the spring is exerting unnecessary force in the Mechanical Device which may cause mechanical failure later. Replace any broken strings as soon as possible.

Whenever replacing strings or adjusting the height of the bridge, if your system is equipped with a Bridge Ground Strap, ensure that it is mounted firmly beneath the Bridge and the Bridge height adjustable Thumb Screw on the string 6 side of the Bridge. (See “Bridge Ground Strap” later in this chapter.)

## Lock Nut

Each guitar equipped with the CAT has a custom-fit Lock Nut. A Lock Nut is necessary for the same reasons that the bridge has rollers. As the strings tighten and loosen during tuning changes, they would slip through the Nut unpredictably, making it impossible to change tunings accurately. The Lock Nut is custom-fit and installed so that it has the least possible effect on the string’s tuning after locking the Lock Nut. This allows the user to spend much less time manually tuning the strings during a Nut Adjust.

### Locking the Lock Nut

With some models, a 3/32” Allen Wrench is supplied for use with the Lock Nut. It is used to tighten the 8/32 X 1/4” screws that tighten the Keepers snug to the strings. Other models are designed to work with a coin (a quarter is best), or a slot screwdriver. When tightening the Lock Nut, do not over-tighten. All that is required is that the Lock Nut be snug. Try not to crush the string. Over time you will get the right “feel” for how tight the Lock Nut should be. The Lock Nut must be tight enough to keep the strings from slipping through as the Arms tighten and loosen the strings, but not so tight that it crushes the string severely. If you are crushing the strings to the point that they become flat, that is too tight. Lighten up a little.

## Recommended Strings

Each CAT is set up specifically for the brand and gage of strings requested by the customer at time of purchase. The proper string gages are displayed on the LCD during Startup. Use *only* the gages specified on the Startup Screen! (See “Bypassing and Freezing the Startup Screens” in Chapter 3.)

Reminder: Proper use of Nut Adjust, always using the correct gage strings and installing the strings correctly is about all that is necessary to keep from ever having any operational problems with the CAT!

The system is designed to operate using reinforced Ernie Ball and D’Addario brand strings. **Always use strings that are reinforced at the ball.** Other brands of strings can be used in the proper string gages. However, TransPerformance will guarantee accurate operation only while using the recommended strings. If you want to use a different brand of strings, give it a try, it may work fine. If you wish to set up your CAT to run a different *gage* of strings, give us a call. To set your guitar up to run different *gages* may require that the guitar be shipped back to the factory for adjustments in both the Mechanical Device and in the software. As always, if you have any problems, give us a call.

## Installing and Replacing Strings

It is very important that you install and replace strings on the CAT correctly to ensure proper operation. Read and understand this section completely and you can keep your CAT running virtually trouble-free. Each CAT is set up specifically for the brand and gage of strings requested by the customer at time of purchase. Always use the correct strings and install them correctly. The proper string gages are displayed on the LCD during Startup. Use *only* the gages specified on the Startup Screen! (See “Bypassing and Freezing the Startup Screens” in Chapter 3.)

Reminder: Proper use of Nut Adjust, always using the correct gage strings and installing the strings correctly is just about all that is necessary to keep from ever having any operational problems with the CAT.

**Important:** When installing or replacing strings, the main thing to be aware of is the importance of having the strings manually set (by using the machine heads) at the proper tension before locking the Lock Nut. Specifically, each string must be manually tuned to the tension (note) corresponding to the position that its respective Arm

(motor) is in when you replace a string or install new strings. This puts all forces in the Mechanical Device in balance enabling it to run its entire range accurately. (See “Nut Adjust” in Chapter 8 for a complete explanation of this principle.)

### ***How to Install New Strings***

The **best** way to replace one or all of the strings is to **set the CAT to STD Tuning before removing the old strings**. *It is highly recommended that you get in the habit of changing strings in this way.* This puts the system into Standard Tuning where you can remove the old strings, install the new strings, stretch them, and manually tune to Standard just like on any guitar. (Remember to lock the Lock Nut snug afterward.) Then you can just Touch Up and begin playing if you are in a hurry, but be sure to execute a Nut Adjust at the earliest opportunity. Although not by any means the only way to change strings, this is the easiest way. Read further for discussions of some other possible ways to change or replace strings, and how to deal with *broken* strings.

**Important:**When installing new strings, **ensure that each string is centered on the roller in each Arm**. Each Arm in the Mechanical Device has a String Roller that the strings roll across. These rollers are located about one inch from the balls of the strings where the Arm pivots. Pay special attention to string 1 here. Since it is the smallest string, it can get stuck on the side of the roller. *Always* ensure that string 1 does not get stuck here.

### ***Stretch New Strings***

**You should always stretch new strings completely when installing them on the CAT.** As with all guitars, the fat strings can stretch up to four half-steps below standard while the smaller strings stretch less. We recommend that, when installing new strings on the CAT, you manually stretch the strings completely along their full lengths, and then run the Stretch Mode also. (See “Stretch” in Chapter 8.) This significantly reduces the number of Touch Ups and Nut Adjusts needed while new strings settle in.

The Stretch routine in the CAT does *not* take the place of the normal manual string stretch. Stretch Mode is intended to be used in *conjunction* with manually stretching the strings to fully settle the strings in.

### ***Changing/Replacing Strings While in Tunings Other Than STD***

As mentioned earlier in this chapter, the main thing to remember, provided that you are using the proper gage strings, is to manually tune the strings to the correct tensions (notes) according to what tuning the Mechanical Device is currently in. Therefore, you can replace strings

while the CAT is in *any* tuning. You just need to know the notes of that tuning and manually tune the strings to those notes. After manually tuned correctly, lock the Lock Nut snug (not too tight). Then execute a Nut Adjust, or if you’re in a hurry, just Touch Up and begin playing (perform a Nut Adjust at the earliest opportunity).

### ***Changing/Replacing Strings While Unsure of the Current Tuning***

#### **1. Old Strings Still Installed**

The best way to change strings is to select STD tuning *before* removing the old strings. (See “How To Install New Strings” above.) Another option is discussed below.

With the old strings still installed on the guitar, use On Screen Tuner (OST) to read the strings so you can see what tuning the system is currently in. (See “On Screen Tuner” in Chapter 5 if necessary.) When you know what notes to manually tune the new strings to, remove the old strings, install the new strings (proper brand and gage), and manually tune to the correct notes. Then perform a Nut Adjust. (See “Nut Adjust” in Chapter 8.)

#### **2. No Strings Installed on the Guitar**

If the old strings are *not* still installed on the guitar and you are *not* sure what tuning the system is currently in, it is more difficult to install the new strings correctly. Start off by installing the correct strings and tune to your best estimate of the correct tuning. With experience, you will be able to estimate what notes to tune each string to by visually looking at the positions of the Arms.

Once you have the strings tuned to your best estimate, execute a Nut Adjust. In this case, you will need to be sure to execute a *successful* Nut Adjust. Watch the Arms make it through the Nut Adjust process completely. (See “Nut Adjust” in Chapter 8.)

Note: If you have any problems executing Nut Adjust *successfully*, you can use **Adjust Strings** Mode to help get the system in line. (See “Adjust Strings” and “Nut Adjust” in Chapter 8.)

### ***Replacing a Broken String***

With experience, handling a broken string will become just about as easy as on any guitar. The same principles discussed above apply here as well. The intention is to get the string tuned to the proper tension for the current position of its respective Arm.

There are two main conditions under which a string will break. A string can break while playing in a particular tuning, or it can break during a tuning change while the motors (Arms) are moving. (You’ll find that the CAT does *not* break strings any more frequently than a normal guitar.) The following discusses these two conditions.

### **1. A String Breaks While the System is in a Known Tuning**

When a string breaks while in a known tuning, simply install the new string (proper gage) and tune to the proper note, then re-tighten the Lock Nut. You then should execute a Nut Adjust as soon as possible. Watch the Arms during Nut Adjust to ensure a successful Nut Adjust (See “Nut Adjust” in Chapter 8.). Again, if you are in a hurry, you can just Touch Up and begin playing, but perform a Nut Adjust at the earliest opportunity.

### **2. A String breaks During a Tuning Change**

If a string breaks during a tuning change (while the motors are moving) it gets a little more complicated. Still, it is handled in much the same way as the scenarios described above. The new string must be the correct gage and manually tuned correctly according to the current position of its respective Arm. You can estimate what note to manually tune the string to and try a Nut Adjust or Touch Up. Or, if necessary, you can use Adjust Strings Mode to enable the Mechanical Device to execute a successful Nut Adjust. (See “Nut Adjust” and “Adjust Strings” in Chapter 8.) Again, if you are in a hurry, you may be able to just Touch Up and begin playing, but perform a Nut Adjust at the earliest opportunity.

## **Identifying Bad Strings**

Bad strings can be identified by intonation that is not where you expect it to be, by inconsistencies between an external tuner and OST (On Screen Tuner), and by getting a different pitch when the string is plucked in different places. In this case we find that the frequency of the string will be read slightly higher or lower in frequency, depending on where the string is strummed.

This problem is due to inconsistencies in the makeup of the materials used in the strings or variance in the outer diameter of the string over its entire length.

If you find that your system is not Touching Up as easily or as accurately as normal, check for a bad string. Replace if necessary. (See “Installing and Replacing Strings” in Chapter 9.)

Hint: Strumming at the 12th fret tends to minimize the effect of bad strings during a Touch Up. If you are having trouble with a suspected bad string during Touch Up, try strumming at the 12th fret.

## **Adjusting Bridge Height**

The bridge is mounted on Thumb Adjusters which control the height of the bridge. Use your thumb or, if necessary, use long billed needle nose pliers to rotate the bridge height adjust thumb screws. We suggest that you protect the face of the guitar with paper to prevent scratching if you slip while using pliers.

Bridge height is set at the factory according to the action requested by the artist at time of purchase. Minor height adjustments by the artist after receipt are usually O.K. Any major height adjustment could affect the Hex Pickups’ ability to read the strings properly (by lowering the bridge significantly), or the strings could begin to buzz on the Hex Pickups (by raising the bridge significantly).

If you adjust the height of your bridge after receipt, and you experience any problems in the operation of your CAT, please refer to “Troubleshooting” in Chapter 13, or if needed, call a qualified service technician.

## **Bridge Ground Strap**

On some models, a Ground Strap is mounted beneath the bridge where it mounts onto the thumb adjuster on the string 6 side of the bridge. This grounds the strings to the Mechanical Device. Whenever you remove and replace the bridge, or adjust the height of the bridge, ensure that this ground strap is seated firmly between the bridge and the top of the string 6 side thumb adjuster, with the bridge seated firmly on top. The other end of the bridge ground strap mounts to the ground lug on the Baseplate of the Mechanical Device.

Some CAT models do not need, and therefore are not equipped with a Bridge Ground Strap.

## **Truss Rod Adjustments**

Your guitar is set up according to the action you requested at time of purchase. If you desire to reset the truss rod, it probably will be fine as long the changes are not major. (See “Testing Calibration” in Chapter 11 if necessary.) Any truss rod adjustment may require resetting intonation.

If you adjust the truss rod in your guitar and experience any problems in the operation of your CAT, please refer to “Troubleshooting”, Chapter 13, or if needed, call a qualified service technician.

## **Setting Intonation**

Intonation is set on the Roller Bridge using the (6) screws on the back side of the bridge, toward the heel of the guitar. Intonation is set at the factory according to the action and string gage requested by the artist at time of purchase. Resetting intonation after receipt *could* affect the Calibration in the system. (See “Calibration” in Chapter 8 if necessary.)

If you do reset intonation, check to see if the CAT still runs properly. In other words, it still runs its full tuning range and is accurate within that range. Minor adjustments to intonation should be O.K. If you adjust the intonation in your guitar and you experience any problems in the operation of your CAT, please refer to “Troubleshooting”, Chapter 13, or if needed, call a qualified service technician.

## Hex Pickups

Six small Hex Pickups are mounted to the bridge, one just below each string. These pickups are used *only* during Touch Ups, On Screen Tuner (OST) and Calibration and have *no* effect on the guitar’s sound. During Touch Up, the Hex Pickups are turned on, the strings are strummed, the strings are read, and the system processes the frequencies and commands the motors to make the proper adjustments. During OST, the strings are strummed; the system reads the strings and displays their tunings on the LCD. During Calibration, the strings are read and the system processes the frequencies to generate each guitar’s unique Calibration.

**Important:** The Hex Pickups are set at specific distances below the strings. (Approximately .020” between the bottoms of the strings and the tops of the Hex Pickups, with the fat strings a little deeper.) The gains (in the computer) for each pickup are set accordingly. **Avoid accidentally banging or knocking these pickups any deeper than they have been set at the factory.**

If you change the height of the bridge significantly, it could also affect the Hex Pickups. It is possible to adjust the heights of these heads by pressing them down or up within their bracket. However, it is not recommended that this be performed by anyone other than a qualified service technician. If, during Touch Up or play, you have any problems with the Hex Pickups, please give us a call.

## Shipping

Always loosen the strings on any guitar that is to be shipped. This lowers the chance that the headstock may break during the rough handling and temperature changes experienced during shipping. With the CAT, simply select the S-3 tuning in the Standard Window in the first Tuning Menu in the Chord Library. This tunes the guitar to Standard Tuning minus 3 half-steps. Be sure to use a sturdy shipping container and pack tightly using packing materials that cushion, but do not compress during shipping.

# Chapter 10 - Mechanical System

The Bridge and Tailpiece on a normal guitar are replaced by our Mechanical Device. All tuning changes and adjustments are mechanically executed by this unit. The balls of each string are anchored into each string's respective Arm on the Mechanical Device. Each Arm is connected to a threaded shaft which is rotated by its respective servo motor. The computer controls the motors, and the actual tensions of the strings are adjusted accordingly.

**Important:** An important characteristic of the Mechanical Device for the user to understand is the balance between the force of the springs (visible just below the bridge) and the force of the guitar strings. The small motors that move each Arm have a limited amount of power. The springs are used to offset the force that the strings exert to bring the forces on the motors into their allowable range. These springs are set at the factory according to the *Brand and Gage of Strings* requested by the artist at the time of purchase.

While it *may* be possible to run different brands of the same gage strings, it is *not* possible to run *heavier* gage strings without sending the guitar back to the factory for adjustments. It is *possible* to run *lighter* gage strings, but the system may not Touch Up as accurately, or run as smoothly and quietly.

## Mechanical Device Maintenance

The CAT is designed to require minimal maintenance. The mechanical part of the system has been constructed with high precision components and operates under close tolerances. Under normal operating conditions, no regular schedule of lubrication or maintenance is required for any component of the Mechanical Device.

## Adjusting Spring(s)

Do not adjust the springs in the Mechanical Device unless directed by a qualified service technician. Proper mechanical operation relies heavily upon these springs being set correctly.

## Lubricating the Roller Bridge

A Roller Bridge with modified String Rollers is mounted on height adjustable thumb screws in the top of the Mechanical Device.

## String Rollers

Rollers are necessary on the Bridge to ensure accurate tuning changes. As the Arms tighten and loosen the strings, the strings must move smoothly across the bridge. These rollers are lightly oiled with high grade machine oil at the factory. Periodically they should be lightly oiled with a light, high quality oil (such as a good sewing machine oil or better) to keep them rolling smoothly during tuning changes. Lightly apply oil at the *sides* of the rollers where the rollers pivot on the pins. Oiling is best accomplished when replacing strings so the roller can be rolled while oil is applied. Just a little oil is fine, don't use too much. Wipe off any excess oil.

## Motor Shafts

Under normal operating conditions, the motor shafts require no regular maintenance. However, be careful not to bend the threaded shafts. Keep your hands and any tools away from the threaded shafts.

## Noise Shielding

Mu Metal shielding is used at strategic areas in the Mechanical Device to minimize electrical noise from the motors and circuitry. The motors make noise only when they are moving. In other words, only during a tuning change. Do not remove any of the shielding installed.

# Chapter 11 - Computer System

## Computer & Memory

The heart of the Smart Bridge™ system in the CAT is the Intel 80c196 microprocessor which processes string information and executes software commands initiated by the user. The computer interface is designed to require no computer programming skills.

The Computer has two sections of memory that are backed up and saved in RAM. These two sections of memory require a live backup battery (lithium battery) at all times. The system saves and backs up all user settings each time new data is entered by the artist and every time the system is powered down.

The first section of memory contains the system calibration, a set of equations that represent the unique characteristics of each individual guitar. The system calibration makes it possible to accurately change tunings, regardless of neck warp, temperature or humidity, without listening to the strings. The second section of memory contains all user settings entered since the last Reset User was performed.

The system programs are burned into a ROM. This is the square socket style chip on the top layer of the computer group. The ROM is removed and replaced during software upgrades.

## Testing Memory

This section will guide you through the Memory Condition test. It is assumed that you are being directed to this section from “Troubleshooting”, Chapter 14.

The following Memory Condition tests are designed to identify which sections of memory are having trouble and give instructions to correct any problem.

While powering up the system, observe the Startup messages on the LCD and find the matching conditional “NV RAM ERROR” messages in this section. Then follow the steps suggested:

### Condition 1

During Startup, there are no “NV RAM ERROR” messages present on the LCD during Startup.

In this case, both sections of memory are intact. If your system is not tuning correctly following a Nut Adjust, it is likely that something about the guitar setup

has changed, such as bridge height, neck adjustment or intonation setting.

Perform calibration tests to determine if the guitar needs a “hand strummed calibration”. (See “Testing Calibration” later in this chapter.)

### Condition 2

During Startup, the hexadecimal value “4d76” appears in the upper left hand corner of the message screen. The upper right hand corner has any hexadecimal value except “4d76” displayed. (Shown below.)

```
4d76  NV RAM ERROR  xxxx
      CHECK NV RAM BATTERY
```

User Settings (User Library) have been lost from memory.

To correct this problem, perform Reset User and reload your user settings. (See “Reset User” in Chapter 8.)

### Condition 3

During Startup, the hexadecimal value “4d76” appears in the upper right hand corner of the message screen. The upper left hand corner has any hexadecimal value except “4d76” displayed. (Shown below.)

```
xxxx  NV RAM ERROR  4d76
      CHECK NV RAM BATTERY
```

System Calibration has been lost from memory.

To correct this problem, perform the following steps in the following order:

1. Replace the backup battery if it is older than 2 years. (See “The Lithium Battery” later in this chapter.)
2. Perform Reset User. (See “Reset User” in Chapter 8, and be sure to have your tunings, etc. recorded in Appendix I before executing Reset User.)
3. Perform Rom Cal. (See “Rom Cal” in Chapter 8.)
4. Reload your user settings (User Library). (See “Editing”, Chapter 7.)

#### **Condition 4**

During Startup, any hexadecimal value except “4d76” appears in the upper left and upper right hand corner of the message screen. (Shown below.)

xxxx	NV RAM ERROR	xxxx
CHECK NV RAM BATTERY		

User Setting and System Calibration have been lost from memory. When both sections of memory have been lost, it is normally caused by the lithium battery going dead.

To correct this problem, perform the following steps in the following order:

1. Replace the backup battery. (See “The Lithium Battery” later in this chapter.)
2. Perform Reset User. (See “Reset User” in Chapter 8, and be sure to have your tunings, etc. recorded in Appendix I before executing Reset User.)
3. Perform Rom Cal. (See “Rom Cal” in Chapter 8.)
4. Reload your user settings (User Library). (See “Editing”, Chapter 7.)

### **Testing Calibration**

The purpose of this section is to provide a test for the artist to check validity of the system calibration equations.

It is assumed you have been directed to this test by the Troubleshooting section to test the accuracy of your calibration for one of two reasons: 1) to determine if a hand-strummed calibration is needed, or 2) to verify the accuracy after a hand-strummed calibration is performed.

#### **Follow these steps to test calibration accuracy:**

1. Verify that the system test menu “TOPBOT” is present in Menu 25 of the User Library. The system is shipped with test menu “TOPBOT”, but may have been erased if a Reset User was performed since the guitar was received, (If a Reset User has been performed, TOPBOT, as well as all other tunings in the User Library have been reset to their default names and values. (See “Reset User” in Chapter 8.)
2. If “TOPBOT” is not present in Menu 25 of the User Library, you will need to create it. Here’s how: a) using Edit, name any menu “TOPBOT”, b) using Edit, name the first tuning in the menu “TOP” and the second tuning in the Window “BOT”, c) using Edit, set the note for each string in TOP to the highest note allowed, d) using Edit, set the note for each string in BOT to the lowest note allowed, and e) Touch Up the tunings as requested by the system when exiting Edit. (See “Editing”, Chapter 7.)
3. Perform a Nut Adjust taking care to adjust all strings as close to STD tuning as possible *after* the Lock Nut

is locked. (All strings within +/- 5 cents is adequate, but the closer to STD the better.)

4. Perform Reset Touch. Reset Touch is located in the Service Menu. Upon entering Reset Touch you will be prompted “Reset ChordLib?”, select “no” by pressing END. Then you will be prompted “Reset User Lib?”, select “yes” by pressing SEL.
5. Go to the TOPBOT Window and select STD tuning.
6. Touch Up STD tuning. (This is an important step in the process.)
7. Move to TOP. **DO NOT TOUCH UP THIS TUNING.** Test the notes of TOP using the On Screen Tuner (OST Pushbutton). Record the cent values.
8. Move to BOT and test notes using the On Screen Tuner (OST Pushbutton). Record the cent values.

#### **Examining Calibration Test Results**

1. If all notes are within +/- 10 cents of the correct notes in TOP and BOT, the system calibration is within system operating parameters.
2. If any notes are not within +/- 10 cents of the correct notes in TOP and BOT, the system needs a hand strummed calibration performed. (See “Calibration” in Chapter 8.)

### **Software Upgrades**

From time to time, TransPerformance will offer software upgrades to the Smart Bridge™ system in your CAT. This process includes replacement of the ROM chip on the computer board and an upgrade to the manual. See your warranty for terms and conditions regarding software upgrades. Of course, give us a call if you have any questions.

#### **Installing the EPROM**

Reminder: You should make a record of your User Library menus, tunings and temperaments before attempting to replace the ROM. “Tuning and Temperament Records”, Appendix I, is supplied for recording your settings.

#### **Follow the steps below to replace the ROM.**

Important: Be careful handling the ROM. Avoid touching its electrical leads. A static discharge could damage the chip.

1. Turn off all external power to the guitar.
2. Remove rear cover plate to access the computer.
3. Remove the old ROM using the extractor tool supplied.
4. Insert the new ROM into the socket being sure to align the keyed corners. Ensure that the chip is fully inserted into the socket.

5. Power up the system.
6. Ensure that your memory is intact by verifying that your tunings and names are still in the User Library and that the system will change tunings.
7. If memory is intact, replace the cover plate, the upgrade is complete.
8. If memory has been lost during the upgrade, complete steps 9-12 below.
9. Perform Reset User as described in Chapter 8.
10. Perform RomCal as described in Chapter 8.
11. Re-enter your settings in the User Library, as described in Chapter 7.
12. Re-install rear cover plate.

## The Lithium Battery

A Lithium battery is used to keep the system memory intact. If the battery is allowed to die, the system will lose all user entered information (User Library) and be unable to change tunings.

### ***When to Replace Battery***

The battery will keep the system memory intact for three years or longer. However, we recommend that you replace the battery every two years to safeguard your system memory.

### ***Manual Battery Monitoring (optional)***

If you wish, you can measure the voltage of the lithium battery and replace it when needed. The Lithium battery is rated at 3 VDC. If the battery is allowed to weaken to 2.0 VDC, the system will lose its memory. Therefore, we recommend that the battery be replaced before it weakens to 2.2 VDC.

Measure the voltage of the lithium battery using any common voltmeter. Place the positive lead on the spring clip holding the battery in place, and the negative lead to any securing post found at the corners of the computer board.

### ***Symptoms of a Dead Battery***

The system will power up even if the lithium battery has died. However, certain error messages will be displayed to inform you that your memory is lost. In this condition, the guitar cannot change tuning. If the lithium battery is dead, the following messages will be displayed:

1. During Startup:

NV RAM ERROR  
CHECK NV RAM BATTERY

SEE MANUAL FOR  
ASSISTANCE

2. While attempting to access the User Library:

System Calibration  
MUST be done first

User Tunings  
MUST be loaded first

2. While attempting to access the Chord Library:

System Calibration  
MUST be done first

### ***Replacing the Battery - Memory Intact***

Reminder: You should make a record of your User Library menus, tunings, temperaments, tuning change speeds, and Footswitch programming before attempting to replace the lithium battery. Appendix I, "Tuning and Temperament Records", is supplied for recording your settings.

1. Remove the rear cover plate from the guitar. Once removed, you have access to the computer. The lithium battery is located on the top layer of the computer and is easily accessible. The battery cell is about the size of a nickel and is secured in its holder by a spring loaded clip.
2. Power up the system using the power supply. This is very important. If the battery is removed while the system's power is *off*, the system will lose its memory and require that Reset User, RomCal and all user tunings be re-entered.
3. Remove the old battery and discard.
4. Install a new battery. The side of the battery with the plus (+) sign must contact the spring loaded clip after insertion. (Plus sign facing up.)
5. Ensure that your memory is intact by verifying that your tunings and names are still in the User Library and that the system will change tunings.
6. Reinstall the rear cover plate on the guitar.

### ***Replacing the Battery - After Memory Loss***

1. Access the battery as described in section "Replacing the Battery - Memory Intact" above.
2. Remove the old battery and discard.
3. Install a new battery. The side of the battery with the plus (+) sign must contact the spring loaded clip after insertion. (Plus sign facing up.)
4. Perform Reset User as described in Chapter 8.

5. Perform RomCal as described in Chapter 8.
6. Re-enter your settings in the User Library, as described in “Editing”, Chapter 7.

### ***Purchasing a Battery***

Replace the lithium cell with a Renata model CR2032 or equivalent. This is a common battery and is available at most department stores.

## **Power Supply Maintenance**

The 12 VDC Power Supply requires minimal maintenance. However, there is a 1 Amp fuse in the Power Supply for safety purposes. In very rare instances, this fuse may blow, in which case the Power Supply will not operate. Replacing this fuse is simple, and replacement fuses can be found at any electronics parts store.

### ***Replacing the 1 Amp Fuse***

First, **unplug the Power Supply from the wall outlet!** Failure to do so could result in electrical shock. Be sure the Power Supply is unplugged before you check or replace the fuse.

Check the Power Supply to see if it has a fuse holder mounted in the rear. If so, unscrew the cap, check the fuse and replace if necessary. Be sure to reinstall the cap.

If the Power Supply does *not* have the fuse holder mounted in the rear, then the fuse holder is inside the Power Supply. Using a Phillips head screwdriver, remove the four screws holding the cover of the Power Supply, and remove the cover. (Be sure the Power Supply is unplugged from the wall outlet.) Open the fuse holder, check the fuse, and replace if necessary. Then close the fuse holder, and reinstall the cover using the four screws.

The fuse used in the Power Supply is a 1 Amp / 250 V, GGS 5 x 20 mm type.

## Chapter 12 - External Battery

The external Battery is a rechargeable 12 Volt Lead Acid Battery, just like in your automobile. It is a little larger than a cigarette pack and weighs 0.8 pounds. Like all lead acid type batteries, it has a shelf life, and requires certain care. The following sections discuss the Battery and how to maximize Battery life.

### Recharging

The lead acid Battery Charger is a regulated taper type charger with an LED (light) in its housing to monitor the battery's condition as it is charged.

To charge the battery, simply plug it into the charger and monitor the LED light on the charger housing. The LED is brightly lit when the battery is low. As the battery accepts charge, the LED begins to flicker. Full charge is indicated when the LED flickers *dimly*. Normal charge time is between 2-5 hours.

### Optimizing Battery Life

To fully optimize the life of the external battery, observe the following rules:

1. Always charge the battery promptly after use.
2. Do not charge longer than 12 hours during a charging period.
3. Charge the battery at least once per month whether it has been used or not.
4. Never keep the battery on the charger for extended periods of time. See next note.

Note: Leaving the battery on the charger overnight will not completely ruin the battery, but each successive time overnight charging is done, the battery becomes slightly less able to take a full charge.

Note: Charger operation instructions are located on the charger housing.

Note: Leaving the battery plugged into the battery charger while the charger is turned *off* will slowly drain the battery.

### Shelf Life and Storage

Battery life depends upon the number of charge cycles and how far the battery was discharged prior to each recharging. The battery will accept approximately 200 full charge cycles. The number of charge cycles will increase if the battery is recharged *before* reaching *full discharge*.

During extended storage periods, battery voltage slowly deteriorates. If during storage, the voltage drops below 1.8 volts per cell (10.8 V total), the battery begins to deteriorate. Consequently, for maximum battery life, it is important to charge the battery monthly even while in storage.

### Purchasing Additional Batteries

Additional batteries can be ordered through the factory or authorized service centers.

## Chapter 13 - Troubleshooting

<b>Display Messages</b>		
Error Messages and Problem Descriptions	Probable Cause	Solution
<p>Message displayed while requesting a tuning change.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;"><b>Outside Limits Execute Nut Adjust</b></p> </div>	<ul style="list-style-type: none"> <li>• Tuning move requested will move the mechanical Arms outside of their operating range.</li> <li>• Strings have stretched or slipped through the nut.</li> </ul>	<ul style="list-style-type: none"> <li>• System requires realignment, perform Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> </ul>
<p>Message displayed while requesting a particular tuning change.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;"><b>Too Fast, Slow Down !</b></p> </div>	<ul style="list-style-type: none"> <li>• Custom Speed has been set to values that request the motors to run faster than they are able for this particular tuning change.</li> </ul>	<ul style="list-style-type: none"> <li>• Edit the Custom Speed values for the selected tuning by decreasing the Beats per Minute or increasing Beats for Change. (See “Custom Speed” in Chapter 7 or “Edit Sequence Block Diagram”, Appendix D.)</li> <li>• Reset the motors to Full Speed for this particular tuning in Edit Mode. (See “Full Speed” in Chapter 7, or “Edit Sequence Block Diagram”, Appendix D.)</li> </ul>
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;"><b>DESTROY CALIBRATION ?</b> yes: SEL                      no: END</p> </div>	<ul style="list-style-type: none"> <li>• You have selected Calibration in the Service Menu.</li> </ul>	<ul style="list-style-type: none"> <li>• Choose yes by pressing SEL to enter the Calibration process.</li> <li>• Choose no by pressing END to exit the Calibration process. (See “Calibration” in Chapter 8.)</li> </ul>
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;"><b>BATTERY EMPTY: POWERDOWN REPLACE BATTERY NOW</b></p> </div>	<ul style="list-style-type: none"> <li>• External battery needs recharging.</li> </ul>	<ul style="list-style-type: none"> <li>• Immediately replace the external battery with a good, fully charged battery.</li> <li>• Power the system with the 120 VAC to 12 VDC power supply.</li> </ul>
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;"><b>Enter Pass Code code :</b></p> </div>	<ul style="list-style-type: none"> <li>• You have selected Service in the Main Menu. The system is asking for the safeguard Pass Code.</li> </ul>	<ul style="list-style-type: none"> <li>• The Pass Code is 1,2,3,4. Hit the four Arrow buttons once each, from left to right, then press SEL to enter the Service Menu.</li> </ul>
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;"><b>Enter Pass Code Incorrect Pass Code</b></p> </div>	<ul style="list-style-type: none"> <li>• You have entered the wrong Pass Code while trying to enter the Service Menu.</li> </ul>	<ul style="list-style-type: none"> <li>• Select (SEL) Service again and re-enter the correct Pass Code (1,2,3,4, SEL) as above.</li> </ul>

Error Messages and Problem Descriptions	Probable Cause	Solution
<p>Startup Message. (<b>4d76</b> in upper left hand corner)</p> <div data-bbox="228 348 496 415" style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>4d76 NV RAM ERROR xxxx CHECK NV RAM BATTERY</p> </div>	<ul style="list-style-type: none"> <li>User settings have been lost from memory.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>If problem persists, perform Memory Condition tests. (See “Testing Memory” in Chapter 11.)</li> </ul>
<p>Startup Message. (<b>4d76</b> in upper right hand corner)</p> <div data-bbox="228 600 496 667" style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>xxxx NV RAM ERROR 4d76 CHECK NV RAM BATTERY</p> </div>	<ul style="list-style-type: none"> <li>System calibration has been lost from memory.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>If problem persists, perform Memory Condition tests. (See “Testing Memory” in Chapter 11.)</li> </ul>
<p>Startup Message. (<b>4d76</b> does not appear in either corner)</p> <div data-bbox="228 831 496 898" style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>xxxx NV RAM ERROR xxxx CHECK NV RAM BATTERY</p> </div>	<ul style="list-style-type: none"> <li>User settings and system calibration have been lost from memory.</li> <li>The memory backup battery has died.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>If problem persists, perform Memory Condition tests. (See “Testing Memory” in Chapter 11.)</li> </ul>
<p>Message displayed when entering User Library. No other messages appear.</p> <div data-bbox="228 1062 496 1129" style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>User Tunings MUST be loaded first</p> </div>	<ul style="list-style-type: none"> <li>User settings have been lost from memory.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>If problem persists, perform Memory Condition tests. (See “Testing Memory” in Chapter 11.)</li> </ul>
<p>Message displayed when entering either Chord or User Libraries. No other messages appear.</p> <div data-bbox="228 1335 496 1402" style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>System Calibration MUST be done first</p> </div>	<ul style="list-style-type: none"> <li>System calibration has been lost from memory.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>If problem persists, perform Memory Condition tests. (See “Testing Memory” in Chapter 11.)</li> </ul>
<p>Messages displayed when entering User Library. Both messages present.</p> <div data-bbox="228 1566 496 1633" style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>System Calibration MUST be done first</p> </div> <div data-bbox="228 1661 496 1728" style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>User Tunings MUST be loaded first</p> </div>	<ul style="list-style-type: none"> <li>User settings and system calibration have been lost from memory.</li> <li>The memory backup battery has died.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>If problem persists, perform Memory Condition tests. (See “Testing Memory” in Chapter 11.)</li> </ul>

## Display Problems

Symptom	Probable Cause	Solution
<ul style="list-style-type: none"> <li>LCD frozen during Startup, backlight alternately flashes bright and dim.</li> </ul>	<ul style="list-style-type: none"> <li>Arm is stuck at Limit Switch during Startup.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system automatically moves any Arm contacting the limit switch to position 100.</li> <li>While system is powered, and LCD is alternately flashing bright and dim, use your finger to gently but firmly press on the Arm that is most upward from the face of the guitar.</li> <li>When the jammed Arm is free, the LCD will display the Main Menu.</li> <li>Immediately perform Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> <li>If problem persists, free the stuck Arm. (See “Adjust Strings” in Chapter 8.)</li> </ul>
<ul style="list-style-type: none"> <li>LCD Display Frozen during normal operation</li> </ul>	<ul style="list-style-type: none"> <li>An Arm has contacted a limit switch halting system operation.</li> <li>Possible memory problem.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system automatically moves any Arm contacting the limit switch to position 100 as described above.</li> <li>Immediately perform Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> <li>If problem persists, free the stuck Arm. (See “Adjust Strings” in Chapter 8.)</li> </ul>
<ul style="list-style-type: none"> <li>Random or scrambled characters appear on the LCD display.</li> </ul>	<ul style="list-style-type: none"> <li>Possible memory problem.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>If problem persists, perform Memory Condition tests. (See “Testing Memory” in Chapter 11.)</li> </ul>
<ul style="list-style-type: none"> <li>LCD flickers on and off while operating on external battery.</li> </ul>	<ul style="list-style-type: none"> <li>Connection at external battery fatigued.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect male pins in the external battery connector. Spread pins using sharp knife if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>During Touch Up, asterisk remains on LCD in place of string number.</li> </ul>	<ul style="list-style-type: none"> <li>String was inadvertently missed during the strum.</li> </ul>	<ul style="list-style-type: none"> <li>Re-strum the string in question.</li> <li>Strum at the 12th fret during Touch Up.</li> </ul>

Symptom	Probable Cause	Solution
<ul style="list-style-type: none"> <li>• During Touch Up, the system appears to freeze after the strum.</li> </ul>	<ul style="list-style-type: none"> <li>• Frequency acquisition of a particular string was incomplete.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify which string does not have a dot after the string number and re-pluck that string.</li> <li>• Strum slower and more consistently during Touch Up. (See “Touch Up” in Chapter 5.)</li> <li>• Strum at the 12th fret during Touch Up.</li> <li>• If needed, use OST and strum to check if the string is being read or not.</li> <li>• If string not read during OST, call qualified service representative.</li> </ul>
<ul style="list-style-type: none"> <li>• Touch Up taking an unusually long time. (Alphabetical characters scroll too long during Touch Up.)</li> </ul>	<ul style="list-style-type: none"> <li>• Hex pickups too close to strings.</li> <li>• Analog gain set too high.</li> </ul>	<ul style="list-style-type: none"> <li>• Verify that hex pickups are set to correct height. (See “Hex Pickups” in Chapter 9.)</li> <li>• Call your nearest qualified Service Representative.</li> </ul>

## Tuning Problems

Symptom	Probable Cause	Solution
<ul style="list-style-type: none"> <li>Touching Up poorly. Tuning changes appear normal.</li> </ul>	<ul style="list-style-type: none"> <li>Strings may need replacing. They may be old, dirty, or both.</li> <li>Bridge rollers may need oil.</li> <li>Setup of the guitar may have been changed, and system may need new calibration.</li> </ul>	<ul style="list-style-type: none"> <li>Perform Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> <li>Install new set of strings. (See “Installing and Replacing Strings” in Chapter 9.)</li> <li>Oil bridge rollers with good quality light machine oil. (See “Lubricating the Roller Bridge” in Chapter 10.)</li> <li>Test calibration to determine if hand strummed calibration is necessary. (See “Testing Calibration” in Chapter 11.)</li> </ul>
<ul style="list-style-type: none"> <li>Tuning of string(s) are gradually drifting sharp as tuning changes are made.</li> </ul>	<ul style="list-style-type: none"> <li>String(s) are slipping through the Lock Nut.</li> </ul>	<ul style="list-style-type: none"> <li>Perform Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> <li>Ensure strings are held securely in the Lock Nut.</li> </ul>
<ul style="list-style-type: none"> <li>High E or B string(s) not tuning properly, all other strings normal.</li> </ul>	<ul style="list-style-type: none"> <li>String(s) have fallen off the string roller(s) at the Arm.</li> <li>Strings need replacing.</li> </ul>	<ul style="list-style-type: none"> <li>Visually inspect string rollers. If string has slipped off the roller, loosen string and reposition the string on the roller and re-tension.</li> <li>Install new string(s).</li> </ul>
<ul style="list-style-type: none"> <li>Tuning accuracy poor (immediately after purchase or after Reset User performed).</li> </ul>	<ul style="list-style-type: none"> <li>All tunings need to be Touched Up after Reset User is performed.</li> </ul>	<ul style="list-style-type: none"> <li>Perform a Reset Touch. (See Chapter 8.)</li> <li>Touch Up your tunings. (See “Touch Up” in Chapter 5.)</li> <li>Perform a Nut Adjust.</li> </ul>
<ul style="list-style-type: none"> <li>Touch Up needed every time a new tuning is selected. (reproducibility poor)</li> </ul>	<ul style="list-style-type: none"> <li>Strings needs replacing.</li> <li>Incorrect string gages installed.</li> <li>String(s) may have slipped in the Lock Nut.</li> <li>Characteristics of the guitar have changed, and system needs new calibration.</li> </ul>	<ul style="list-style-type: none"> <li>Install new strings.</li> <li>Ensure recommended gage strings (displayed on the Startup Screen) are installed.</li> <li>Perform a successful Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> <li>If problem persists, perform Testing Calibration. (See “Testing Calibration” in Chapter 11.)</li> </ul>
<ul style="list-style-type: none"> <li>One or more strings seem to Touch Up sharp or flat in all tunings.</li> </ul>	<ul style="list-style-type: none"> <li>String Temper setting.</li> <li>Tune Temper setting.</li> </ul>	<ul style="list-style-type: none"> <li>Reset or adjust String Temper.</li> <li>Reset or adjust Tune Temper.</li> </ul>
<ul style="list-style-type: none"> <li>String(s) sharp or flat in one tuning.</li> </ul>	<ul style="list-style-type: none"> <li>Tune Temper setting.</li> <li>Edit temper setting.</li> </ul>	<ul style="list-style-type: none"> <li>Reset or adjust temper in String Temper mode.</li> <li>Reset or adjust temper in Edit mode.</li> </ul>

## Mechanical Problems

Symptom	Probable Cause	Solution
<ul style="list-style-type: none"> <li>Arm(s) stuck during system power up. LCD backlight alternately flashing bright / dim.</li> </ul>	<ul style="list-style-type: none"> <li>Arm(s) stuck at lower limit switch.</li> <li>System program halted until Arms(s) are off limit switches.</li> </ul>	<ul style="list-style-type: none"> <li>Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>While system is powered, and LCD is alternately flashing bright and dim, use your finger to gently but firmly press on the Arm that is most upward from the face of the guitar.</li> <li>When the jammed Arm is free, the LCD will display the Main Menu.</li> <li>Immediately perform Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> <li>If problem persists, free the stuck Arm. (See “Adjust Strings” in Chapter 8.)</li> </ul>
<ul style="list-style-type: none"> <li>Arms are stuck soon after installing new strings.</li> </ul>	<ul style="list-style-type: none"> <li>After string change, strings manually re-tuned to a different tuning than the system was in when strings were removed.</li> </ul>	<ul style="list-style-type: none"> <li>Perform successful Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> <li>If problem persists, set notes at position 100. (See “Adjust Strings” in Chapter 8.)</li> </ul>
<ul style="list-style-type: none"> <li>Arm(s) not moving during Nut Adjust.</li> <li>Arm(s) not moving during a tuning change.</li> <li>Arm(s) stuck in the middle of the operating range.</li> <li>Arm(s) stuck outside of the operating range.</li> <li>Arm(s) stuck at the upper or lower wall.</li> </ul>	<ul style="list-style-type: none"> <li>String(s) installed may be other than the correct gages.</li> <li>String(s) may have slipped off the Arm roller.</li> <li>String(s) may have slipped in the Lock Nut.</li> <li>Mechanical system needs alignment.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure recommended gage strings (displayed on the Startup Screen) are installed.</li> <li>Ensure strings have not slipped off their rollers.</li> <li>Perform successful Nut Adjust. (See “Nut Adjust” in Chapter 8.)</li> <li>If problem persists, free the stuck Arm. (See “Adjust Strings” in Chapter 8.)</li> </ul>
<ul style="list-style-type: none"> <li>Excessive noise coming from tuning device during tuning change.</li> </ul>	<ul style="list-style-type: none"> <li>String(s) installed is too small in diameter (gage).</li> <li>Springs need adjustment.</li> <li>String(s) installed wrong.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure proper gage string(s) is installed correctly.</li> <li>Perform a successful Nut Adjust.</li> <li>Call your nearest qualified Service Representative if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>Power Supply not powering up.</li> </ul>	<ul style="list-style-type: none"> <li>Power Supply may not be plugged into wall outlet.</li> <li>Guitar may not be plugged into Power Supply.</li> <li>Fuse in Power Supply may be blown.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure Power Supply is plugged into the wall outlet.</li> <li>Ensure guitar is plugged into Power Supply.</li> <li>If necessary, replace 1 Amp fuse in the Power Supply. (See “Power Supply Maintenance” in Chapter 11.)</li> <li>Call your nearest qualified Service Representative if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>Both top and bottom rows of Pushbuttons inoperative.</li> </ul>	<ul style="list-style-type: none"> <li>Water or some other liquid may be shorting out Pushbuttons or LCD.</li> </ul>	<ul style="list-style-type: none"> <li>Power down (turn power off) and Allow to dry.</li> </ul>

## Operational Problems

Symptom	Probable Cause	Solution
<ul style="list-style-type: none"> <li>• Random or scrambled characters appear on the LCD display.</li> </ul>	<ul style="list-style-type: none"> <li>• Possible memory problem.</li> </ul>	<ul style="list-style-type: none"> <li>• Turn the system off and back on again, the system reboots from the RAM DISK avoiding the error.</li> <li>• If problem persists, perform Memory Condition tests. (See “Testing Memory” in Chapter 11.)</li> </ul>
<ul style="list-style-type: none"> <li>• Top row of Pushbuttons inoperative.</li> </ul>	<ul style="list-style-type: none"> <li>• Stage Mode is on.</li> </ul>	<ul style="list-style-type: none"> <li>• Turn off Stage Mode. (See “Stage” in Chapter 8.)</li> </ul>
<ul style="list-style-type: none"> <li>• Footswitch does not operate while in a User Library Tuning Window</li> </ul>	<ul style="list-style-type: none"> <li>• No values entered in Footswitch Sequence.</li> </ul>	<ul style="list-style-type: none"> <li>• Enter values in Footswitch Sequence. (See “Footswitch” in Chapter 7.)</li> </ul>
<ul style="list-style-type: none"> <li>• Footswitch does not operate in Chord Library</li> </ul>	<ul style="list-style-type: none"> <li>• No values entered in Footswitch Sequence in corresponding Menu in User Library.</li> </ul>	<ul style="list-style-type: none"> <li>• Go to the corresponding Tuning Menu in the User Library and enter a Footswitch Sequence. (See “Using Footswitch in the Chord Library” in Chapter 6.)</li> </ul>
<ul style="list-style-type: none"> <li>• Random and erratic operational problems</li> </ul>	<ul style="list-style-type: none"> <li>• Touchup is required after capo is removed.</li> <li>• Calibration corrupted.</li> <li>• User area defaults corrupted.</li> </ul>	<ul style="list-style-type: none"> <li>• Turn system power off, wait 5 seconds, and turn power back on (re-boot).</li> <li>• Perform Nut Adjust.</li> <li>• If problem persists, perform Reset User. Remember to have your User Library tunings written down first. (See “Reset User” in Chapter 8.)</li> <li>• If problem persists, perform RomCal. (See “RomCal” in Chapter 8.)</li> </ul>

## Audio Problems

Symptom	Probable Cause	Solution
<ul style="list-style-type: none"> <li>Noise is bleeding through the pickups.</li> </ul>	<ul style="list-style-type: none"> <li>Noise is created three ways:</li> <li>magnetic induction from the motors into the pickups;</li> <li>mechanical vibration through the body; and</li> <li>magnetic induction from motor lead wires into wiring in the cavity (DTS-1 models only).</li> </ul>	<ul style="list-style-type: none"> <li>Noise can be reduced by:</li> <li>Ensuring all magnetic shields are properly installed as shipped.</li> <li>Ensuring pickups are solidly mounted.</li> <li>Ensuring noise shield is installed over the audio cavity in DTS-1 models.</li> </ul>
<ul style="list-style-type: none"> <li>Audio noise level higher than expected when using special effects.</li> </ul>	<ul style="list-style-type: none"> <li>When using a processor that raises the noise floor, such as a distortion or boost, the signal-to-noise ratio is lowered and the motor noise is effectively amplified.</li> </ul>	<p><u>Tips to reduce amplified motor noise:</u></p> <ul style="list-style-type: none"> <li>Lower the distortion or boost.</li> <li>Switch to the pickup that is furthest away from the motors before changing tuning. (Rhythm pickup)</li> <li>Play the strings during the change with enough intensity to drown out the motor noise.</li> <li>Try an A/B switch.</li> <li>Try a Noise gate.</li> </ul> <p>Turn off guitar volume during tuning change.</p>
<ul style="list-style-type: none"> <li>Excessive noise coming from tuning device during tuning change.</li> </ul>	<ul style="list-style-type: none"> <li>String(s) installed is too small in diameter (gauge).</li> <li>Springs need adjustment.</li> <li>String(s) installed wrong.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure proper gauge string(s) is installed correctly.</li> <li>Perform a successful Nut Adjust.</li> <li>Call your nearest qualified Service Representative if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>Hum present in the guitar amplifier.</li> </ul>	<ul style="list-style-type: none"> <li>Power supply is too close to the pickups.</li> </ul>	<ul style="list-style-type: none"> <li>Locate power supply at least 3 feet away from the pickups.</li> </ul>

## Chapter 14 - Service and Repair

### Obtaining Service and Repairs

The Owner must ship the instrument, freight and insurance pre-paid to TransPerformance at the address given below. No instrument may be returned to TransPerformance without prior Return Authorization. Please phone or write for such authorization. When writing to TransPerformance, please include a detailed description of the problem.

When returning the system for service or warranty repair, include all system components unless otherwise instructed.

Once the guitar arrives, we will inspect it, and will advise you of the approximate date of completion for repairs. If non-warranty work is recommended, a quotation will be issued and must be approved by the owner before work is started. The repaired instrument or part will be returned freight collect insured.

For further information, write or call:

TransPerformance Inc.  
Service Dept.  
2526 Courtland Court  
Fort Collins, Colorado 80526-1324  
(970) 482-9132

### Shipping and Transporting

This guitar, as with any guitar, should always be shipped with the strings loosened, but not slack. Set at 3 half steps below standard tuning (S-3 in the Standard Window of the Chord Library) if possible. If the system is unable to tune to S-3, then loosen the Lock Nut and manually loosen the strings a bit for shipping. Be sure to use a sturdy shipping container and pack tightly with packing materials that cushion, but do not compress during shipping.

# Appendix A - Menu Organization Diagram

## MAIN MENU

<b>Play</b>	<b>IndivStr</b>
<b>Maint</b>	<b>Service</b>

## PLAY MENU

<b>UserLib</b>	<b>ChrdLib</b>
<b>StrTemper</b>	<b>TuneTemper</b>
<b>Stage</b>	<b>LCDTimeout</b>

## MAINT MENU

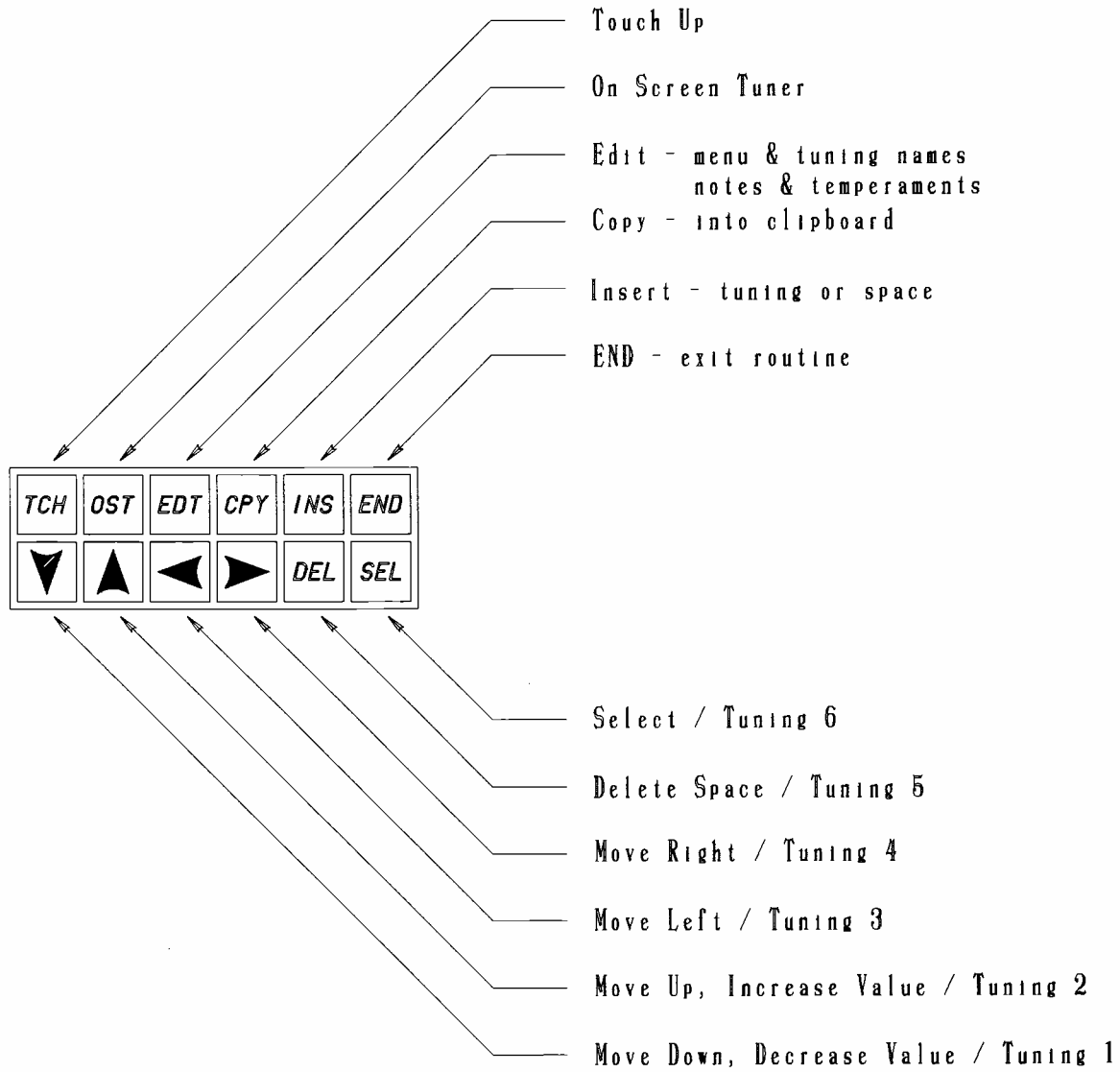
<b>NutAdjust</b>	<b>Stretch</b>
<b>AdjStrgs</b>	<b>Battery</b>

## SERVICE MENU

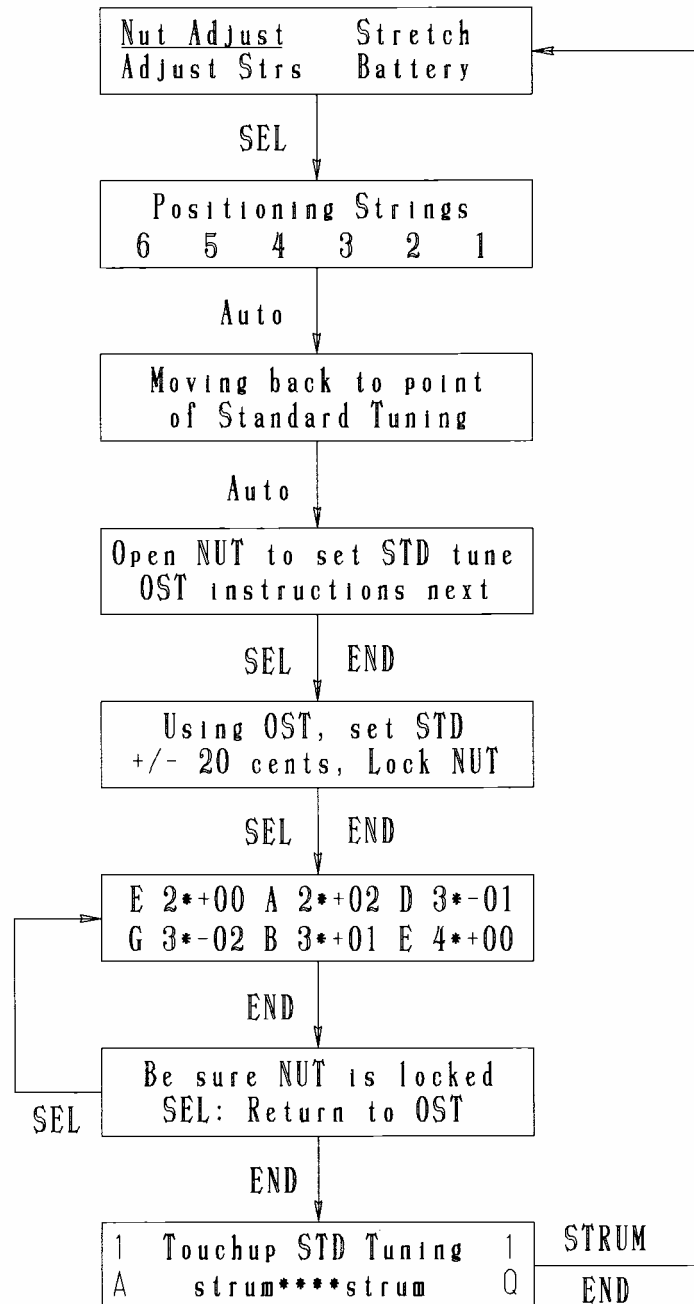
**Pass Code 1234**

<b>ResetUser</b>	<b>ResetTouch</b>
<b>Calibration</b>	<b>RomCal</b>

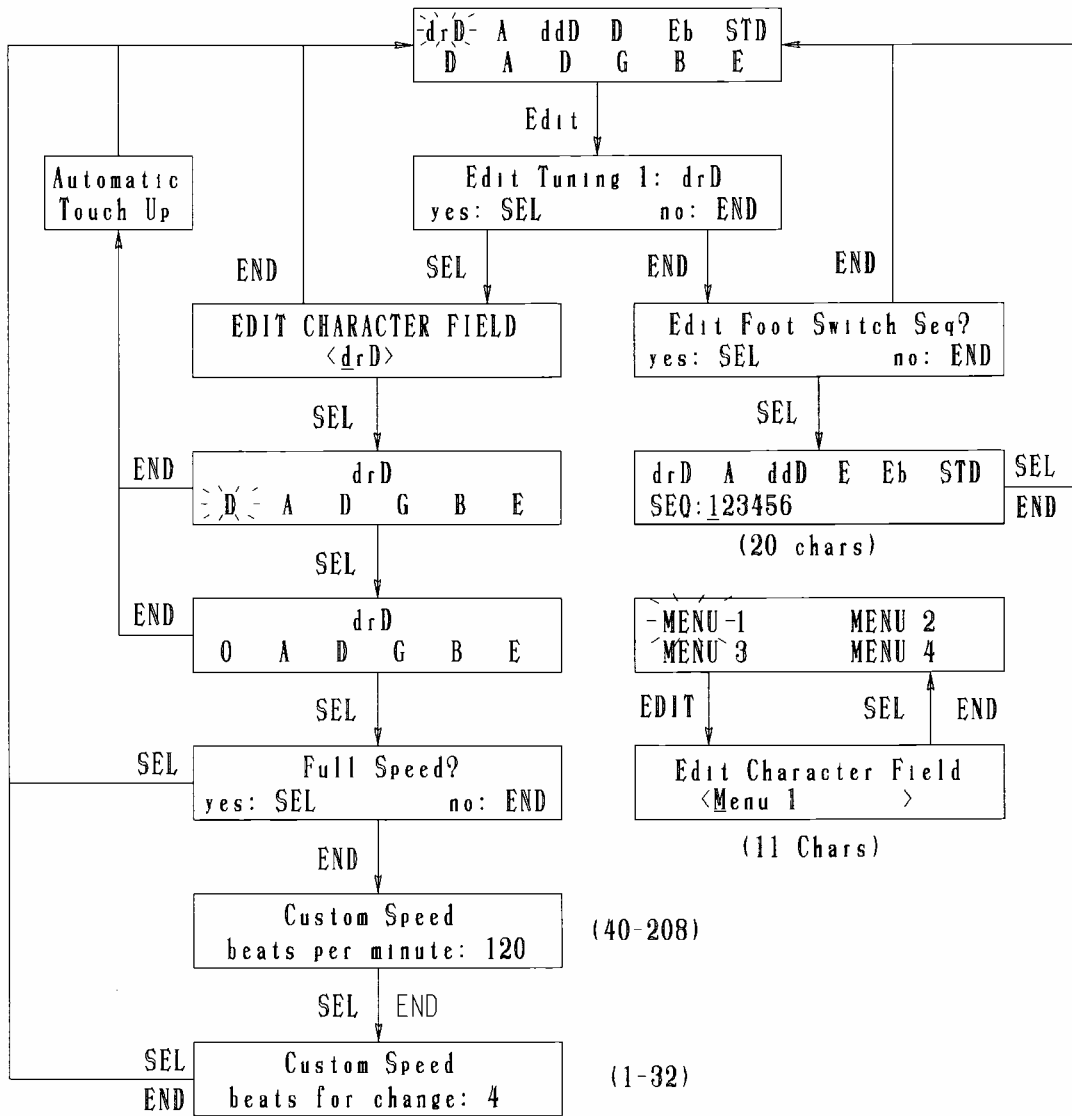
# Appendix B - Pushbutton Diagram



## Appendix C - Nut Adjust Sequence Block



# Appendix D - Edit Sequence Block Diagram



## Appendix E - System Operating Ranges

Cents from STD	Hardware Version 000					
	6	5	4	3	2	1
+300	-	-	-	-	D <sub>4</sub>	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	F# <sub>4</sub>
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G <sub>3</sub>	C <sub>4</sub>
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.042	.032	.024	.016	.011	.009
<b>Reinforced Strings Recommended - Ernie Ball RPS-9, D'Addario KXL-120</b>						

Cents from STD	Hardware Version 0A0					
	6	5	4	3	2	1
+300	-	-	-	-	D <sub>4</sub>	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	F# <sub>4</sub>
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G <sub>3</sub>	-
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.042	.032	.024	.016	.011	.009
<b>Reinforced Strings Recommended - Ernie Ball RPS-9, D'Addario KXL-120</b>						

Cents from STD	Hardware Version 001					
	6	5	4	3	2	1
+300	-	-	-	-	D <sub>4</sub>	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	F# <sub>4</sub>
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G <sub>3</sub>	C <sub>4</sub>
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.042	.032	.024	.015	.011	.009
<b>Reinforced Strings Recommended - Ernie Ball Hybrid, D'Addario Hybrid</b>						

Cents from STD	Hardware Version 0A1					
	6	5	4	3	2	1
+300	-	-	-	-	D <sub>4</sub>	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	F# <sub>4</sub>
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G <sub>3</sub>	-
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.042	.032	.024	.015	.011	.009
Reinforced Strings Recommended - Ernie Ball Hybrid, D'Addario Hybrid						

Cents from STD	Hardware Version 002					
	6	5	4	3	2	1
+300	-	-	-	-	-	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	-
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	-	Eb <sub>3</sub>	G <sub>3</sub>	C <sub>4</sub>
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.046	.036	.026	.017	.013	.010
Reinforced Strings Recommended - Ernie Ball RPS10, D'Addario KXL110						

Cents from STD	Hardware Version 0P2					
	6	5	4	3	2	1
+300	-	-	-	-	D <sub>4</sub>	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	-
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G <sub>3</sub>	C <sub>4</sub>
-500	B <sub>2</sub>	-	-	-	-	B <sub>3</sub>
-600	Bb <sub>2</sub>	-	-	-	-	-
Str Gages	.052	.042	.032	.024w	.016	.012
Reinforced Strings Recommended - D'Addario J-21						

Cents from STD	Hardware Version 003					
	6	5	4	3	2	1
+300	-	-	-	-	D <sub>4</sub>	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	F# <sub>4</sub>
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	-	Eb <sub>3</sub>	G <sub>3</sub>	C <sub>4</sub>
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.046	.036	.026	.016	.011	.009
Reinforced Strings Recommended - Ernie Ball Hybrid, D'Addario hybrid						

Cents from STD	Hardware Version 0A3					
	6	5	4	3	2	1
+300	-	-	-	-	D <sub>4</sub>	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	F# <sub>2</sub>
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	-	Eb <sub>3</sub>	G <sub>3</sub>	-
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.046	.036	.026	.016	.011	.009
Reinforced Strings Recommended - Ernie Ball Hybrid, D'Addario hybrid						

Cents from STD	Hardware Version 004					
	6	5	4	3	2	1
+300	-	-	-	-	-	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	F# <sub>4</sub>
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	-	-	Eb <sub>3</sub>	G <sub>3</sub>	C <sub>4</sub>
-500	B <sub>1</sub>	-	-	D <sub>3</sub>	-	-
Str Gages	.048	.036	.026	.017	.013	.009
Reinforced Strings Recommended - Ernie Ball RPS10 Hybrid, D'Addario KXL110 Hybrid						

Cents from STD	Hardware Versions 007, 010, 041 & 043					
	6	5	4	3	2	1
+300	-	-	-	-	-	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	-
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	-	-	Eb <sub>3</sub>	G <sub>3</sub>	C <sub>4</sub>
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.046	.036	.026	.017	.013	.010
<b>Reinforced Strings Recommended - Ernie Ball RPS-10, D'Addario KXL-110</b>						

Cents from STD	Hardware Version 008					
	6	5	4	3	2	1
+300	-	-	-	-	-	-
+200	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	A <sub>3</sub>	C# <sub>4</sub>	-
+100	F <sub>2</sub>	Bb <sub>2</sub>	Eb <sub>3</sub>	G# <sub>3</sub>	C <sub>4</sub>	F <sub>4</sub>
0 (STD)	E <sub>2</sub>	A <sub>2</sub>	D <sub>3</sub>	G <sub>3</sub>	B <sub>3</sub>	E <sub>4</sub>
-100	Eb <sub>2</sub>	G# <sub>2</sub>	C# <sub>3</sub>	F# <sub>3</sub>	Bb <sub>3</sub>	Eb <sub>4</sub>
-200	D <sub>2</sub>	G <sub>2</sub>	C <sub>3</sub>	F <sub>3</sub>	A <sub>3</sub>	D <sub>4</sub>
-300	C# <sub>2</sub>	F# <sub>2</sub>	B <sub>2</sub>	E <sub>3</sub>	G# <sub>3</sub>	C# <sub>4</sub>
-400	C <sub>2</sub>	F <sub>2</sub>	-	Eb <sub>3</sub>	G <sub>3</sub>	C <sub>4</sub>
-500	-	-	-	D <sub>3</sub>	-	-
Str Gages	.046	.036	.026	.017	.013	.010
<b>Reinforced Strings Recommended - Ernie Ball RPS-10, D'Addario KXL-110</b>						

## Appendix F - Chord Library Listing

STANDARD		6	5	4	3	2	1
1	S+1	F	Bb	Eb	G#	C	F
2	STD	E	A	D	G	B	E
3	S-1	Eb	G#	C#	F#	Bb	Eb
4	S-2	D	G	C	F	A	D
5	S-3	C#	F#	B	E	G#	C#
6	STD	E	A	D	G	B	E

EGDAC		6	5	4	3	2	1
1	opE	E	B	E	G#	B	E
2	opG	D	G	D	G	B	D
3	opD	D	A	D	F#	A	D
4	opA	E	A	E	A	C#	E
5	opC	C	G	C	G	C	E
6	STD	E	A	D	G	B	E

A-C		6	5	4	3	2	1
1	opA	E	A	E	A	C#	E
2	Am	E	A	C	E	A	E
3	opB	Eb	F#	B	F#	B	Eb
4	Bm	D	B	D	F#	B	D
5	opC	C	G	C	G	C	E
6	STD	E	A	D	G	B	E

D-E		6	5	4	3	2	1
1	opD	D	A	D	F#	A	D
2	Dm	F	A	D	F	A	D
3	D#	Eb	Bb	Eb	G	Bb	Eb
4	opE	E	B	E	G#	B	E
5	Em	E	B	E	G	B	E
6	STD	E	A	D	G	B	E

<b>F-G</b>		<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>1</b>	<b>F</b>	<b>F</b>	<b>A</b>	<b>C</b>	<b>A</b>	<b>C</b>	<b>F</b>
<b>2</b>	<b>F#</b>	<b>F#</b>	<b>Bb</b>	<b>C#</b>	<b>F#</b>	<b>Bb</b>	<b>C#</b>
<b>3</b>	<b>F#m</b>	<b>F#</b>	<b>A</b>	<b>C#</b>	<b>F#</b>	<b>A</b>	<b>C#</b>
<b>4</b>	<b>opG</b>	<b>D</b>	<b>G</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>D</b>
<b>5</b>	<b>Gm</b>	<b>D</b>	<b>G</b>	<b>D</b>	<b>G</b>	<b>A#</b>	<b>D</b>
<b>6</b>	<b>STD</b>	<b>E</b>	<b>A</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>E</b>

<b>OPEN</b>		<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>1</b>	<b>Am</b>	<b>E</b>	<b>A</b>	<b>C</b>	<b>E</b>	<b>A</b>	<b>E</b>
<b>2</b>	<b>GM7</b>	<b>D</b>	<b>G</b>	<b>D</b>	<b>F#</b>	<b>B</b>	<b>D</b>
<b>3</b>	<b>AM7</b>	<b>C#</b>	<b>A</b>	<b>C#</b>	<b>G#</b>	<b>A</b>	<b>E</b>
<b>4</b>	<b>Fm7</b>	<b>F</b>	<b>Ab</b>	<b>C</b>	<b>Eb</b>	<b>Ab</b>	<b>Eb</b>
<b>5</b>	<b>C#m</b>	<b>C#</b>	<b>G#</b>	<b>C#</b>	<b>G#</b>	<b>C#</b>	<b>E</b>
<b>6</b>	<b>STD</b>	<b>E</b>	<b>A</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>E</b>

<b>Modal 1</b>		<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>1</b>	<b>GAD</b>	<b>D</b>	<b>A</b>	<b>D</b>	<b>G</b>	<b>A</b>	<b>D</b>
<b>2</b>	<b>DAD</b>	<b>D</b>	<b>A</b>	<b>D</b>	<b>D</b>	<b>A</b>	<b>D</b>
<b>3</b>	<b>C+9 (Cadd9-1)</b>	<b>D#</b>	<b>B</b>	<b>D#</b>	<b>F#</b>	<b>B</b>	<b>C#</b>
<b>4</b>	<b>D5</b>	<b>D</b>	<b>A</b>	<b>D</b>	<b>A</b>	<b>A</b>	<b>D</b>
<b>5</b>	<b>BB</b>	<b>E</b>	<b>A</b>	<b>E</b>	<b>G</b>	<b>A</b>	<b>E</b>
<b>6</b>	<b>STD</b>	<b>E</b>	<b>A</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>E</b>

<b>Modal 2</b>		<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>1</b>	<b>D69 (D6/9 no 3rd)</b>	<b>D</b>	<b>A</b>	<b>E</b>	<b>A</b>	<b>B</b>	<b>D</b>
<b>2</b>	<b>Em1 (Em11)</b>	<b>E</b>	<b>B</b>	<b>E</b>	<b>G</b>	<b>A</b>	<b>D</b>
<b>3</b>	<b>Bb2 (Bb sus 2)</b>	<b>C</b>	<b>Bb</b>	<b>C</b>	<b>F</b>	<b>Bb</b>	<b>F</b>
<b>4</b>	<b>Dm1 (Em 11)</b>	<b>D</b>	<b>A</b>	<b>C</b>	<b>G</b>	<b>C</b>	<b>E</b>
<b>5</b>	<b>Bb9 (Bb(9)/Eb)</b>	<b>Eb</b>	<b>Bb</b>	<b>C</b>	<b>F</b>	<b>C</b>	<b>D</b>
<b>6</b>	<b>STD</b>	<b>E</b>	<b>A</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>E</b>

Modal A		6	5	4	3	2	1
1	MA1	D	A	D	G	C	D
2	MA2	C	G	E	G	B	D
3	MA3	E	G#	D	F#	B	E
4	MA4	C	G	D	G	A	D
5	MA5	D	A	D	E	A	D
6	STD	E	A	D	G	B	E

Modal B		6	5	4	3	2	1
1	MB1	E	G#	E	G#	B	C#
2	MB2	E	B	D	G#	B	D
3	MB3	D	G	D	G	A	D
4	MB4	D	G	D	G	C	D
5	MB5	C	G	C	G	C	F
6	STD	E	A	D	G	B	E

Modal C		6	5	4	3	2	1
1	MC1	D	A	D	G	C	E <sup>b</sup>
2	MC2	F	B <sup>b</sup>	C	F	A	D
3	MC3	E	B	E	G	A	E
4	MC4	E	B	E	G	C	E
5	MC5	E	A	C#	E	A	E
6	STD	E	A	D	G	B	E

UNISON		6	5	4	3	2	1
1	Un1	E	A	E	E	A	E
2	Un2	C	G	D	D	A	E
3	Un3 (Min2nd 4)	G#	G#	E	F	B	D#
4	Un4 (DAD)	D	A	D	D	A	D
5	Un5 (Sitar)	E	B	B	E	B	E
6	STD	E	A	D	G	B	E

Minor		6	5	4	3	2	1
1	Em	E	B	E	G	B	E
2	Gm	D	G	D	G	Bb	D
3	Dm	F	A	D	F	A	D
4	Dm9	D	A	E	F	C	E
5	Cm9	C	G	D	Eb	Bb	Eb
6	STD	E	A	D	G	B	E

Altered		6	5	4	3	2	1
1	G6	D	G	D	G	B	E
2	DM7	D	A	D	F#	A	C#
3	D7	D	A	D	F#	C	D
4	C6	C	G	C	G	A	E
5	DM9	D	A	E	F#	C#	D
6	STD	E	A	D	G	B	E

STD Var 1		6	5	4	3	2	1
1	DrD (Drop D)	D	A	D	G	B	E
2	DdD (Double Drop D)	D	A	D	G	B	D
3	Lut (Ren Lute)	E	A	D	F#	B	E
4	LtD (Ren Lute Drop D)	D	A	D	F#	B	E
5	4th (Fourths)	E	A	D	G	C	F
6	STD	E	A	D	G	B	E

STD Var 2		6	5	4	3	2	1
1	SV1 (Std Var 1)	E	G	D	G	B	E
2	SV2 (Std Var 2)	E	A	E	G	B	E
3	SV3 (Std Var 3)	F	A	D	G	B	E
4	SV4 (Std Var 4)	D	A	D	G	C	E
5	STD (Std Var 5)	E	A	D	G	B	E
6	STD	E	A	D	G	B	E

ARTISTS		6	5	4	3	2	1
1	JP (Jimmy Page)	C	G	C	G	C	D
2	CSN (Crosby Stills Nash)	E	B	E	E	B	E
3	FLT (Fleetwood Mac)	E	G	D	G	B	E
4	KR (Keith Richards G)	D	G	D	G	B	D
5	NY (Neil Young)	D	A	D	G	A	D
6	STD	E	A	D	G	B	E

M. Hedges		6	5	4	3	2	1
1	MH	D	A	E	A	B	D
2	LEN	F	A	D	G	B	E
3	BAB	D	A	D	G	C	E
4	HAP	F#	Bb	Eb	F	G#	C#
5	LAY	D	A	C	G	C	E
6	STD	E	A	D	G	B	E

D. Beegle		6	5	4	3	2	1
1	G/C	C	G	C	G	B	D
2	C2	C	G	C	G	C	D
3	EbC	C	G	Eb	G	Bb	D
4	C2	C	G	C	G	C	D
5	D/G	D	A	D	G	B	D
6	STD	E	A	D	G	B	E

Relatives		6	5	4	3	2	1
1	ST1	D	G	C	F	A	D
2	DrD	C	G	C	F	A	D
3	DM7	E	B	E	G#	B	D#
4	DAD	E	B	E	E	B	E
5	STD	E	A	D	G	B	E
6	STD	E	A	D	G	B	E

<b>Invs-EMaj (Inversions E Major)</b>		<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>1</b>	<b>E1</b>	<b>E</b>	<b>B</b>	<b>E</b>	<b>G#</b>	<b>B</b>	<b>E</b>
<b>2</b>	<b>E2</b>	<b>E</b>	<b>B</b>	<b>B</b>	<b>E</b>	<b>G#</b>	<b>E</b>
<b>3</b>	<b>E3</b>	<b>E</b>	<b>G#</b>	<b>B</b>	<b>G#</b>	<b>B</b>	<b>E</b>
<b>4</b>	<b>E4</b>	<b>E</b>	<b>G#</b>	<b>E</b>	<b>E</b>	<b>B</b>	<b>E</b>
<b>5</b>	<b>E5</b>	<b>E</b>	<b>B</b>	<b>E</b>	<b>E</b>	<b>G#</b>	<b>E</b>
<b>6</b>	<b>STD</b>	<b>E</b>	<b>A</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>E</b>

<b>Invs-GMaj (Inversions G Maj)</b>		<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
<b>1</b>	<b>G1</b>	<b>D</b>	<b>G</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>D</b>
<b>2</b>	<b>G2</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>G</b>	<b>B</b>	<b>D</b>
<b>3</b>	<b>G3</b>	<b>D</b>	<b>B</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>D</b>
<b>4</b>	<b>G4</b>	<b>D</b>	<b>B</b>	<b>B</b>	<b>G</b>	<b>G</b>	<b>D</b>
<b>5</b>	<b>G5</b>	<b>D</b>	<b>B</b>	<b>B</b>	<b>G</b>	<b>B</b>	<b>D</b>
<b>6</b>	<b>STD</b>	<b>E</b>	<b>A</b>	<b>D</b>	<b>G</b>	<b>B</b>	<b>E</b>

# Appendix G - R2V1 System Specifications

## **Tuning Accuracy** +/- 2 cents

The following conditions must be met while testing tuning accuracy:

1. A locknut is required.
2. During "Nut Adjust" procedure, strings must be adjusted to within +/- 20 cents of STD A-440 tuning after nut is locked.
3. The roller bridge is installed and working properly.
4. The recommended string gages are installed.
5. The hex pickup sensors must be adjusted to specified height.
6. Frequency of string determined after strings settle no less than 3 seconds after being struck.

## **Tempering**

Adjustment	1 cent increments
Note	+10cents, -25 cents
String	+10 cents, -10 cents
Tuning	+50 cents, -50 cents

**Chord Library Tunings** 144 - permanent memory

**User Library Tunings** 240 - programmable

**Tunings per LCD Window** 6, (+ STD in background of each tuning)

## **Speed of Tuning Change**

Full Speed	Less than one second per 1/2 musical step change.
Variable Speed	Set by Beats per Minute (BPM) & number of Beats for tuning change.

**Strings Brand** Ernie Ball or D'Addario reinforced

**Scale Length** 24.625"

**String Gages** 9-42, 9-46, and 10-46

## **Hex Pickup Sensors**

Height	Between .020" and .035" beneath strings
Magnets	Required

## **Motor Noise**

The amount of motor noise is relative to the impedance of the pickup winding and will vary from guitar to guitar.

The following conditions must be met while testing motor noise:

1. zero attenuation on volume and tone potentiometers (full on)
2. strings muted
3. Mu metal shields installed
4. normal noise floor
5. voltage reading taken from audio jack
6. pickup selector switch is in the proper positions

7. readings taken while moving between S-3 and S+1 tunings (found in STANDARD MENU in the Chord Library)

Rhythm Pickup	2-4 mV (p-p) typ.
Treble Pickup	8-12 mV (p-p) typ.

**Signal to Noise Ratio**

Guitar audio voltages were determined by strumming the guitar and reading the voltage output of the pickups using three strumming forces.

		Rhythm 3 mV	Treble 10 mV
Light Strum	175 mV (p-p)	35 dB	25 dB
Medium Strum	350 mV (p-p)	41 dB	31 dB
Heavy Strum	700 mV (p-p)	47 dB	37 dB

**Mu Metal Shielding**

Motors .005" netic	Required on all motors
Motors .025" co-netic	Required on motors 2, 4 and 6
Base Shield .025" co-netic	Required
Front Shield .025" co-netic	Required
Barrier Shield .025" co-netic	Required

# Appendix H - Tuning & Temperament Records

(Make copies of this form)

Menu Name (11 Characters)	Footswitch Sequence (20 Characters)											
Tuning 1	Str 6	Temp	Str 5	Temp	Str 4	Temp	Str 3	Temp	Str 2	Temp	Str 1	Temp
	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC
Tuning 2	Str 6	Temp	Str 5	Temp	Str 4	Temp	Str 3	Temp	Str 2	Temp	Str 1	Temp
	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC
Tuning 3	Str 6	Temp	Str 5	Temp	Str 4	Temp	Str 3	Temp	Str 2	Temp	Str 1	Temp
	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC
Tuning 4	Str 6	Temp	Str 5	Temp	Str 4	Temp	Str 3	Temp	Str 2	Temp	Str 1	Temp
	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC
Tuning 5	Str 6	Temp	Str 5	Temp	Str 4	Temp	Str 3	Temp	Str 2	Temp	Str 1	Temp
	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC
Tuning 6	Str 6	Temp	Str 5	Temp	Str 4	Temp	Str 3	Temp	Str 2	Temp	Str 1	Temp
	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC	BPM	BFC

# Glossary

**Action**—String height above the fret board. Height is measured at the 12th fret from the top of the fret to the bottom of the string(s).

**Alternate Tuning**—Any tuning that is other than Standard Tuning.

**Arms**—The part of the Mechanical Device where the balls of the strings are seated. Each string has its own Arm with a motor connected to each Arm. The Arms pivot to adjust each string to its desired tuning.

**Background Tuning**—Standard Tuning. Behind every tuning in the CAT is Standard Tuning.

**Baseplate**—The frame base of the Mechanical Device. All mechanical subassemblies are attached to the Baseplate.

**Battery**—The 12 VDC lead acid battery used to power the system.

**Bridge**—The support means at the heel end of the guitar for the playing length of the string. Intonation and action are adjusted at the bridge.

**Bridge Ground Strap**—A jumper wire that provides electrical ground from the strings to audio ground. On some models, this strap is mounted between the bottom of the bridge and the top of the thumb adjuster on the string 6 side of the bridge.

**Bridge Rollers**—Rollers mounted on the bridge that allow string movement with minimal friction as the system changes tunings.

**Buttons**—See Pushbuttons.

**Calibration**—The group of equations characterizing guitar composition, neck warp, string characteristics, etc., unique to each guitar. The calibration allows the system to change tunings accurately without having to listen to the strings.

**Capo Mode**—A hidden mode that Touches Up the guitar after installing a capo. Capo Mode is turned on by executing a Touch Up while a capo is installed. It is turned off by Touching Up with no capo installed.

**Cell**—An area in which a character can be inserted within a name, tuning, or Footswitch Sequence during Editing.

**Cent**—One percent of the musical pitch between adjacent half steps. There are 100 cents between each half-step.

**Chord Library**—One of the two main groups of tunings in the CAT. The Chord Library has 144 tunings in 24 groupings of 6 related tunings (Tuning Menus / Tuning Windows). The Chord Library is permanent memory set at the factory.

**Clipboard**—An area reserved in the system that is used to hold a single tuning in memory for later use with Insert Tuning or Individual Strings.

**Cursor**—Underline. During Editing, the cursor is positioned beneath a cell to set a character in that cell.

**CPY**—Copy. This Pushbutton copies whatever tuning the system is currently in and places it into the clipboard.

**Defaults**—The original settings of values and data within the system software.

**DEL**—Delete. This Pushbutton erases characters displayed on the LCD screen during the Editing process.

**DIN Connector**—The 7 pin jack mounted in the guitar next to the 1/4" audio jack, and in the back of the power supply.

**EDT**—Edit. This Pushbutton enables the Edit process.

**END**—This Pushbutton quits certain actions, leaves modes, backs out through the menu structure, represents a "no" answer to questions displayed on the LCD, and allows you to bypass the startup screens.

**External Battery**—See Battery.

**Footswitch**—A footswitch can be used to select tunings allowing the player to keep his or her hands free while changing tunings.

**Foreground Tuning**—All tunings displayed on the LCD when initially entering a Tuning Window. See Background Tuning (STD).

**Full Speed**—The fastest speed possible for a tuning change.

**Half-Step**—A one note change. For example: G# is one half-step above G.

**Headstock**—The part of the guitar neck above the nut containing the machine heads where the strings are wound.

**Heel**—The part of the guitar on the edge of the body opposite the headstock (tuning pegs).

**Hex Pickups**—The 6 pickup sensors mounted in the bracket just below the strings at the front of the bridge. The Hex Pickups are used only during Touch Up, OST and Calibration and have no effect on the sound of the guitar.

**Highlight**—Flashing. While navigating the menu structure and enabling certain actions, the Arrow buttons are used to highlight the desired selection before pressing the SEL button to enable that selection. Whatever is flashing on the LCD is the Highlighted selection.

**INS**—Insert. This Pushbutton pastes the tuning held in the clipboard over any selected tuning in the User Library.

**Intonation**—String length compensation. The point of proper intonation brings the string(s) into tune along the full length of the fret board.

**Key**—One Pushbutton. See Pushbuttons.

**Keypad**—See Pushbuttons.

**LCD**—Liquid Crystal Display.

**Limit Switch**—The switch located at the exact motor position of zero (Position 0) for each string on the guitar. During a Nut Adjust, when each Arm touches this switch the computer recognizes it and adjusts accordingly.

**Lithium Battery**—The battery on the computer board. This lithium battery prevents the computer from losing memory when the system is powered down (turned off). To prevent memory loss, this battery should be replaced every 2 years.

**Lock Nut**—Located just above the nut on the headstock, the Lock Nut prevents the strings from slipping through the nut as the system tightens and loosens the strings.

**Lock Nut Keepers**—The three rectangular shaped tabs that clamp down to hold the strings as you tighten the screws in the Lock Nut.

**Machine Heads**—Often called Tuning Pegs. The machine heads, located on the headstock of the guitar, are used to install and manually tune the strings.

**Mechanical Device**—The CAT system component that functions as the tailpiece and bridge of the guitar and executes all adjustments to string tension while operating the system.

**Nut**—The part of the guitar that begins the play length of the strings at the headstock end of the neck. Six slots, one for each string, are filed into the nut.

**Nut Adjust**—The process the CAT uses to bring the physical forces in the Mechanical Device and the forces created by the tension of the strings into balance. Nut Adjust achieves the correct balance between the position of the Arms (motors) and the manual tuning of the guitar (tension of the strings) to enable the Mechanical Device to run its entire range and be accurate within that range.

**Operating Range**—The highest and lowest notes possible on each string, plus or minus any temperament.

**OST**—On Screen Tuner. This Pushbutton enables the On Screen Tuner which reads and displays the tuning of each string simultaneously on the LCD. On Screen Tuner is also a part of the Nut Adjust process.

**Partial Capo**—A capo installed across some, but not all strings at a particular fret.

**Power Supply**—A 12 Volt power supply that plugs into your wall outlet is used to power the system and allow Footswitch operation.

**Prompt**—A message, instruction, or question displayed on the LCD that informs the user about current status of the system or alerts the user to execute some function.

**Pushbuttons**—Also called buttons, keys, or keypad. All features in the CAT are accessed and enabled with the pushbuttons. Pushbuttons are located in the face of the guitar above the rhythm pickup.

**Range**—See Operating Range.

**Reboot**—Reset the computer system. In the CAT, turning power off and then back on again reboots the system.

**Rhythm Pickup**—The audio pickup in the guitar closest to the neck.

**Rom Cal**—The process the CAT uses to reinitialize the calibration equations.

**Scroll**—To use the many features in the CAT, the up, down, and sideways Arrow pushbuttons are used to move or scroll through the menu structure to highlight a desired selection.

**SEL**—Select. This Pushbutton enters whatever menu item is highlighted, and once in a particular menu, enables whatever function that is highlighted on the LCD. SEL also represents a “yes” answer to questions displayed on the LCD, selects its respective tuning while in a Tuning Window, and freezes the screens during the startup process.

**Smart Bridge™**—The patented, multiple stringed instrument tuning technology used in the CAT that enables the CAT to change tunings, touch up, read and display tunings, etc.

**Speed of Tuning Change**—The rate of change from one tuning to another.

**Standard Tuning**—The E,A,D,G,B,E tuning considered standard for guitars. From the sixth string to the first string, notes are: E 2, A 2, D 3, G 3, B 3, E 4 in standard A-440 pitch.

**Startup**—First powering up (turning on) the system.

**Startup Screens**—When first powering up (turning on) the system, the LCD displays information about the computer hardware and software, and string gages the system is set up to run before proceeding to the Main Menu.

**String Gage**—The size(s) of the string(s) in diameter.

**String Rollers**—The part of the Mechanical Device located within each Arm at its pivot point about 1 inch from the ball of the string. The balls of each string anchor in the socket at the end of their respective Arms, come up over the String Rollers, and proceed to the bridge.

**Tailpiece**—The part of the guitar that anchors the ball end of the strings toward the heel of the guitar. In the CAT the Arms serve as the tailpiece.

**TCH**—Touch Up. This button executes the Touch Up function which listens to and corrects the tuning that the system is currently in.

**Temper**—To adjust the pitch of (a note) or tune (an instrument) according to some temperament. See temperament.

**Temperament**—A system of adjustment of the intervals between the tones of an instrument of fixed

intonation: it may be *pure temperament*, in which the intervals are set exactly according to theory, or *equal temperament*, as in a piano, in which the pitch of the tones is slightly adjusted to make them suitable for all keys.

**Thumb Adjusters**—The height adjustable screws that the bridge is mounted on.

**Treble Pickup**—The audio pickup in the guitar closest to the bridge.

**Truss Rod**—The part of the guitar neck used to set the amount of bow along the length of the neck.

**Tune Arm**—See Arms.

**Tuning Change Speed**—The rate of change from one tuning to another. In the CAT, Full Speed is the fastest speed, and Custom Speed is used to adjust the speed to something slower than Full Speed.

**Tuning Menu**—A grouping of six tunings in the User Library and Chord Library. The User Library consists of 40 Tuning Menus that can be customized and individually named, and the Chord Library consists of 24 Tuning Menus that are permanent memory. Each Tuning Menu has its own corresponding Tuning Window where the six tunings in the Tuning Menu are accessed. See Tuning Window.

**Tuning Window**—The part of the CAT's menu structure where all tunings are accessed. Each Tuning Window belongs to its own corresponding Tuning Menu and is accessed by selecting that Tuning Menu. See Tuning Menu.

**User Library**—One of the two main groups of tunings in the CAT. The User Library has 240 tunings in 40 groupings of 6 related tunings. The User Library is completely programmable and is where the user creates and uses his or her own customized tunings.

**Well-Temper**—Stretch temper. In well-tempered tuning, technically each note is slightly out of tune, but the notes sound good to the ear in all keys. See Temperament.

**Window**—See Tuning Window.

**Wrapping**—The ability of the highlighted cell to scroll through the menu structure without boundaries.