

# **peterson**

## **Strobe Center™ 5000 II Strobe Tuner**

### **Instruction Manual**

Revised 4-00 for Software Revision 1.05

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# TABLE OF CONTENTS

INTRODUCTION .....	Page 1
EASY TO USE GUIDE FOR BASIC EQUAL TEMPERAMENT TUNING .....	Page 1
SUMMARY OF FEATURES AND FRONT PANEL CONTROLS .....	Page 2
STEP-BY-STEP INSTRUCTIONS FOR USING THE Strobe Center 5000 .....	Page 4
1. EQUAL TEMPERAMENT TUNING .....	Page 4
2. ENHANCING THE VISIBILITY OF THE STROBE PATTERNS .....	Page 4
3. TUNING TO A PITCH STANDARD OTHER THAN A=440 .....	Page 7
4. TUNING INSTRUMENTS THAT PLAY IN OTHER THAN THE KEY OF “C” .....	Page 8
5. CUSTOMIZING THE START-UP MEMORY SETTINGS .....	Page 8
6. CHECKING INTONATION WITH THE SC-5000 .....	Page 9
7. ENHANCED RESOLUTION OF INTONATION MEASUREMENTS .....	Page 10
8. ON-STAGE TUNING USING THE SC-5000 DURING A PERFORMANCE .....	Page 11
9. TUNING FOR NON-EQUAL TEMPERAMENTS .....	Page 11
10. SETTING AND USING CUSTOM NON-EQUAL TEMPERAMENTS .....	Page 15
11. COPYING AND MODIFYING (OR DELETING) AN EXISTING TEMPERAMENT FILE .....	Page 19
12. STRETCH SCALE TUNINGS FOR PIANOS AND SLIGHTLY INHARMONIC INSTRUMENTS ...	Page 22
13. CREATING CUSTOM STRETCH TUNINGS .....	Page 26
14. COPYING AND MODIFYING (OR DELETING) AN EXISTING STRETCH FILE .....	Page 32
APPENDIX A: TEMPERAMENT FILL-IN FORM .....	Page 36
APPENDIX B: STRETCH FILL-IN FORM .....	Page 37
APPENDIX C: STRETCH FILE DATA AND CHARTS .....	Page 38
INDEX .....	Page 46



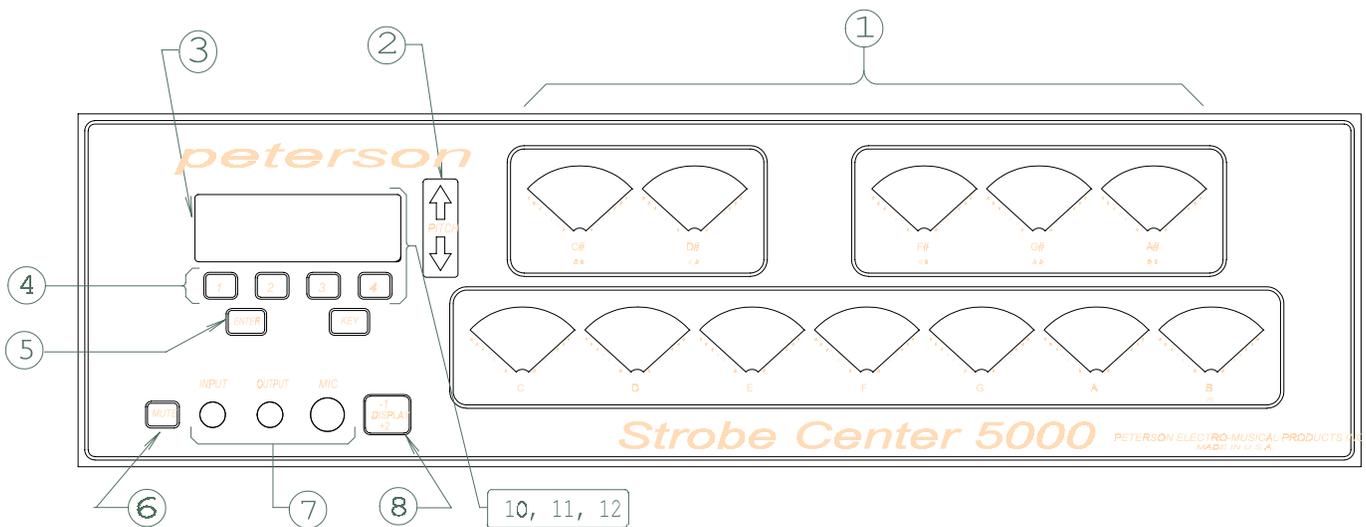
The built-in microphone will pick up an instrument from across a relatively quiet room. However, if you are working in a noisy environment it may be helpful to use an external microphone to be more selective and point the microphone directly at the instrument you wish to tune. At this point you simply play the note you wish to tune.

Each of the 12 tuning wheels is marked with a note corresponding to the chromatic scale. The tuning wheel that matches the note sounded will glow brightly, and a dark pattern will appear on the wheel. When this pattern appears to be stationary, the note is perfectly in tune with the equal-tempered scale derived from middle A at 440 Hertz (cycles per second). When the pattern appears to rotate to the right, the note being played is sharp. Conversely, if the note is flat the pattern will appear to rotate to the left. The faster the pattern appears to be moving, the farther out of tune the note is. Observe that the pattern will appear to move more slowly as your instrument is brought more closely into tune, and that it will appear to stop moving when the sounded note is exactly in tune.

## SUMMARY OF FEATURES AND FRONT PANEL CONTROLS

We'll begin with a brief description of the basic features plus the front panel controls and indicators of the Strobe Center 5000. This will provide you with a quick reference guide to the front panel of the tuner. Detailed information about each control is explained later in the section titled "Step-by-Step Instructions".

### FRONT PANEL



- 1. IMPROVED ACCURACY AND STABILITY WITH QUIET OPERATION, 12 SEPARATE MOTORS** - An internal quartz crystal reference provides absolute stability to the tuning accuracy. No warm up period is required unless the tuner has been subjected to extreme temperatures, either hot or cold. In this instance allow the tuner to sit at room temperature for about ten minutes before starting. The tuner is accurate to within 1/10 of 1 cent throughout the entire range of the instrument. Each of the twelve strobe tuning discs is driven by an individual, electronically-controlled motor. All twelve motor controllers receive their commands from the microprocessor or "brains" of the tuning center. Gear box noises previously experienced with 12-wheel tuners are entirely eliminated. Separate motors also allow the versatility of both multiple temperaments and stretch tuning with the Strobe Center 5000.

2. **PITCH UP / PITCH DOWN arrows** - Precision digital Vernier Control permits you to sharpen or flatten the pitch of the SC-5000 to measure the correctness of your own intonation with an accuracy of 1/1000 of a semitone. You can adjust the tuner sharp or flat over a range of one half semitone (50 cents) each way, with selectable resolution of 1/10, 1/2 or 1 cent increments (1 cent equals 1/100 semitone). If you use this feature to stop a strobe pattern, after the tuner wheel is stationary, the display indicates how many cents sharp or flat the tuner has been adjusted, giving you an exact reading of the difference from correct intonation for each note observed. (These buttons are also used as select buttons under some of the Temperament and Stretch Menu screens.)
3. **EIGHTY-CHARACTER LCD MENU SCREEN** - Simplicity and ease of operation are enhanced by the intuitive and user-friendly menu screen displays which address all the functional features of the tuner.
4. **FOUR MENU-DRIVEN FUNCTION KEY BUTTONS** - These four keys are each defined by the specific menu-screen information for each of the various operational modes of the tuner. They permit great flexibility and simple user interaction with the Strobe Center 5000.
5. **ENTER** - This push button is used to select specific values of Pitch Up or Pitch Down deviations when editing customized temperament and/or stretch tuning files used in specialized tuning applications. It is also used for some of the user selections in the programming menu of the tuner.
6. **MUTE** - The Strobe Center 5000 may be used on-stage during a performance with the external Input patched through to the Output. The Mute Mode disconnects the internal patch through path to permit silent on-stage tuning. The Mute is a toggle function. Press the key once to engage the Mute Mode ("M" will be indicated on the display panel when this feature is activated). Press the key again to restore normal patch through operation.
7. **SELF-CONTAINED MICROPHONE & EXTERNAL PATCH THROUGH INPUT**- The Strobe Center 5000 is equipped with a built-in condenser microphone as a complete self-contained tuning center. The intonation of notes sounded into this microphone will immediately be visible on the corresponding tuning disc. The front panel also includes connectors for an external Input and patch through to Output. The internal microphone is automatically disconnected whenever the external Input is used for an outboard microphone or other electrical input.
8. **DISPLAY +2 / -1** - Improved pattern clarity is achieved for the hard to see lower and upper octaves by pressing this key once or twice. The +2 Mode lifts the bass notes up by two octaves into the middle of the strobe discs for easier readability. Similarly, the -1 Mode drops the treble notes down one octave on the strobe wheels. Combining this feature with both Advanced Image Clarifier filtering and automated contrast adjustment makes the Strobe Center 5000 very easy to use.
9. **KEY** - Selectable key signature is used to change the Strobe Center 5000 to the key in which your instrument is tuned. You no longer have to transpose your note to the key of C. Press this button once, twice, or three times to adjust the tuner between the keys of C, B=, F, and E=. Sound your note and the tuner will show your intonation on the tuning disc corresponding to the note you are playing.
10. **USER SELECTABLE PITCH** - The International Standard Pitch of A=440 Hertz (cycles per second) can be raised or lowered to any tuning frequency you desire. The adjustment range for Middle A (A4) is from A=350 Hz to A=550 Hz. This modified standard pitch can be memorized in the Strobe Center 5000 so that the tuner starts up calibrated for the selected pitch of your preference. The pitch currently selected for "A" is displayed by the LCD indicator screen.
11. **SELECTABLE TEMPERAMENTS** - The microprocessor circuitry allows you to choose the equal tempered scale or one from a list of seven preprogrammed non-equally tempered tunings. You may program and save personal custom temperaments by entering the tempered values for each of the twelve notes in the chromatic scale in 1/10 of 1 cent increments. The current temperament in use is shown in the LCD display panel whenever it is different from the equal tempered scale.
12. **STRETCH TUNING FROM STANDARD OR CUSTOM TABLES** - The Strobe Center 5000 has 8 built-in stretch

tables for tuning pianos or other slightly inharmonic instruments. You may also enter your own preferred stretch configuration. You may then save this information into memory. The chosen stretch configuration in use is displayed on the LCD display screen whenever Stretch Mode is engaged.

## STEP-BY-STEP INSTRUCTIONS FOR USING THE Strobe Center 5000

### 1. EQUAL TEMPERAMENT TUNING

- a. Check the back of the Strobe Center 5000 to verify that the AC Input Switch is set to the correct position of 110 Volts AC or 220 Volts AC. Connect the line cord to the AC input receptacle.
- b. After confirming the setting of the AC Input Switch and attaching the Line Cord to your AC power source, move the power switch located on the back of the tuner to the ON (up) position. The Strobe Center 5000 will take approximately 5 seconds to perform a self-check during the power-up cycle. During this self-diagnostic interval, the display panel will indicate:

**PETERSON  
MODEL SC 5000 TUNER  
REV #XXXX  
SERIAL #XXXXXXXXXX**

- 
- c. At the conclusion of the power-up tests, all twelve tuning wheels will begin rotating and will flicker slightly in response to random sounds in the room. The display panel will change to the normal Run Mode screen:

**KEY=C  
A=440                      00 ¢  
HI  
SETUP IMAG**

When the power is first turned on, the Strobe Center 5000 defaults to the equally tempered chromatic scale based on middle A at 440 Hertz (cycles per second). Each of the 12 wheels is computer controlled to indicate whether a note played into the microphone is sharp or flat from the correct pitch by means of dark markings which create a pattern which appears to move either in a clockwise or counterclockwise direction. Counterclockwise movement of the pattern indicates that the note is flat, while clockwise movement indicates that the note is sharp. The pattern appears to move more slowly as the note is brought closer into tune and it appears to be stationary when the note is in tune.

- d. Use the built-in microphone on the front of the Strobe Center 5000, or you may connect an external microphone or other direct input to the external Input connector on the front panel. The internal microphone is disconnected whenever the external Input is used.
- e. Each of the 12 tuning wheels is identified with its corresponding note in the chromatic scale. In a relatively quiet room, play the note to be tuned, and it will be picked up by the internal microphone. When using an external microphone, it may be placed as close as a few inches from the musical instrument in order to pick up the maximum volume of the tone being produced.

### 2. ENHANCING THE VISIBILITY OF THE STROBE PATTERNS

At times when playing in the lower or upper musical registers, you may want to make the strobe patterns more distinct. The Strobe Center 5000 is equipped with an adjustment to enhance the visibility of the strobe patterns. The Image Clarifier is

always active and is set to either Low or High, corresponding to the lower or upper musical registers. Although the SC-5000 II contains imaging improvements which yield good results even for low frequency sounds when in the factory-default “HI” setting, the strobe patterns for very low notes can be further clarified by changing to the “LOW” setting. This is now a one button function.

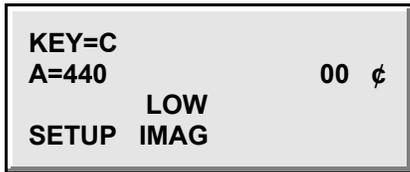
a. ADJUSTING THE IMAGE CLARIFIER



Key #1 calls up the Setup Menu.  
Key #2 toggles the current Image Clarifier setting shown on the third line of the LCD screen.



Pressing Key #2 “IMAG” will toggle the current clarifier setting which is always shown on the third line of the LCD screen immediately above the “IMAG” label on the RUN screen:

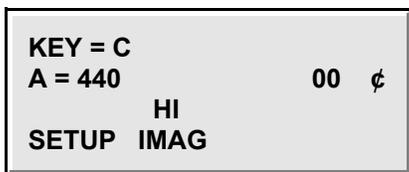


Function Key #2 will toggle the Image Clarifier setting.

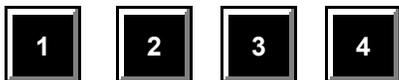


The tuner will continue to operate normally while you are making adjustments to these image enhancements thus enabling you to view the effect of the changes you are making. Pressing Key #2 again will toggle the current IMAG status back to “HI” once again. This can be repeated indefinitely. *NOTE: The adjustments you make from this screen will only stay in this particular setting while you are using the tuner until you turn off the tuner’s power switch. To change the Image Clarifier default setting (the way it will be set on power-up), use the following method.*

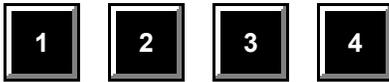
b. SETTING THE DEFAULT (POWER-UP) ADJUSTMENTS OF THE IMAGE CLARIFIER



Key #1 calls up the Setup Menu.  
Key #2 toggles the current Image Clarifier setting shown on the third line of the LCD screen.



- i. From the Run Mode screen press Key #1 to bring up the Setup Menu.



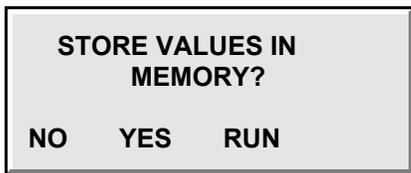
Key #1 will call up additional option menus.  
Key #2 will bring you to the temperament and stretch file choice menu.  
Key #3 will return the tuner to the Run Mode  
Key #4 will call up factory diagnostics.

- ii. Press the #1 key which is labeled OPTN (meaning Options) and you will first see a screen for recalibrating the tuner to a different pitch standard. From this new screen press the #1 key again (labeled NEXT) to bring up the menu for adjusting the Image Clarifier:



Key #1 brings up the next choice of Image setting.  
Key #2 returns tuner to Run Mode.  
Key #3 when pressed will set Image Clarifier to Low.  
Key #4 when pressed will set Image Clarifier to High.  
The present setting is shown in (NOW - XXX).

Press the #3 function key to set the Image Clarifier to Low or key #4 to set it to High. After you have chosen the desired Low or High register, your choice will show in the "NOW - XXX" portion of the window. The tuner again continues to operate in the normal Run Mode when you are setting the Image Clarifier so that you may observe the difference in the clarity of the pattern while you make these adjustments. Pressing the #1 key will advance to the next screen which allows you to store the last selected Concert A, Image Clarifier, +2/-1 Display, and Key settings into the power-up memory:



Key #1 returns to SETUP menu without storing defaults.  
Key #2 stores new defaults and returns to SETUP menu.  
Key #3 returns to Run screen without storing defaults.

### c. USING DISPLAY +2 / -1 FOR ENHANCED VISIBILITY

The Display +2 Mode is used when tuning extremely low bass notes. Press the Display button once and all strobe patterns are shifted up exactly two octave bands on the strobe disc. With the tuner in the Display +2 Mode, all twelve tuning discs are now slowed down exactly two octaves, so that the strobe patterns on the tuning wheels are correspondingly shifted upward exactly two bands on each wheel into the easier to read middle bands or registers on the strobe discs.

Similarly for extremely high treble notes, Display -1 mode shifts all strobe patterns down exactly one octave. The

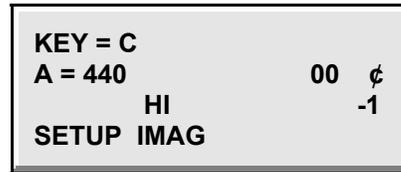
rotational speed of each strobe disc is doubled beyond the normal tuning speed. The dark tuning indications are then shifted downward by one octave into the middle region of the tuning wheels. When in the Display +2 mode, press the Display key one more time and the tuner wheels are shifted to the -1 mode.

Press the Display key one more time to return the Strobe Center 5000 back to the normal speed tuning mode. The Display modes will follow this sequence as the Display button is pressed repeatedly: Normal display mode, Display +2 mode, Display -1 mode, Normal display mode, etc. When in Display +2 or Display -1 modes, the indicator panel will show the Display status:



**Display for +2 Mode**

OR



**Display for -1 Mode**

NOTE - The Display +2 / -1 button is only active in the Run Mode, with the Run Mode screen showing as above.

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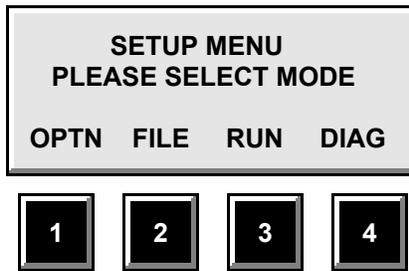
### 3. TUNING TO A PITCH STANDARD OTHER THAN A=440

The International Standard pitch of A=440 Hertz (cycles per second) can be raised or lowered to any tuning frequency you desire within a broad range. This range of adjustment for middle A (A4) is from A = 350 Hz to A = 550 Hz. This modified standard pitch can be memorized in the Strobe Center 5000 so that the tuner powers-up calibrated for the selected pitch. The currently selected pitch for "A" is displayed by the LCD indicator screen.

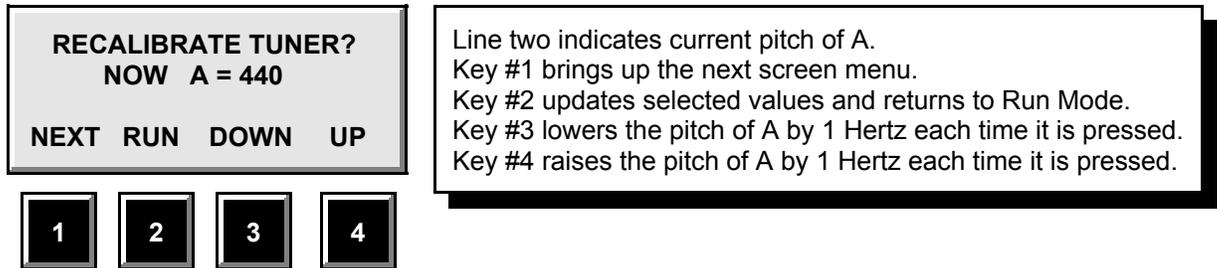
- a. To change the pitch standard of the tuner use the following procedure. After the tuner has gone through the power-up self-check it will then display the Run Mode screen with the standards you have previously chosen. New from the factory the tuner is set to power-up on equal temperament at A=440Hz. This is shown on the second line of the screen below as A=440:



- 
- b. From the Run Mode menu above, press key #1 (SETUP) to call up the Setup Menu shown next.



- c. Press key #1 OPTN (Option) once, and the tuner will display the screen for pitch recalibration:

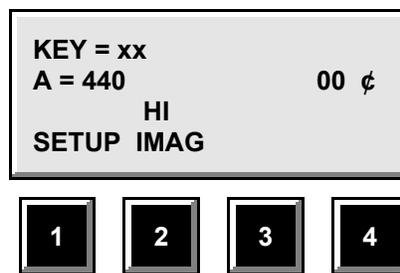


- d. Press key #3 to lower the pitch by 1 Hertz. Key #4 will raise the pitch in increments of 1 Hertz. You can press and hold either button and the tuner will automatically step down to A=350 or up to A=550. Once the pitch is at the desired frequency, press key #2 labeled RUN to return the tuner to the normal Run Mode screen. If you choose the #1 function key labeled NEXT, you can proceed through the Image Clarifier and Store Memory screens before returning to the Run Mode menu screen. Once you have returned to the Run Mode screen, notice that the display will be changed to show the new pitch standard you have entered.

#### 4. TUNING INSTRUMENTS THAT PLAY IN OTHER THAN THE KEY OF "C"

The Strobe Center 5000 solves one of the biggest difficulties of wind players, and other non-"C" instrument musicians when using a precision tuner. Mental transposition of your note into the key of "C" is no longer required. The tuner can be easily shifted to show the correct note being played for all instruments in C, B=, F, and E=.

When the Strobe Center 5000 is displaying the normal Run Mode screen, simply press the front panel button labeled "KEY". Press this button once, twice, or three times to cycle the tuner between the musical instrument tuning keys of C, B=, F, and E=. The pitch of the twelve tuning motors will change as the speed of each tuning disc is internally transposed to the new tuning key. Sound your note and the tuning will show up on the corresponding tuning wheel. The key signature selected will be shown in the upper left hand corner of the Run Mode screen.



## 5. CUSTOMIZING THE START-UP MEMORY SETTINGS

If you desire the Strobe Center 5000 to always start-up in a different pitch standard than A=440, to a key other than "C" (band directors may desire B=, for example), or with different settings of the Image Clarifier and +2/-1 DISPLAY controls, it is easy to do.

- a. In the Run Mode menu, make the adjustment to the key you desire by pressing the KEY button as just described. Choose the display mode you desire of NORMAL, +2, or -1 by pressing the DISPLAY +2 / -1 button as described previously.
- b. Press the #1 function key to call up the Setup menu. Then press the #1 function key three more times (sequencing through the #1 function key labels of OPTN {OPTION}, NEXT, and NEXT) to go through the screens of RECALIBRATE TUNER?, and SET IMAGE CLARIFIER. As you proceed through each of these menus, check that the settings are those you desire for the start-up memory values. You may adjust these values as needed until you reach the menu screen:

<b>STORE VALUES IN MEMORY?</b>			
<b>NO</b>	<b>YES</b>	<b>RUN</b>	
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

Key #1 returns to the Setup menu.  
 Key #2 saves new values and returns to the Setup menu.  
 Key #3 returns to Run Mode and uses new values.  
 (new value are not put into startup memory with #3)

- c. You are now asked if you want to permanently store the choices you have just made into the "STANDARDS" or power-up memory of the tuner. The power-up memory includes the user selection of the pitch frequency chosen for middle A (A4), LOW or HIGH register for the Image Clarifier, the Display Mode (+2, -1, or NORMAL), and the KEY in which your instrument is tuned (C, B=, F, or E=). The #2 key button (YES) will rewrite the power-up memory of the tuner and return you to the Setup menu; key #1 (NO) will simply return you to the Setup menu allowing you to re-sequence through the steps of the Setup menu to verify and/or reset your selections before proceeding with the tuning process. Pressing the #3 key (RUN) will enter the new values you have selected and return you directly to the Run mode; however, *these new values will not be entered into the power-up memory.*

<b>KEY = xx</b>			
<b>A = xxx</b>		<b>00 ¢</b>	
<b>xxx</b>		<b>xx</b>	
<b>SETUP</b>		<b>IMAG</b>	
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

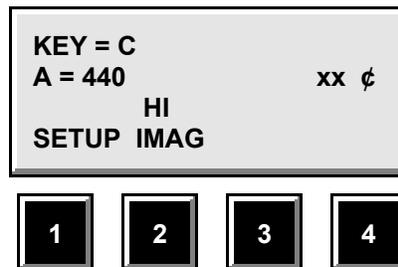
- d. At the Setup menu press key #3 labeled RUN to return to the normal running mode of the tuner. You are now ready to begin tuning with the new parameters you have set.

## 6. CHECKING INTONATION WITH THE SC-5000

When you desire to check your playing intonation, the tuner can assist in a very simple manner. You will need a partner to adjust the pitch of the tuner to match the intonation of the note(s) you are checking.

When checking and adjusting your own intonation, it is useful to use an external microphone. Turn your back to the tuner while playing your note so you don't see the indications on the tuning discs while your partner is making the adjustments. That way you will be less likely to slowly change your intonation at the same time your partner is adjusting the tuner.

- a. Connect an external microphone to the Input connector of the tuner. Set this microphone on a stand so that you can face away from the tuner.
- b. Adjust the tuner to the tuning key of your instrument as detailed in Section 4 above. If necessary, raise or lower the standard tuning pitch of the tuner by following Section 3.
- c. You are now ready to begin. For the remainder of this section we will assume that your instrument is tuned in "C" with a Concert A reference pitch of A = 440 Hertz. The normal Run Mode screen of the tuner will be displayed:



- d. Play your note into the microphone, while your partner watches the strobe windows. While you are sounding your note, your partner will press the PITCH UP and/or PITCH DOWN buttons until the dark markings on the tuning wheel corresponding to your note appear to be stationary. When these markings are stationary the tuner is in-tune with the note you are playing.
- e. The display will show the correctness of your intonation by indicating how many cents sharp or flat your partner adjusted the tuner to match the note as you actually played it. This is presented in the "+" (sharp) or "-" (flat) "XX.X" "¢" (cents) location of the display screen.
- f. Musical tuning is measured by units called cents, representing a 1/100 division of a semitone. There are 1200 cents in each octave, and exactly 100 cents between each half-step note in equal temperament tuning. The SC-5000 is adjustable in a range of 1/2 semitone (+50.0 cents sharp to -50.0 cents flat) from being perfectly in tune (00.0 cents) with the selected temperament and pitch.

## 7. ENHANCED RESOLUTION OF INTONATION MEASUREMENTS

As you continue to practice your intonation with the SC-5000, you will find that your pitch accuracy continually improves. As you find yourself playing more and more closely to perfect intonation, you may desire that your partner adjust the tuner more closely to your pitch. The SC-5000 has tuning accuracy to within 0.1 cent. The tuner may be adjusted to your note within that same accuracy. The tuner always starts with a displayed resolution of 1 cent. This is shown as "00 ¢". When operating in the Run Mode, the tuner can be set for enhanced resolution of either 0.5 cents or 0.1 cents. Press and hold the ENTER key, then press either PITCH UP or PITCH DOWN and the resolution will be changed to 0.5 cents. To further

enhance the resolution to 0.1 cent increments, first release the ENTER key, then press and hold it again while you press either PITCH UP or PITCH DOWN. The display screen always presents enhanced resolution of 0.5 cents and 0.1 cents by showing a decimal point and place: "xx.x ¢".

When the tuner is set for enhanced resolution, the PITCH UP/DOWN buttons increment the tuning adjustments of the tuner in steps of 0.5 cents or 0.1 cents. This permits intonation measurements with an accuracy of 1/1000 semitone.

The resolution of the tuner may be returned to 1 cent resolution by again using the shifted key buttons for PITCH UP/DOWN (press and hold the ENTER KEY while you press either PITCH UP or PITCH DOWN). The tuner resolution cycles through a selection sequence of 1 cent, 0.5 cent, 0.1 cent, 1 cent, etc. Note that the tuner requires you to release the ENTER key between each step of this resolution selection cycle. Then press and hold it again to go to the next step selection.

Other possible uses of the enhanced resolution of 0.5 cent, or 0.1 cent could be for exact measurements of precise partial tone frequencies during the manufacture of percussive musical instruments (for example - bells, chimes, gongs, etc.), or for specific scientific research into the timbral structure of complex sounds and vibrations in the musical and audible frequency spectrum.

## 8. ON-STAGE TUNING USING THE SC-5000 DURING A PERFORMANCE

You can measure your intonation during an on-stage performance by connecting a direct input to the external Input of the tuner. This direct input can be another microphone, a clip-on pick-up, a direct feed from a mixing console, etc. Your intonation precision and that of other performing partners can be visible to you and your performing ensemble as you observe the SC-5000 during the performance. This same external Input may be patched through to the output connector and returned to a mixing console as an extra signal source to the audience reinforcement. The internal microphone is automatically bypassed whenever the external Input is connected to a signal source.

When using the external Input in the patch through mode to the Output connector, you and/or your performing partners may want to tune-up your instruments while the audience is present. The Mute button permits you to execute a silent tuning without disturbing your audience.

The Mute is a toggle function. Press the Mute button once, and the Input to Output patch through signal path connection is interrupted. Press this same Mute button again, and the patch through connection is restored. The activated state for the Mute Mode is indicated by the letter "M" on the regular Run Mode screen below the A = XXX indication as shown here:



## 9. TUNING FOR NON-EQUAL TEMPERAMENTS

Equal temperament divides a musical octave into 12 equal semitones. The distance in pitch between any two neighboring notes is exactly 100 cents (1200 cents making one musical octave). Since approximately 1850, Equal Temperament has been commonly accepted as the standard musical tuning temperament - because any and all musical keys sound "equally" the same and are completely enharmonic. All keys can be "equally" used - thus the name "Equal Temperament".



TEMPERAMENT MENU  
PLEASE SELECT MODE  
START COPY  
-EDIT -DEL RUN STOP



Key #1 is used to Start a TMPR file; also to use and/or edit a new or existing TMPR file.  
Key #2 Copies or Deletes a Custom TMPR file.  
Key #3 returns the tuner to the Run Mode.  
Key #4 Stops an active TMPR or STRCH File.

- d. Press the #1 key labeled START-EDIT to call up the listing of all preprogrammed temperaments, and any custom temperaments you have saved in the memory. The display screen will first show the 8 temperaments preprogrammed into the Strobe Center 5000: The cursor is an underline beneath the first character of any file name. In this first screen it shows as "EQUA", with an underline under the "E" character.

SELECT TMPR =  
EQUA PYTH JUMA MEAN  
WRK3 KRN3 YONG KLNR  
NEW (EDIT) CNCL START



Key #1 begins the process of naming and editing a new temperament file.  
Key #2 is visible only from custom user files, and goes to the Edit sequence for the file name at the cursor.  
Key #3 returns to the TEMPERAMENT MENU.  
Key #4 activates the selected temperament and returns to RUN Mode.

- e. Use the Pitch Down and Pitch Up Keys (Down Arrow - cursor forward and down; and Up Arrow - cursor up and back) to scroll the cursor through the preprogrammed temperaments. When the cursor is on the eighth Name on any page of stored temperaments (in this case YONG), press the Down Arrow key again and the tuner will display the first memory page of your custom temperaments. Similarly, when the cursor is on the first Name of any custom temperaments screen, pressing the Up Arrow key for the Back Cursor will show the previous page of custom or preprogrammed temperaments.

When the cursor is on the temperament memory file you desire, press the #4 function key to load this temperament into the operation buffer of the tuner. The display will then return to the Run Mode screen and indicate the chosen temperament file.

The temperaments listed on the screen above are the eight preprogrammed temperaments shipped with the Strobe Center 5000. These eight temperaments are stored in a non-alterable, non-erasable memory of the tuner. Remembering that there is always a perfect 2/1 frequency ratio (and 1200 Cents) between all octaves, each of the eight Preprogrammed Temperaments are briefly described below:

**EQUA - EQUAL TEMPERAMENT** is the standard tuning scale in which the tuner powers up. There are exactly 100 Cents between each note in the chromatic scale and 1200 Cents in each octave. Equal Temperament has been the standard musical tuning used throughout the world since about 1850.

**PYTH - PYTHAGOREAN TUNING** is the most ancient method of tuning musical instruments in our recorded history of Western music. This tuning was the musical standard for more than 1000 years, until the fourteenth century. It is based on the exact, whole number frequency ratios of 2/1 for octaves, 3/2 for Perfect fifths, and 4/3 for Perfect fourths. The tuning was started with the note E= and proceeded in an ascending circle of Perfect fifths (and descending octaves), ending on the note G<. The interval E= - G< is much too wide to be usable and is known as a "wolf" tone. Major thirds are very wide, and minor thirds are very narrow compared to the Equal Temperament to which we are accustomed. Thus, triads will sound

very different. This may be the reason why music from that era was based mostly on octaves, fifths, and fourths and for which this tuning is said to sound extremely good.

**JUMA - JUST INTONATION (MAJOR PITCH)** was created after musicians discovered the sweet richness of the perfectly aligned harmonic partial tones in the major third whole-number frequency-ratio of 5/4. The tuning uses as many whole number ratio perfect fifths, perfect major thirds, and perfect minor thirds as possible. It sets a scale with 6 perfect major triads and 6 perfect minor triads, while the other 12 musical keys are essentially unusable "wolves". "White" note major keys, with more key signature sharps than flats, and their relative minors are more favored by Just Intonation in Major Pitch.

**MEAN - (1/4 COMMA) MEAN-TONE** is a temperament used to increase the number of usable keys beyond the twelve permissible with either just intonation tuning described above, while retaining the purity of the 5/4 whole-number ratios for the major thirds as much as possible. This temperament creates eight perfect major thirds, with sixteen favorable good keys and eight "wolves". The fifths are all tempered slightly more narrow than in equal temperament.

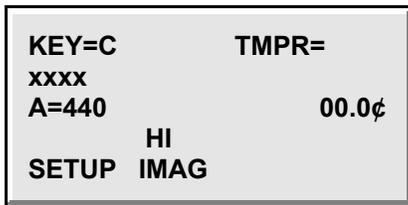
**WRK3 - WERCKMEISTER III** is classified under the category of a "well temperament". Tunings in a "well temperament" allow performance of music in any key. Although some keys sound more favorably close to pure whole number ratio tuning and some keys are more roughly in tune, there are no completely unacceptable "wolf" keys in a "well temperament" tuning. There is a sense of key "color" because the keys with a more favorable tuning are described by some scholars as having a peaceful, restful quality; while those more roughly in tune are characterized as being more active and brilliant in their timbre. Werckmeister III sets most of the major thirds slightly wide, and is a useful method for "well temperament" tuning. It should be used with the warning that one major third (A = C) is much too wide and sounds very out of tune. Keys with few sharps or flats are favored, with C major and A minor being the best. Those keys with many sharps or flats produce a rougher tonality.

**KRN3 - KIRNBERGER III** is another "well temperament" which uses five tempered (narrowed) fifths, the perfect major third of C - E, and a sequence of seven perfect fifths. All keys are usable, yet due to the basis on tempered and perfect fifths, there are only a few good intervals of major or minor thirds. Kirnberger III sounds much different than the equal temperament to which our ears are accustomed. It is probably best for music from the late eighteenth century.

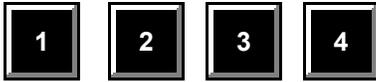
**YONG - THOMAS YOUNG's** temperament is a "well temperament" identical to one discovered by Francescantonio Vallotti. The scale tempers six fifths by narrowing them, while six fifths retain the pure ratio of 3/2. Young started the tuning with the note C, while Vallotti began with the note F. The favorable and less favorable keys get shifted slightly when one modulates from C to F. Of the seven preprogrammed non-equal temperaments available in the tuner, the Young temperament is the closest to Equal Temperament, with some differentiation of color in the various musical keys. Young's choice of starting on C seems to slightly favor some of the more commonly encountered historic keys over starting on F.

**KLNR - KELLNER** is another "well-tempered" scale believed to be that employed by J. S. Bach for "The Well-Tempered Clavier". It is built on the concept of producing equal beat rates in the major third and fifth intervals built on the C key root. It has become an extremely popular temperament because of its excellent balance of tone color among a wide range of keys with minimal "wolf" intervals (only three Pythagorean thirds at Ab, F#, and C#).

- f. Returning to our previous section about selecting a preprogrammed temperament, you have made your choice by moving the cursor to the desired temperament and then pressing the #4 function key (SLCT) to select the temperament. The tuner has modified the operating parameters buffer to the new Temperament values and returned you to the Run Mode screen. The display indicates the temperament you have chosen, and also shows Enhanced Resolution of the tuner:



The selected temperament is shown by "xxxx". Resolution is Enhanced to 0.1 Cent Steps.

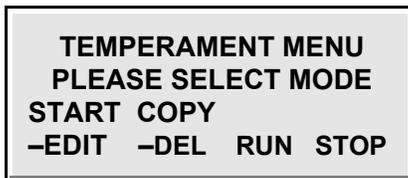


The resolution may later be changed back to 1 cent, or 0.5 cent increments. Internal accuracy of the Temperament is always maintained to the precise 0.1 Cent values which have been stored in the memory file. When exiting the Temperament Menu, the tuner indicates the Enhanced Resolution to denote the accuracy with which the temperament values are being used by the tuning motor controllers.

**NOTE :** The SC-5000 tuner powers-up in equal temperament. During the power-up sequence the EQUA file (with the values for equal temperament) is input to the operating parameters of the tuner with the full precision of 0.1 Cent Resolution. Accuracy of the strobe discs is always correct to 0.1 Cents, even when the displayed resolution shows Pitch Up/Down increments of 1 Cent, or 0.5 Cent. The tuner always powers-up with resolution set to 1 Cent increments.

## 10. SETTING AND USING CUSTOM NON-EQUAL TEMPERAMENTS

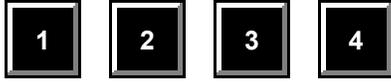
- a. To make and save a new Custom Temperament, it is first necessary to assign a new name to the tempered scale values you plan to enter. You may also copy an existing TMPR file to a new name and modify it from there. From the Run mode screen, press the #1 SETUP, #2 FILE, and #1 TMPR (Temperament) function key buttons to call up the Temperament Menu:



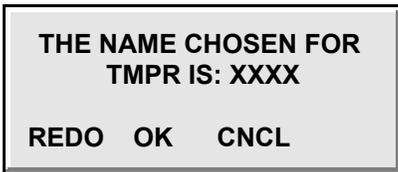
- b. Press the Start/Edit (#1) function key to see the list of preprogrammed TMPR files, then press the NEW (#1) Function key to open and save a new custom temperament file. The following Pick Name screen will be displayed:



Key #1 shifts the cursor Left by one space.  
 Key #2 shifts the cursor Right by one space.  
 Key #3 backspaces and deletes one character in the name.  
 Key #4 cancels the New file name and returns to the Temperament Menu.



- c. Scroll through the letters and numbers using the #1 and #2 function keys as the Left Cursor and Right Cursor respectively. Move the cursor to the corresponding letter, space (directly following digit "9"), or number in the 4-character NAME of your new Custom Temperament. Press the Enter key to select the desired character at the cursor location. Press the #3 BKSP (Backspace) function key to delete the previous character you have just entered. The #4 function key is used to cancel the newly opened file and returns you to the Temperament Menu. Once the fourth letter or number of the name has been selected, the display screen will permit you to confirm the file name you have chosen:

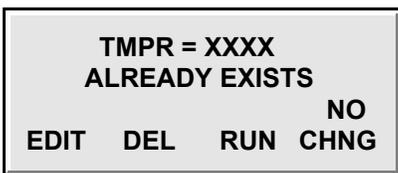


Key #1 returns to the previous screen.  
 Key #2 advances to the next screen.  
 Key #3 cancels the New file name and returns to the Temperament Menu.



- d. If the characters were entered incorrectly, you can press the #1 function button and re-enter the name of the custom temperament. You may choose to Cancel the entry of a new temperament and to return to the Temperament Menu. To Cancel, press the function key #3. Any existing temperament or stretch files will be stopped as the tuner returns to the normal RUN Mode screen.

Press the #2 function key to edit the scale values for the temperament file name you have selected. The tuner will first check its memory to see if the name you have selected has already been used. A warning screen will appear if the name has been previously stored in the custom user memory:



Key #1 proceeds to the Editing sequence.  
 Key #2 permits DELetion of old TMPR file.  
 Key #3 returns the tuner to the Run Mode, using no TMPR or STRCH files.  
 Key #4 returns to the Temperament Menu screen.



- e. Use the #3 function button to return the tuner to the Run Mode using no temperament or stretch files. When you choose to go back and enter a different name for the custom temperament, press the #4 Function key to return to

the Temperament Menu. You can again press START-EDIT (Function Key #1) in the Temperament Menu and then NEW (Function Key #1) under the SELECT screen to enter a different designator for your custom scale values. You may also choose a different option from the Temperament Menu.

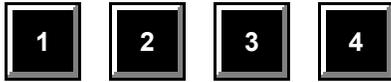
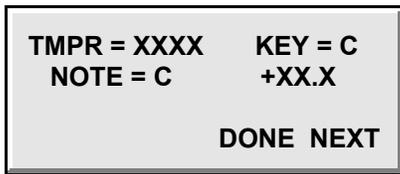
Use the #2 function key when you want to delete the existing custom TMPR file from your custom temperament memory locations.

**NOTE:** Due to a program oversight in this version of software, the DELEte choice will *always* return to the Temperament Menu screen *without* deleting the named file (normal if the name corresponds to a factory pre-programmed file) even if the named file does not conflict with a factory file. However, you may still delete the appropriate previously-programmed user file under COPY-DEL (Function Key #2) of the Temperament Menu.

- f. To Edit the temperament which already exists (on screen: TMPR= XXXX ALREADY EXISTS), use the #1 function key. The tuner will advance to the Edit TMPR sequence. In the Edit TMPR sequence, the offsets for each note are updated and/or rewritten into the tuner memory as each note value is entered. *The existing temperament value for each note is overwritten as you enter each new value!* Use the Copy procedure to make a duplicate of a useful existing temperament with a different name, and then edit the newly-made copy of the TMPR file.
- g. Similarly, if you have confirmed that the selected name (on the screen - THE NAME CHOSEN FOR TMPR IS: XXXX) is OK, by pressing the #2 Function button and the memory check determines that the selected name does not already exist, the tuner immediately opens a new TMPR file with the name you have selected. The screen advances to the Edit TMPR sequence.

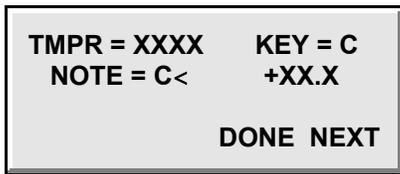
In the unlikely event that the memory of the tuner is full, you will see an error message of “MEMORY IS FULL - PLEASE DELETE A TMPR OR STRCH FILE”. The tuner memory capacity is 255 custom TMPR files, or 31 custom STRCH files, or a mixture of both custom TMPR and custom STRCH files. If you see this message display, it will be necessary to delete one or more custom TMPR or STRCH files in order to enter your new file. Before deleting one of these useful files, you will probably want to write down the specific values for every tempered and/or stretched note in the file. In Appendix A and Appendix B of this instruction manual, you will find blank tables for your hard copy entry of custom temperament files and custom stretch files (with permission to photocopy these pages). Use the Edit TMPR or Edit STRCH sequence to examine the specific values for each note in the TMPR or STRCH file you plan to delete. Do not alter any value as you transfer this information to your hard copy paper record. After you have documented the details of your file it is then safe to delete it and make room for more custom files.

- h. In the Edit TMPR sequence, the temperament value for each note (in Cents deviation from the Equal Tempered Scale) is input using the Pitch Up and Pitch Down buttons on the tuner front panel. Entering the selection for each note overwrites that value into the memory location for that specific note in the TMPR file. The tuner starts with C and proceeds in an increasing sequence through all twelve notes of the chromatic scale, ending on B. The first screen display is:
-



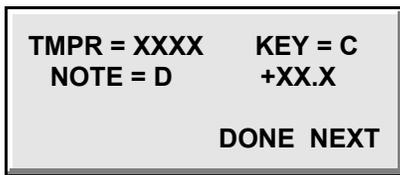
Use the Pitch Up and/or the Pitch Down control to adjust the number of Cents deviation from the Equal Temperament tuning for the note C. You may enter this value with a precision of 1/10 of 1 Cent. Press the ENTER button on the tuner front panel or Function Key #4 (NEXT) when the displayed temperament value for the note C is correct. The display will increment the note to C#:

---



Use the Pitch Up and/or the Pitch Down control to adjust the number of Cents deviation from the Equal Temperament tuning for the note C#. You may enter this value with a precision of 1/10 of 1 Cent. Press the ENTER button on the tuner front panel or Function Key #4 (NEXT) when the displayed temperament value for the note C# is correct. The display will increment the note to D:

---



Use the Pitch Up and/or the Pitch Down control to adjust the number of Cents deviation from the Equal Temperament tuning for the note D. You may enter this value with a precision of 1/10 of 1 Cent. Press the ENTER button on the tuner front panel or Function Key #4 (NEXT) when the displayed temperament value for the note D is correct. The display will increment the note to D#.

The same procedure will be continued sequentially through the notes E, F, F<, G, G<, A, and A<, until the screen increments to the note B:

**TMPR = XXXX    KEY = C**  
**NOTE = B        +XX.X**  
  
**DONE NEXT**



Use the Pitch Up and/or the Pitch Down control to adjust the number of Cents deviation from the Equal Temperament tuning for the note B. You may enter this value with a precision of 1/10 of 1 Cent. Press either the ENTER button on the tuner front panel or Function Key #3 (DONE) or Function Key #4 (NEXT) when the displayed temperament value for the note B is correct. The display screen will now change to:

**TMPR = XXXX**  
**SETTINGS**  
**COMPLETE - PRESS**  
**ENTER TO CONTINUE**



- i. Press the Enter button on the tuner front panel. All custom temperament note values are now saved to the "XXXX" TMPR file. The tuner returns to the normal RUN screen with the edited temperament file now active:

**KEY=C            TMPR=**  
**xxxx**  
**A=440            00.0¢**  
  
**HI**  
**SETUP IMAG**

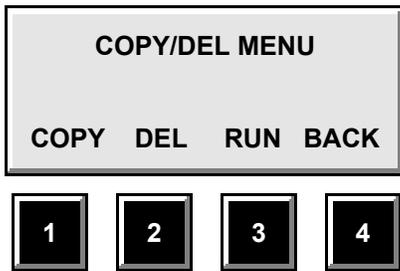


The selected temperament is shown by "xxxx". Resolution is Enhanced to 0.1 Cent Steps.

## 11. COPYING AND MODIFYING (OR DELETING) AN EXISTING TEMPERAMENT FILE

Although this is a subset of the material above, proper explanation of the COPY/DELETE procedures calls for an independent description. Sometimes it is easier and faster to copy and modify an existing TMPR file than to create a whole new one. Particularly with Custom Non-Equal Temperaments, there may just be two or three sharps which, for example, get raised to the pitch level of their non-enharmonic flats (this is the sole difference between the Minor Mode of Just Intonation and the Major Mode tuning preprogrammed into the non-volatile memory).

- a. Use the #2 Function Key in the Temperament Menu to call up the Copy/Delete Menu:



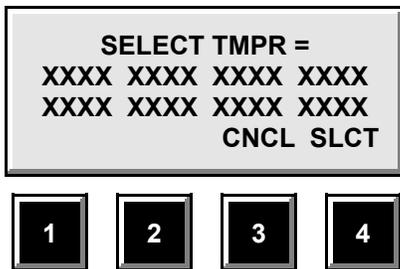
Key #1 copies a custom TMPR file to a new name.  
 Key #2 deletes a custom TMPR file from memory.  
 Key #3 returns the tuner to the Run Mode using standard EQUAL-TEMPERED tuning values.  
 Key #4 returns the tuner to the TEMPERAMENT Menu.

Use the #3 function key to exit the temperament menu sequence. The tuner will return to the Run Mode using standard equal-tempered tuning.

Use the #4 function key to return to the Temperament Menu screen when you desire to follow a procedure different from the COPY/DELETE menu. The Temperament Menu will again appear and allow you to reselect your desired option.

b. Deleting a custom temperament file

If you have received a MEMORY IS FULL... error message, and you have already documented some presently unused custom TMPR files, you can Delete them by first pressing the #2 function key. After you press the DELete key, the tuner will display a listing of all the custom TMPR files:



Key #3 returns to the Temperament Menu with no changes.  
 Key #4 selects TMPR file to delete from memory.

Use the Pitch Down and Pitch Up Keys (Down Arrow - cursor forward and down; and Up Arrow - cursor up and back) to scroll the cursor through the user-programmed temperaments. When the cursor is on the eighth name on any page of stored temperaments, press the Down Arrow key again and the tuner will display the next memory page of your custom temperaments. Similarly, when the cursor is on the first Name of any custom temperaments screen, pressing the Up Arrow key will show the previous page of custom (or preprogrammed) temperaments.

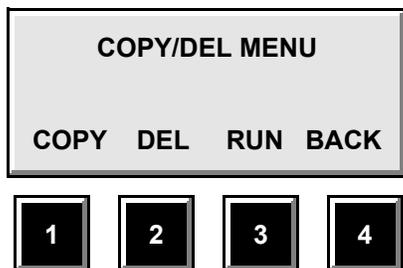
When the cursor is on the temperament memory file you desire to delete, press the #4 function key (SLCT). The tuner will always ask for confirmation of file deletion before executing your request:



Key #1 deletes file and returns to TMPR Menu.  
 Key #2 returns to the Temperament Menu.

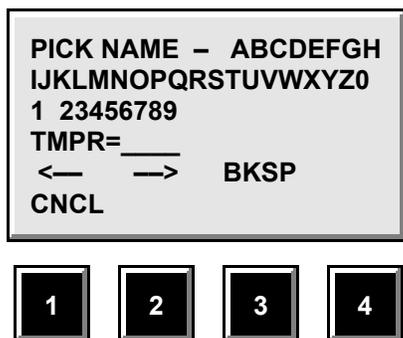
Choose the #2 function key to return directly to the Temperament Menu without deleting the selected custom TMPR file. Use the #1 function key to Delete the selected custom TMPR file. After deleting the file, the tuner returns to the Temperament Menu.

c. COPYING AN EXISTING CUSTOM TEMPERAMENT FILE TO A NEW NAME



Key #1 copies a custom TMPR file to a new name.  
 Key #2 deletes a custom TMPR file from memory.  
 Key #3 returns the tuner to the Run Mode using standard EQUAL-TEMPERED tuning values.  
 Key #4 returns the tuner to the TEMPERAMENT Menu.

Use the #1 function key to Copy an existing TMPR file to a new custom TMPR file with a new name. When the Copy function key is pressed, the screen first asks for a new name to which the existing TMPR file will be copied:



Key #1 shifts the cursor Left by one space.  
 Key #2 shifts the cursor Right by one space.  
 Key #3 backspaces and deletes one character in the name.  
 Key #4 cancels the New file name and returns to the Temperament Menu.

Scroll through the letters and numbers using the #1 and #2 Function keys as the Left Arrow and Right Arrow respectively. Press the #3 function key to reenter the previous letter or number in the 4-space name of your new custom temperament. Press the #4 function key to return to the COPY/DEL menu screen.

When the fourth letter or number of the name has been selected, the tuner will first check its memory to see if the name you have selected has already been used. A warning screen will appear if the name has been previously used by another custom TMPR file:



Key #1 returns to the PICK NAME sequence.  
 Key #2 permits DELetion of old TMPR file.  
 Key #3 returns the tuner to the Run Mode, using standard EQUAL-TEMPERED tuning values.

Use the #3 function key to return the tuner to the Run Mode using standard equal-tempered tuning. The #1 function button returns you to the Name Selection screen, permitting you to make a different choice. Use the #2 function key when you want

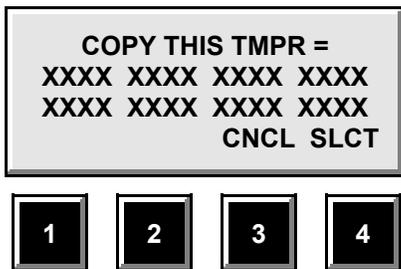
to DELEte the previously used TMPR file name from your custom temperament memory locations. Whenever you choose to Delete a custom TMPR file, the tuner will request confirmation of the file deletion before performing the erasure:



Key #1 deletes file and returns to TMPR Menu.  
Key #2 returns to the Temperament Menu.

Choose the #2 function key to return directly to the Temperament Menu without deleting the selected TMPR file or copying a file. Use the #1 function key to Delete the selected custom TMPR file. After deleting the file, the tuner returns to the Temperament Menu.

If, instead, a valid name for the new temperament file had been created, the display screen will change to:

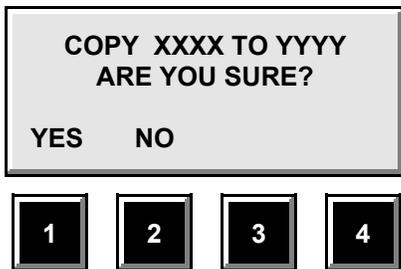


Key #3 returns to the Temperament Menu with no changes.  
Key #4 selects TMPR file in memory to copy from.

Use the #3 function key to return the tuner to the Temperament Menu screen with no copy file created.

Use the Pitch Down and Pitch Up Keys (Down Arrow - cursor forward and down; and Up Arrow - cursor up and back) to scroll the cursor through the programmed temperaments. When the cursor is on the eighth Name on any page of stored temperaments, press the Down Arrow key again and the tuner will display the next memory page of your custom temperaments. Similarly, when the cursor is on the first Name of any custom temperaments screen, pressing the Up Arrow key will show the previous page of custom or preprogrammed temperaments.

When the cursor is on the temperament memory file you desire, press the #4 function key to select that temperament into the operation buffer of the tuner. The display will then proceed to a confirmation screen:



Key #1 copies file and proceeds to the EDIT screen.  
Key #2 returns to the Temperament Menu.

Use function key #2 to return to the Temperament Menu without creating a copy of the existing temperament file. Choose the #1 function key to copy the existing TMPR file to the newly named file and store it in memory. You will then be transferred to the EDIT screen so as to immediately alter the newly-made copy file or, if you choose, exit with no changes to the note offsets of the file and return to the RUN screen with the newly-made file now activated.

## 12. STRETCH SCALE TUNINGS FOR PIANOS AND SLIGHTLY INHARMONIC INSTRUMENTS

“Stretch” refers to specific adjustments in the frequencies (itches) of notes—both within octaves and over multiple octaves—to enhance the overall quality of tuning within an instrument. While such adjustments have traditionally been applied only to the acoustic piano, it has become increasingly popular to exploit this tuning consideration in allied instruments such as the harp, bass, and guitar as well as in percussive instruments such as the xylophone, vibraphone, and steel pan. The need for stretch adjustments arises from the “non-ideal” vibrational mechanisms that are inherent to such instruments. This is not to say that they are *inferior* in some way; on the contrary, it is the *non-ideal* vibrational modes of these instruments that lend unique interest to their tones. Rather, “non-ideal” refers to the fact that these sound vibrations do not precisely follow simple mathematical models that create frequencies of sound at integer ratios to one another. In short, with *no* stretch tuning in these types of instruments, the *overtone* frequencies produced when striking lower-pitched notes do not match the *fundamental* frequencies of notes in higher octaves. This results in a subjective impression of discord even when the fundamental pitches of these notes are completely harmonious with one another!

In order to minimize this disparity, the pitches of notes in lower octaves must generally be made increasingly flat and the pitches of notes in upper octaves made increasingly sharp—hence, the term “stretch”. However, the proper degree of stretching depends on many factors. In a piano, for example, the thickness, tension, and type of construction of the strings as well as the “scale” of the piano all play a role in determining how much stretch should be employed. In reality, no two pianos would ever be properly tuned to the exact same note frequencies throughout.

Moreover, stretch tuning is a highly subjective adjustment which is necessarily a compromise between minimizing overtone beats and maintaining the “cohesiveness” of fundamental pitch. In fact, no two critical listeners (or even *one* listener at two distinct times or locations) would ever truly agree on the “ultimate” tuning of any given piano! Thus, customizing a stretch for a piano based on the vibrations of three or four strings—as at least one tuner manufacturer does—is, in some ways, providing a false sense of security. Even if your piano matches another perfectly at such points (yielding identical stretch curves under such a method), does your piano “break” into wound strings at the same note as the another? Have *each* of your strings really aged *uniformly* and in the *exact* same way as those on another piano? Seems unlikely, doesn’t it?!

Is there *no hope*! Are we destined to mire in a sea of cacophony!! Not really. True, there is no possibility of *mathematical* perfection in the tuning of a piano, but, after all, this is not why pianos exist. A piano is a wonderful tool for creating sounds that please the human ear and soul. The piano technician’s goal then is to maximize the playing and listening pleasure of his clients. A reasonable compromise (or at least a good starting point) for tuning pianos and related instruments is to employ stretch tuning to match those factors which have the greatest impact on the perception of pleasing pitch and harmony. For pianos, these factors are, overwhelmingly, the type (upright or grand) and scale (string lengths) of a given instrument. The SC-5000 II addresses this need by supplying a number of preset stretch profiles which correspond to the range of instruments most piano technicians will likely ever encounter.

The FILE (temperament or stretch) menus are accessed under the SETUP screen. Thus, the first step when starting from the normal RUN screen is to press the “1” button to enter SETUP:

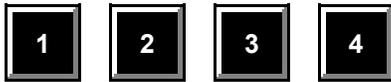
To access the Stretch Tuning functions on the Strobe Center 5000, we begin from the Run Mode screen:



```

SELECT STRETCH=
CNGD STGD AVRG SMGD
UPRT VERT CNSL SPNT
NEW (EDIT) CNCL START

```



Key #1 begins the process of naming and editing a new stretch file.  
 Key #2 is visible only from custom user files, and goes to the Edit sequence for the File name at the cursor.  
 Key #3 returns to the STRETCH MENU.  
 Key #4 activates the selected stretch and returns to RUN Mode.

- e. The screen shown above would be the first “page” of the list of preprogrammed stretch charts and custom stretch charts. Use the PITCH UP arrow and PITCH DOWN arrow buttons to the right of the screen to scroll the cursor through the preprogrammed stretch files. When the cursor is on the eighth name (right side of second row) on any page of stored stretch files, press the PITCH DOWN arrow button again and the tuner will display the next page of custom stretch files (if any). Similarly, when the cursor is on the first name (left side of first row) on any screen of custom stretch files, pressing the PITCH UP arrow button will show the previous page of custom or preprogrammed stretch files.

When the cursor is on the stretch memory file you desire, press the #4 Function key to select this stretch file. The tuner will then return to the RUN Mode screen and will be updated to operate using the stretch you have selected.

```

KEY=C      STRCH= xxxx
A=440      00.0¢
           HI   OCT= 4
SETUP IMAG OCT- OCT+

```



The stretch file selected is shown in the upper right hand corner of the screen as STRCH = xxxx. Resolution is shown on the second line as 00.0 ¢. This indicates it is enhanced to be in 0.1 cent steps.

- f. The tuner activates the new stretch file and returns you to the RUN Mode screen. The display indicates the stretch file you have selected, and also shows enhanced resolution of the tuner. The resolution may later be changed back to 1 cent, or 0.5 cent increments. Internal accuracy of the stretch file is always maintained to the precise 0.1 cent values which have been stored in the memory file. When exiting the Stretch Menu, the tuner indicates the enhanced resolution to denote the accuracy with which the stretch file values are being used by the tuning motor controllers.

**NOTE:** The SC-5000 Tuner powers-up in Equal Temperament and with no stretch. During the power-up sequence the EQUA Tmpr file (with the values for Equal Temperament) is input to the operating parameters of the tuner. All deviation values are set to 00.0 cents (no stretch) - with the full precision of 0.1 cent resolution. Accuracy of the strobe discs is always correct to 0.1 cents, even when the global cent offset is displayed in increments of 1 cent, or 0.5 cent. The power-up memory is set to start the tuner with the global cent offset in increments of 1 cent because this is the most easily used mode of the tuner.

Whenever a stretch file is active under the RUN screen, an indication of the current octave (OCT) of scale note settings that the unit is referencing from that stretch file is displayed on the third line of the LCD display. The current octave is never automatically sensed but is chosen at the discretion of the user by pressing buttons "3" or "4" beneath the display. Specifically, button "3" (OCT-) will decrement the octave setting (octave 7 through octave 0). If held continuously, it will continue to decrement the setting shown on screen line 3, wrapping back around from OCT=0 to OCT=7. Conversely, button "4" will increment the octave setting, eventually wrapping from OCT=7 to OCT=0.

## STANDARD STRETCH TUNING FILES

The SC-5000 II comes with 8 non-erasable, unmodifiable stretch profiles. These “piano” stretches vary steadily in order from very minimal (CNGD—Concert Grand) to extreme (SPNT—Spinnet).

**SELECT STRETCH=**  
**CNGD STGD AVRG SMGD**  
**UPRT VERT CNSL SPNT**  
**NEW (EDIT) CNCL START**

A table describing all included stretches is presented below. The piano scale length numbers are given as a rough guide for selecting appropriate tables and refer to the dimensions normally associated with this measurement. Specifically, the vertical pianos are measured from the floor to the highest point on the piano. The grand pianos are measured from the key slip (the piece of wood in front of the keys) to the furthest point back on the piano.

SC-5000 NAME	FULL NAME	DESCRIPTION
CNGD	CONCERT GRAND	Useful for all concert style grand pianos of approximately 8 feet in length or greater. This minimal stretch profile may also be of use on smaller pianos strung with thin piano wire or in situations where the user wishes a greater coherence of fundamental pitch throughout the instrument.
STGD	STUDIO GRAND	Optimal for a 6’ to 7’11” range of grand piano.
AVRG	AVERAGE (all classes)	Taken from optimal settings for vertical and grand pianos of many makes and sizes, this profile will produce a reasonable tuning for non-critical applications. It also provides a good starting point for creating your own stretch profiles.
SMGD	SMALL GRAND	Useful for grand pianos that are 5’10” or smaller in scale.
UPRT	UPRIGHT	Suitable for vertical pianos equal or exceeding 51”.
VERT	VERTICAL	Taken from optimal settings for many makes and sizes of <i>vertical</i> pianos, this profile will produce good results for any vertical-style piano in typical playing environments for such pianos.
CNSL	CONSOLE	Designed for vertical pianos in 39” to 51” range.
SPNT	SPINET	Designed for vertical pianos smaller than 39”, this profile is the most extreme (farthest bass and treble note stretching) of these piano preset stretches.

Although they cannot be edited directly, one may copy any of these permanent stretches into a custom stretch file which can then be viewed or edited further on a note-by-note basis. The SC-5000 II permits up to 31 user-programmable stretches which can be created in this way or “from scratch”.

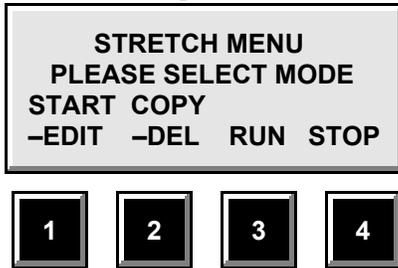
The actual note offset values for each of the piano presets is presented in Appendix C at the back of this document.

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### 13. CREATING CUSTOM STRETCH TUNINGS

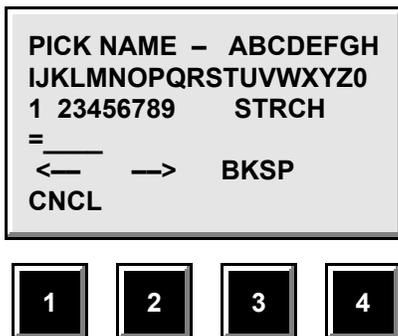
Under stretch tuning, different octave and note frequency relationships may be set to any value desired up to  $\pm 50$  cents offset ( $\frac{1}{2}$  semitone). These custom stretch tuning ratios may be named and saved for future use by the simple touch of a few buttons. Refer to the following procedures which describe Naming, Saving, Editing, Copying, Deleting and Using custom stretch tuning files.

- a. To make and save a new custom stretch file, it is first necessary to assign a new name to the stretched scale values you plan to enter. (You may also copy an existing stretch file to a new name and modify it from there.) From the RUN Mode screen, press the #1 SETUP, #2 FILE, and #2 STRCH function keys to call up the Stretch Menu:



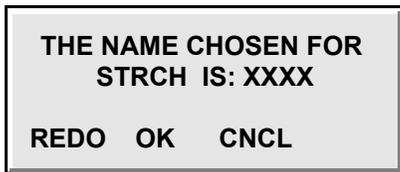
Key #1 is used to Start a stretch file; also to use and/or edit a new or existing stretch file.  
Key #2 Copies or Deletes a Custom stretch file.  
Key #3 returns the tuner to the Run Mode.  
Key #4 Stops an active temperament or stretch file.

- b. Press the START-EDIT (#1) Function key to "name and save" a new custom stretch file. The following will show up in the display:



Key #1 shifts the cursor Left by one space.  
Key #2 shifts the cursor Right by one space.  
Key #3 backspace and deletes one character in the name.  
Key #4 cancels the New file name and returns to the Stretch Menu.

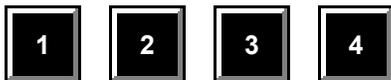
- c. Scroll through the letters and numbers using the #1 and #2 function keys as the Left Cursor and Right Cursor respectively. Move the cursor to the corresponding letter, space (directly following digit "9"), or number in the 4-character NAME of your new Custom Stretch. Press the Enter key to select the desired character at the cursor location. Press the #3 BKSP (Backspace) function key to delete the previous character you have just entered. The #4 function key is used to cancel the newly opened file and returns you to the Stretch Menu. Once the fourth letter or number of the name has been selected, the display screen will permit you to confirm the file name you have chosen:



Key #1 returns to the previous screen.  
Key #2 advances to the next screen.  
Key #3 cancels the New file name and returns to the Stretch Menu.

- d. If the characters were entered incorrectly, you can press the #1 function button and re-enter the name of the custom stretch file. You may choose to Cancel the entry of a new stretch and to return to the Stretch Menu. To Cancel, press the function key #3. Any existing temperament or stretch files will be stopped as the tuner returns to the normal RUN Mode screen.

Press the #2 function key to edit the scale values for the stretch file name you have selected. The tuner will first check its memory to see if the name you have selected has already been used. A warning screen will appear if the name has been previously stored in the custom user memory:



Key #1 proceeds to the Editing sequence.  
Key #2 permits DELEtion of old STRCH file.  
Key #3 returns the tuner to the Run Mode, using no TMPR or STRCH files.  
Key #4 returns to the Stretch Menu screen.

- e. Use the #3 function button to return the tuner to the Run Mode using no temperament or stretch files. When you choose to go back and enter a different name for the custom stretch, press the #4 Function key to return to the Stretch Menu. You can again press START-EDIT (Function Key #1) in the Stretch Menu and then NEW (Function Key #1) under the SELECT screen to enter a different designator for your custom scale values. You may also choose a different option from the Stretch Menu.

Use the #2 function key when you want to delete the existing custom STRCH file from your custom stretch memory locations.

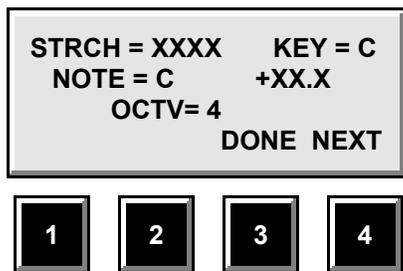
**NOTE:** Due to a program oversight in this version of software, the DELEte choice will *always* return to the Stretch Menu screen *without* deleting the named file (normal if the name corresponds to a factory pre-programmed file) even if the named file does not conflict with a factory file. However, you may still delete the appropriate previously-programmed user file under COPY-DEL (Function Key #2) of the Stretch Menu.

- f. To Edit the stretch which already exists (on screen: STRCH= XXXX ALREADY EXISTS), use the #1 function key. The tuner will advance to the Edit STRCH sequence. In the Edit STRCH sequence, the offsets for each note are updated and/or rewritten into the tuner memory as each note value is entered. *The existing stretch value for each note is overwritten as you enter each new value!* Use the Copy procedure to make a duplicate of a useful existing stretch with a different name, and then edit the newly-made copy of the STRCH file.
- g. Similarly, if you have confirmed that the selected name (on the screen - THE NAME CHOSEN FOR STRCH IS: XXXX) is OK, by pressing the #2 Function button and the memory check determines that the selected name does

not already exist, the tuner immediately opens a new STRCH file with the name you have selected. The screen advances to the Edit STRCH sequence.

In the unlikely event that the memory of the tuner is full, you will see an error message of “MEMORY IS FULL - PLEASE DELETE A TMPR OR STRCH FILE”. The tuner memory capacity is 255 custom TMPR files, or 31 custom STRCH files, or a mixture of both custom TMPR and custom STRCH files. If you see this message display, it will be necessary to delete one or more custom TMPR or STRCH files in order to enter your new file. Before deleting one of these useful files, you will probably want to write down the specific values for every tempered and/or stretched note in the file. In Appendix A and Appendix B of this instruction manual, you will find blank tables for your hard copy entry of custom temperament files and custom stretch files (with permission to photocopy these pages). Use the Edit TMPR or Edit STRCH sequence to examine the specific values for each note in the TMPR or STRCH file you plan to delete. Do not alter any value as you transfer this information to your hard copy paper record. After you have documented the details of your file it is then safe to delete it and make room for more custom files.

- h. In the Edit STRCH sequence, the stretch value for each note (in Cents deviation from the Equal-Tempered Scale) is input using the Pitch Up and Pitch Down buttons on the tuner front panel. Entering the selection for each note overwrites that value into the memory location for that specific note in the STRCH file. The tuner starts with note C in Octave 4 and proceeds in an increasing sequence through all twelve notes of the chromatic scale in Octave 4, ending on B. Then, following a typical piano tuning order, the sequence proceeds through alternating octaves above and below Octave 4, gradually widening to the highest (7) and lowest (0) octaves. The first screen display is:



Key #3 holds values entered - advances screen to save current STRCH tuning values.  
Key #4 enters and holds value - goes to next note.

Use the **PITCH UP** and/or the **PITCH DOWN** Control to adjust the number of cents deviation from standard, Equal Temperament tuning for the note C in Octave 4. You may enter this value with a precision of 1/10 of 1 cent. Whenever you have modified as many Octaves and Note values as you require for your Custom STRCH file, you may exit the Stretch Edit sequence by using the **#3** Function key (DONE) and then the **ENTER** button. The values you have entered will be saved and the tuner will return to the RUN Mode, using the programmed STRCH tuning values. Alternatively, press the **#4** Function key when the displayed Stretch file value for Octave 4, Note C is correct. The display will increment the note to C#.

---

STRCH = XXXX    KEY = C  
 NOTE = C#       +XX.X  
 OCTV= 4  
 DONE NEXT

Key #3 holds values entered - advances screen to save current STRCH tuning values.  
 Key #4 enters and holds value - goes to next note.



Use the **PITCH UP** and/or the **PITCH DOWN** Control to adjust the number of cents deviation from standard, Equal Temperament tuning for the note C# in Octave 4. You may enter this value with a precision of 1/10 of 1 cent. Whenever you have modified as many Octaves and Note values as you require for your Custom STRCH file, you may exit the Stretch Edit sequence by using the #3 Function key (DONE) and then the **ENTER** button. The values you have entered will be saved and the tuner will return to the RUN Mode, using the programmed STRCH tuning values. Alternatively, press the #4 Function key when the displayed Stretch file value for Octave 4, Note C# is correct. The display will increment the note to D.

STRCH = XXXX    KEY = C  
 NOTE = D        +XX.X  
 OCTV= 4  
 DONE NEXT

Key #3 holds values entered - advances screen to save current STRCH tuning values.  
 Key #4 enters and holds value - goes to next note.



Use the **PITCH UP** and/or the **PITCH DOWN** Control to adjust the number of cents deviation from standard, Equal Temperament tuning for the note D in Octave 4. You may enter this value with a precision of 1/10 of 1 cent. Whenever you have modified as many Octaves and Note values as you require for your Custom STRCH file, you may exit the Stretch Edit sequence by using the #3 Function key (DONE) and then the **ENTER** button. The values you have entered will be saved and the tuner will return to the RUN Mode, using the programmed STRCH tuning values. Alternatively, press the #4 Function key when the displayed Stretch file value for Octave 4, Note D is correct. The display will increment the note to D#.

The same procedure will be continued sequentially through the notes E, F, F<, G, G<, A, and A<, until the screen increments to the note B:

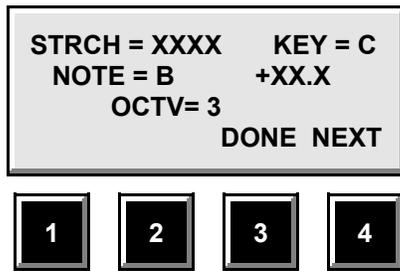
STRCH = XXXX    KEY = C  
 NOTE = B        +XX.X  
 OCTV= 4  
 DONE NEXT

Key #3 holds values entered - advances screen to save current STRCH tuning values.  
 Key #4 enters and holds value - goes to next note.



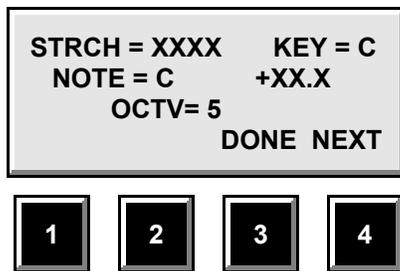
Use the **PITCH UP** and/or the **PITCH DOWN** Control to adjust the number of cents deviation from standard, Equal Temperament tuning for the note B in Octave 4. You may enter this value with a precision of 1/10 of 1 cent. Whenever you have modified as many Octaves and Note values as you require for your Custom STRCH file, you may exit the Stretch Edit sequence by using the #3 Function key (DONE) and then the **ENTER** button. The values you have entered

will be saved and the tuner will return to the RUN Mode, using the programmed STRCH tuning values. Alternatively, press the #4 Function key when the displayed Stretch file value for Octave 4, Note B is correct. With Octave 4 now completed, the display will jump to Octave 3, Note B:



Key #3 holds values entered - advances screen to save current STRCH tuning values.  
Key #4 enters and holds value - goes to next note.

Use the **PITCH UP** and/or the **PITCH DOWN** Control to adjust the number of cents deviation from standard, Equal Temperament tuning for the note B in Octave 3. You may enter this value with a precision of 1/10 of 1 cent. Whenever you have modified as many Octaves and Note values as you require for your Custom STRCH file, you may exit the Stretch Edit sequence by using the #3 Function key (DONE) and then the **ENTER** button. The values you have entered will be saved and the tuner will return to the RUN Mode, using the programmed STRCH tuning values. Alternatively, press the #4 Function key when the displayed Stretch file value for Octave 3, Note B is correct. The display will now decrement the note to Octave 3, Note A#. This process continues through Octave 3 through notes A, G#, G, F#, F, E, D#, D, C#, and C. With Octave 3 now completed, the display will jump to Octave 5, Note C:



Key #3 holds values entered - advances screen to save current STRCH tuning values.  
Key #4 enters and holds value - goes to next note.

Use the **PITCH UP** and/or the **PITCH DOWN** Control to adjust the number of cents deviation from standard, Equal Temperament tuning for the note C in Octave 5. You may enter this value with a precision of 1/10 of 1 cent. Whenever you have modified as many Octaves and Note values as you require for your Custom STRCH file, you may exit the Stretch Edit sequence by using the #3 Function key (DONE) and then the **ENTER** button. The values you have entered will be saved and the tuner will return to the RUN Mode, using the programmed STRCH tuning values. Alternatively, press the #4 Function key when the displayed Stretch file value for Octave 5, Note C is correct. The display will now increment the note to Octave 5, Note C#. This process continues through Octave 5 through notes D, D#, E, F, F#, G, G#, A, A#, and B. With Octave 5 now completed, the display will jump to Octave 2, Note B. This pattern proceeds—decrementing through lower octaves and incrementing through upper octaves—through Octaves 2, 6, 1, 7, and finally Octave 0, Note C:

```

STRCH = XXXX   KEY = C
NOTE = C       +XX.X
OCTV= 0
                DONE NEXT

```

Key #3 holds values entered - advances screen to save current STRCH tuning values.  
Key #4 enters and holds value - advances screen.



Use the **PITCH UP** and/or the **PITCH DOWN** Control to adjust the number of cents deviation from standard, Equal Temperament tuning for the note C in Octave 0. You may enter this value with a precision of 1/10 of 1 cent. Having reached the final note in the editing sequence, pressing either the #3 Function key (DONE) or the #4 Function key when the displayed Stretch file value for Octave 0, Note C is correct will exit this procedure. The screen that follows requests one final button input to actually save all settings for this STRCH File in permanent memory:

```

STRCH = XXXX
SETTINGS
COMPLETE - PRESS
ENTER TO CONTINUE

```



- i. Press the Enter button on the tuner front panel. All custom stretch note values are now saved to the "XXXX" STRCH file. The tuner returns to the normal RUN screen with the edited stretch file now active:

```

KEY=C          STRCH= xxxx
A=440          00.0¢
                HI   OCT= 4
SETUP  IMAG  OCT- OCT+

```

The stretch file selected is shown in the upper right hand corner of the screen as STRCH = xxxx. Resolution is shown on the second line as 00.0 ¢. This indicates it is enhanced to be in 0.1 cent steps.



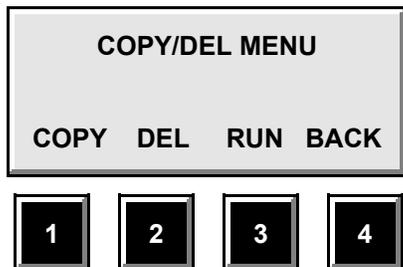
Whenever a stretch file is active under the RUN screen, an indication of the current octave (OCT) of scale note settings that the unit is referencing from that stretch file is displayed on the third line of the LCD display. The current octave is never automatically sensed but is chosen at the discretion of the user by pressing buttons "3" or "4" beneath the display. Specifically, button "3" (OCT-) will decrement the octave setting (octave 7 through octave 0). If held continuously, it will continue to decrement the setting shown on screen line 3, wrapping back around from OCT=0 to OCT=7. Conversely, button "4" will increment the octave setting, eventually wrapping from OCT=7 to OCT=0.

#### 14. COPYING AND MODIFYING (OR DELETING) AN EXISTING STRETCH FILE

Although this is a subset of the material above, proper explanation of the COPY/DELETE procedures calls for an independent description. Sometimes it is easier and faster to copy and modify an existing stretch file than to create a whole

new one. Particularly with Custom Stretch files, there may just be one or two Octaves which get slightly modified in the revised Custom STRCH file.

- a. Use the #2 Function Key in the Stretch Menu to call up the Copy/Delete Menu:



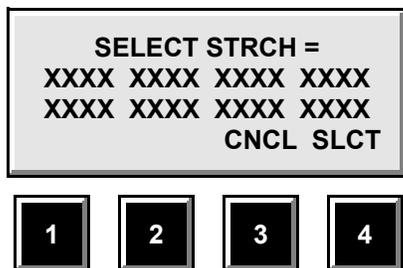
Key #1 copies a custom STRCH file to a new name.  
Key #2 deletes a custom STRCH file from memory.  
Key #3 returns the tuner to the Run Mode using standard unstretched tuning values.  
Key #4 returns the tuner to the STRETCH Menu.

Use the #3 function key to exit the stretch menu sequence. The tuner will return to the Run Mode using standard unstretched tuning.

Use the #4 function key to return to the Stretch Menu screen when you desire to follow a procedure different from the COPY/DELETE menu. The Stretch Menu will again appear and allow you to reselect your desired option.

- b. Deleting a custom stretch file

If you have received a MEMORY IS FULL... error message, and you have already documented some presently unused custom STRCH files, you can delete them by first pressing the #2 function key. After you press the DELeTe key, the tuner will display a listing of all the custom STRCH files:



Key #3 returns to the Stretch Menu with no changes.  
Key #4 selects STRCH file to delete from memory.

Use the Pitch Down and Pitch Up Keys (Down Arrow - cursor forward and down; and Up Arrow - cursor up and back) to scroll the cursor through the user-programmed stretches. When the cursor is on the eighth name on any page of stored stretches, press the Down Arrow key again and the tuner will display the next memory page of your custom stretches. Similarly, when the cursor is on the first Name of any custom stretch screen, pressing the Up Arrow key will show the previous page of custom (or preprogrammed) stretches.

When the cursor is on the stretch memory file you desire to delete, press the #4 function key (SLCT). The tuner will always ask for confirmation of file deletion before executing your request:

**DELETE STRCH = XXXX  
ARE YOU SURE?**

**YES    NO**

1
2
3
4

Key #1 deletes file and returns to STRETCH Menu.  
Key #2 returns to the STRETCH Menu.

Choose the #2 function key to return directly to the Stretch Menu without deleting the selected custom STRCH file. Use the #1 function key to delete the selected custom STRCH file. After deleting the file, the tuner returns to the Stretch Menu.

c. **COPYING AN EXISTING CUSTOM STRETCH FILE TO A NEW NAME**

**COPY/DEL MENU**

**COPY   DEL   RUN   BACK**

1
2
3
4

Key #1 copies a custom STRCH file to a new name.  
Key #2 deletes a custom STRCH file from memory.  
Key #3 returns the tuner to the Run Mode using standard unstretched tuning values.  
Key #4 returns the tuner to the STRETCH Menu.

Use the #1 function key to Copy an existing STRCH file to a new custom STRCH file with a new name. When the Copy function key is pressed, the screen first asks for a new name to which the existing STRCH file will be copied:

**PICK NAME – ABCDEFGH  
IJKLMNOPQRSTUVWXYZ0  
1 23456789  
STRCH= \_\_\_\_\_  
←                    →    BKSP  
CNCL**

1
2
3
4

Key #1 shifts the cursor Left by one space.  
Key #2 shifts the cursor Right by one space.  
Key #3 backspaces and deletes one character in the name.  
Key #4 cancels the New file name and returns to the Stretch Menu.

Scroll through the letters and numbers using the #1 and #2 Function keys as the Left Arrow and Right Arrow respectively. Press the #3 function key to reenter the previous letter or number in the 4-space name of your new custom stretch. Press the #4 function key to return to the COPY/DEL menu screen.

When the fourth letter or number of the name has been selected, the tuner will first check its memory to see if the name you have selected has already been used. A warning screen will appear if the name has been previously used by another custom STRCH file:

**STRCH = XXXX  
ALREADY EXISTS**  
RE-  
NAME DEL RUN



Key #1 returns to the PICK NAME sequence.  
Key #2 permits DELETion of old STRCH file.  
Key #3 returns the tuner to the Run Mode, using standard unstretched tuning values.

Use the #3 function key to return the tuner to the Run Mode using standard unstretched tuning. The #1 function button returns you to the Name Selection screen, permitting you to make a different choice. Use the #2 function key when you want to DELETE the previously used STRCH file name from your custom stretch memory locations. Whenever you choose to Delete a custom STRCH file, the tuner will request confirmation of the file deletion before performing the erasure:

**DELETE STRCH = XXXX  
ARE YOU SURE?**  
YES NO



Key #1 deletes file and returns to STRCH Menu.  
Key #2 returns to the Stretch Menu.

Choose the #2 function key to return directly to the Stretch Menu without deleting the selected STRCH file or copying a file. Use the #1 function key to Delete the selected custom STRCH file. After deleting the file, the tuner returns to the Stretch Menu.

If, instead, a valid name for the new stretch file had been created, the display screen will change to:

**COPY THIS STRCH =  
XXXX XXXX XXXX XXXX  
XXXX XXXX XXXX XXXX  
CNCL SLCT**



Key #3 returns to the Stretch Menu with no changes.  
Key #4 selects STRCH file in memory to copy from.

Use the #3 function key to return the tuner to the Stretch Menu screen with no copy file created.

Use the Pitch Down and Pitch Up Keys (Down Arrow - cursor forward and down; and Up Arrow - cursor up and back) to scroll the cursor through the programmed stretches. When the cursor is on the eighth Name on any page of stored stretches, press the Down Arrow key again and the tuner will display the next memory page of your custom stretches. Similarly, when the cursor is on the first Name of any custom stretch screen, pressing the Up Arrow key will show the previous page of custom or preprogrammed stretches.

When the cursor is on the stretch memory file you desire, press the #4 function key to select that stretch into the operation buffer of the tuner. The display will then proceed to a confirmation screen:

---

**COPY XXXX TO YYYY  
ARE YOU SURE?**

**YES    NO**

Key #1 copies file and proceeds to the EDIT screen.  
Key #2 returns to the Stretch Menu.

**1    2    3    4**

Use function key #2 to return to the Stretch Menu without creating a copy of the existing stretch file. Choose the #1 function key to copy the existing STRCH file to the newly named file and store it in memory. You will then be transferred to the EDIT screen so as to immediately alter the newly-made copy file or, if you choose, exit with no changes to the note offsets of the file and return to the RUN screen with the newly-made file now activated.

## APPENDIX A: TEMPERAMENT FILL-IN FORM

Temperament Name = \_\_\_\_\_

C	C#	D	D#	E	F	F#	G	G#	A	A#	B

Temperament Name = \_\_\_\_\_

C	C#	D	D#	E	F	F#	G	G#	A	A#	B

Temperament Name = \_\_\_\_\_

C	C#	D	D#	E	F	F#	G	G#	A	A#	B

Temperament Name = \_\_\_\_\_

C	C#	D	D#	E	F	F#	G	G#	A	A#	B

Temperament Name = \_\_\_\_\_

C	C#	D	D#	E	F	F#	G	G#	A	A#	B

Temperament Name = \_\_\_\_\_

C	C#	D	D#	E	F	F#	G	G#	A	A#	B

Temperament Name = \_\_\_\_\_

C	C#	D	D#	E	F	F#	G	G#	A	A#	B

Temperament Name = \_\_\_\_\_

C	C#	D	D#	E	F	F#	G	G#	A	A#	B

## APPENDIX B: STRETCH FILL-IN FORM

Stretch Name = \_\_\_\_\_

OCTV	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
0												
1												
2												
3												
4												
5												
6												
7												

Stretch Name = \_\_\_\_\_

OCTV	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
0												
1												
2												
3												
4												
5												
6												
7												

# APPENDIX C: STRETCH FILE DATA AND CHARTS

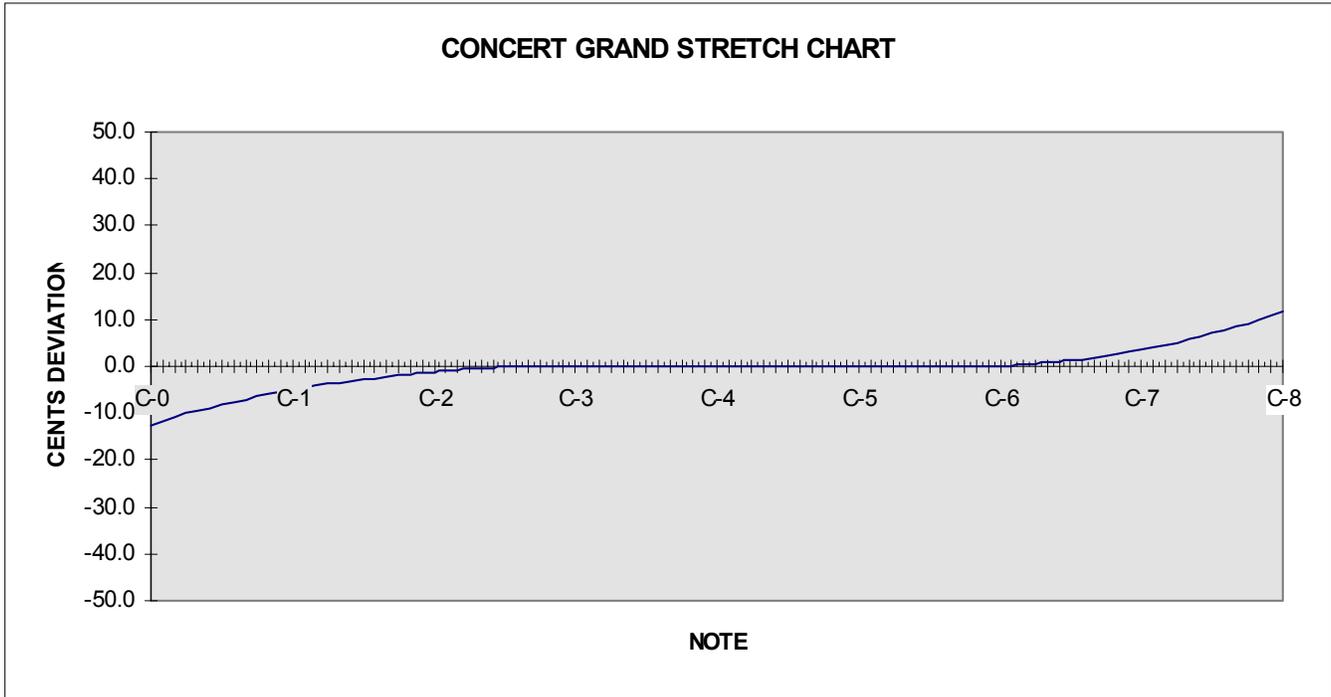
FILE: CNGD

Note No.	Note Name	Cents Deviation
1	C-0	-12.8
2	C#-0	-11.8
3	D-0	-10.9
4	D#-0	-10.1
5	E-0	-9.4
6	F-0	-8.8
7	F#-0	-8.2
8	G-0	-7.6
9	G#-0	-7.0
10	A-0	-6.5
11	A#-0	-6.0
12	B-0	-5.5
13	C-1	-5.0
14	C#-1	-4.6
15	D-1	-4.2
16	D#-1	-3.8
17	E-1	-3.4
18	F-1	-3.1
19	F#-1	-2.8
20	G-1	-2.5
21	G#-1	-2.2
22	A-1	-1.9
23	A#-1	-1.6
24	B-1	-1.4

Note No.	Note Name	Cents Deviation
25	C-2	-1.2
26	C#-2	-1.0
27	D-2	-0.8
28	D#-2	-0.6
29	E-2	-0.4
30	F-2	-0.3
31	F#-2	-0.2
32	G-2	-0.1
33	G#-2	0.0
34	A-2	0.0
35	A#-2	0.0
36	B-2	0.0
37	C-3	0.0
38	C#-3	0.0
39	D-3	0.0
40	D#-3	0.0
41	E-3	0.0
42	F-3	0.0
43	F#-3	0.0
44	G-3	0.0
45	G#-3	0.0
46	A-3	0.0
47	A#-3	0.0
48	B-3	0.0

Note No.	Note Name	Cents Deviation
49	C-4	0.0
50	C#-4	0.0
51	D-4	0.0
52	D#-4	0.0
53	E-4	0.0
54	F-4	0.0
55	F#-4	0.0
56	G-4	0.0
57	G#-4	0.0
58	A-4	0.0
59	A#-4	0.0
60	B-4	0.0
61	C-5	0.0
62	C#-5	0.0
63	D-5	0.0
64	D#-5	0.0
65	E-5	0.0
66	F-5	0.0
67	F#-5	0.0
68	G-5	0.0
69	G#-5	0.0
70	A-5	0.0
71	A#-5	0.0
72	B-5	0.0

Note No.	Note Name	Cents Deviation
73	C-6	0.1
74	C#-6	0.2
75	D-6	0.3
76	D#-6	0.5
77	E-6	0.7
78	F-6	0.9
79	F#-6	1.2
80	G-6	1.5
81	G#-6	1.8
82	A-6	2.2
83	A#-6	2.6
84	B-6	3.0
85	C-7	3.5
86	C#-7	4.0
87	D-7	4.5
88	D#-7	5.1
89	E-7	5.7
90	F-7	6.3
91	F#-7	7.0
92	G-7	7.7
93	G#-7	8.4
94	A-7	9.2
95	A#-7	10.0
96	B-7	10.9



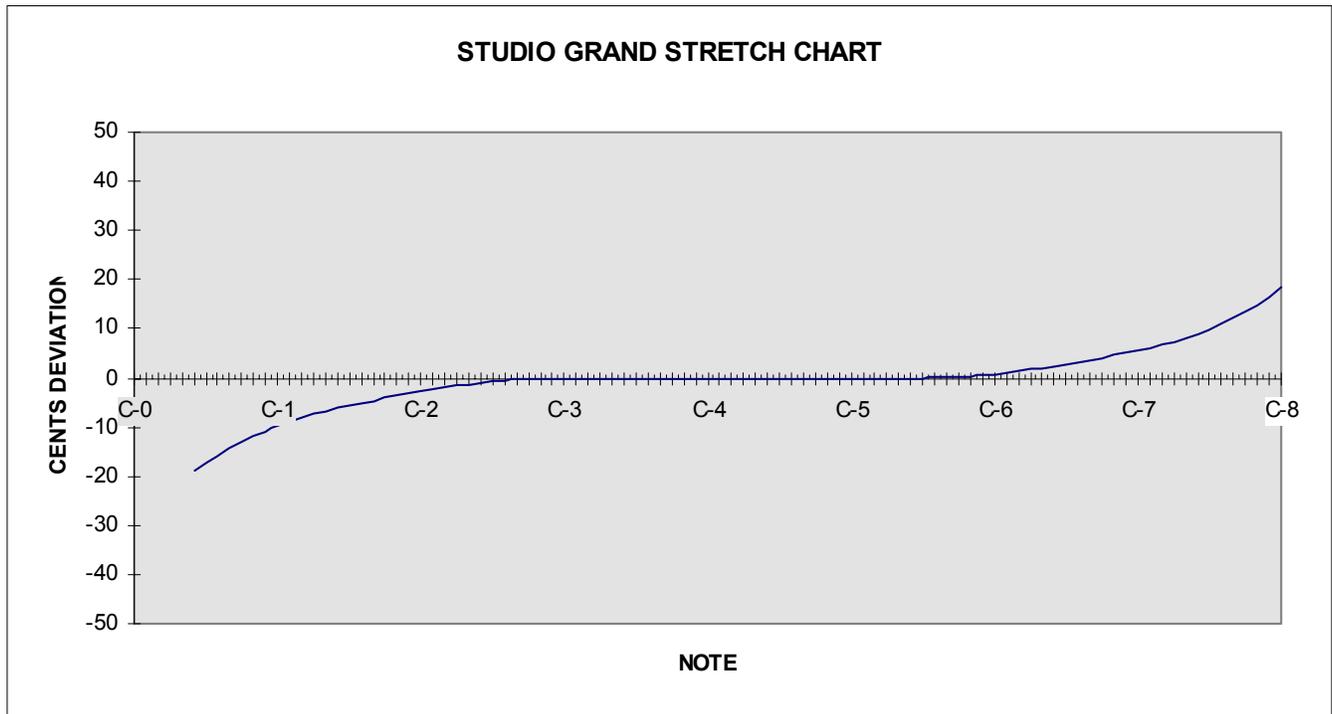
FILE: STGD

Note No.	Note Name	Cents Deviation
1	C-0	-28.3
2	C#-0	-26.3
3	D-0	-24.3
4	D#-0	-22.4
5	E-0	-20.6
6	F-0	-18.9
7	F#-0	-17.3
8	G-0	-15.8
9	G#-0	-14.4
10	A-0	-13.1
11	A#-0	-11.9
12	B-0	-10.8
13	C-1	-9.8
14	C#-1	-8.9
15	D-1	-8.1
16	D#-1	-7.4
17	E-1	-6.8
18	F-1	-6.2
19	F#-1	-5.6
20	G-1	-5.1
21	G#-1	-4.6
22	A-1	-4.1
23	A#-1	-3.6
24	B-1	-3.2

Note No.	Note Name	Cents Deviation
25	C-2	-2.8
26	C#-2	-2.4
27	D-2	-2.0
28	D#-2	-1.6
29	E-2	-1.4
30	F-2	-1.1
31	F#-2	-0.8
32	G-2	-0.6
33	G#-2	-0.4
34	A-2	-0.3
35	A#-2	-0.2
36	B-2	-0.1
37	C-3	0.0
38	C#-3	0.0
39	D-3	0.0
40	D#-3	0.0
41	E-3	0.0
42	F-3	0.0
43	F#-3	0.0
44	G-3	0.0
45	G#-3	0.0
46	A-3	0.0
47	A#-3	0.0
48	B-3	0.0

Note No.	Note Name	Cents Deviation
49	C-4	0.0
50	C#-4	0.0
51	D-4	0.0
52	D#-4	0.0
53	E-4	0.0
54	F-4	0.0
55	F#-4	0.0
56	G-4	0.0
57	G#-4	0.0
58	A-4	0.0
59	A#-4	0.0
60	B-4	0.0
61	C-5	0.0
62	C#-5	0.0
63	D-5	0.0
64	D#-5	0.0
65	E-5	0.0
66	F-5	0.0
67	F#-5	0.0
68	G-5	0.1
69	G#-5	0.2
70	A-5	0.3
71	A#-5	0.4
72	B-5	0.6

Note No.	Note Name	Cents Deviation
73	C-6	0.8
74	C#-6	1.1
75	D-6	1.4
76	D#-6	1.7
77	E-6	2.0
78	F-6	2.4
79	F#-6	2.8
80	G-6	3.2
81	G#-6	3.6
82	A-6	4.1
83	A#-6	4.6
84	B-6	5.1
85	C-7	5.6
86	C#-7	6.1
87	D-7	6.7
88	D#-7	7.3
89	E-7	8.1
90	F-7	8.9
91	F#-7	9.9
92	G-7	11.0
93	G#-7	12.2
94	A-7	13.5
95	A#-7	14.9
96	B-7	16.5



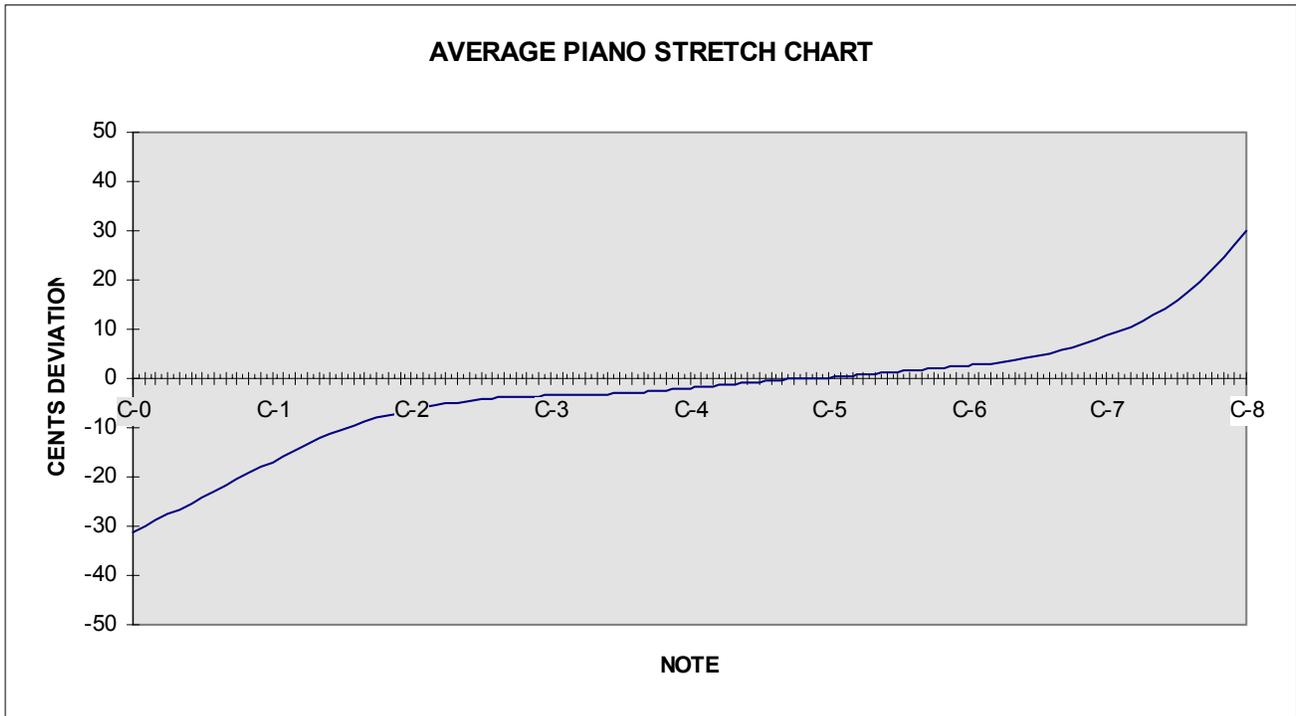
FILE: AVRG

Note No.	Note Name	Cents Deviation
1	C-0	-31.3
2	C#-0	-30.1
3	D-0	-28.9
4	D#-0	-27.7
5	E-0	-26.5
6	F-0	-25.3
7	F#-0	-24.1
8	G-0	-22.9
9	G#-0	-21.7
10	A-0	-20.5
11	A#-0	-19.3
12	B-0	-18.1
13	C-1	-16.9
14	C#-1	-15.7
15	D-1	-14.5
16	D#-1	-13.3
17	E-1	-12.2
18	F-1	-11.2
19	F#-1	-10.3
20	G-1	-9.5
21	G#-1	-8.8
22	A-1	-8.1
23	A#-1	-7.5
24	B-1	-6.9

Note No.	Note Name	Cents Deviation
25	C-2	-6.4
26	C#-2	-5.9
27	D-2	-5.5
28	D#-2	-5.1
29	E-2	-4.8
30	F-2	-4.5
31	F#-2	-4.3
32	G-2	-4.1
33	G#-2	-3.9
34	A-2	-3.8
35	A#-2	-3.7
36	B-2	-3.6
37	C-3	-3.5
38	C#-3	-3.5
39	D-3	-3.5
40	D#-3	-3.4
41	E-3	-3.3
42	F-3	-3.2
43	F#-3	-3.1
44	G-3	-3.0
45	G#-3	-2.8
46	A-3	-2.6
47	A#-3	-2.4
48	B-3	-2.2

Note No.	Note Name	Cents Deviation
49	C-4	-2.0
50	C#-4	-1.8
51	D-4	-1.6
52	D#-4	-1.4
53	E-4	-1.2
54	F-4	-1.0
55	F#-4	-0.8
56	G-4	-0.6
57	G#-4	-0.4
58	A-4	-0.2
59	A#-4	0.0
60	B-4	0.0
61	C-5	0.2
62	C#-5	0.4
63	D-5	0.6
64	D#-5	0.8
65	E-5	1.0
66	F-5	1.2
67	F#-5	1.4
68	G-5	1.6
69	G#-5	1.8
70	A-5	2.0
71	A#-5	2.2
72	B-5	2.4

Note No.	Note Name	Cents Deviation
73	C-6	2.6
74	C#-6	2.8
75	D-6	3.1
76	D#-6	3.4
77	E-6	3.8
78	F-6	4.2
79	F#-6	4.7
80	G-6	5.2
81	G#-6	5.8
82	A-6	6.4
83	A#-6	7.1
84	B-6	7.8
85	C-7	8.6
86	C#-7	9.5
87	D-7	10.5
88	D#-7	11.6
89	E-7	12.8
90	F-7	14.2
91	F#-7	15.8
92	G-7	17.6
93	G#-7	19.6
94	A-7	21.9
95	A#-7	24.5
96	B-7	27.2



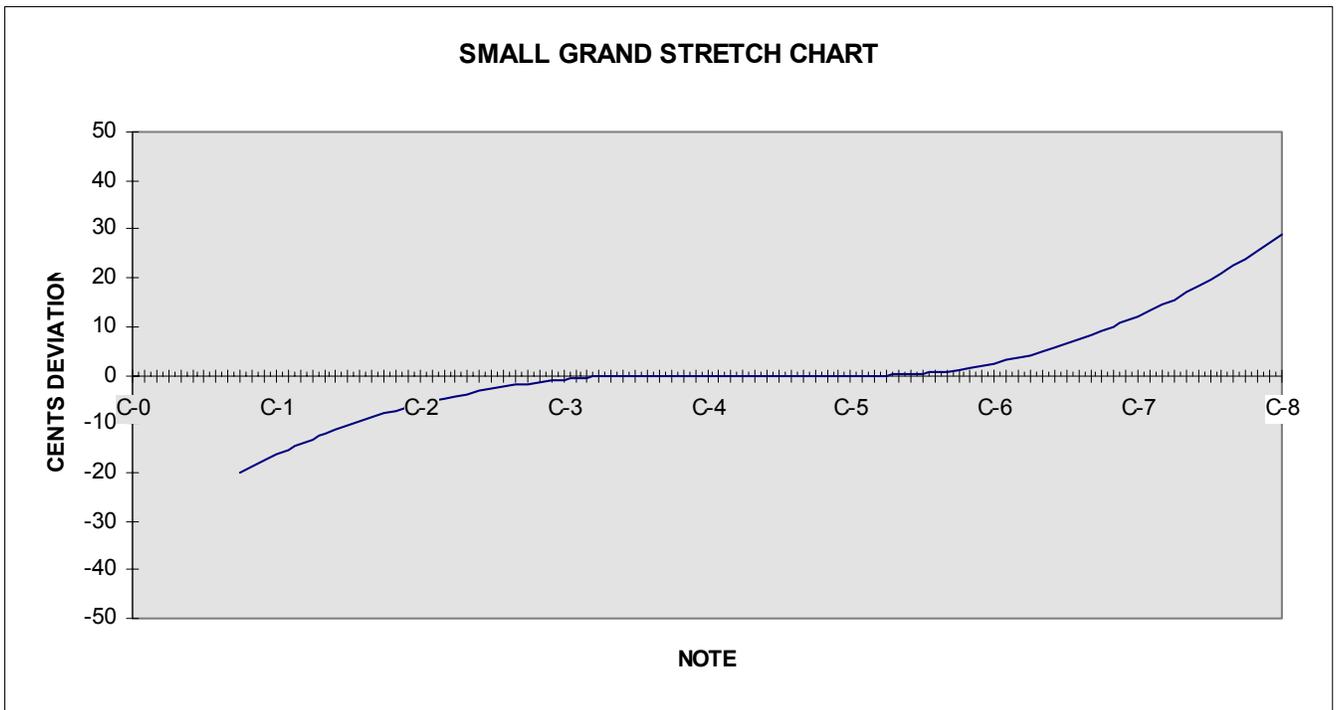
FILE: SMGD

Note No.	Note Name	Cents Deviation
1	C-0	-33.1
2	C#-0	-31.6
3	D-0	-30.1
4	D#-0	-28.6
5	E-0	-27.1
6	F-0	-25.6
7	F#-0	-24.1
8	G-0	-22.7
9	G#-0	-21.3
10	A-0	-20.0
11	A#-0	-18.7
12	B-0	-17.5
13	C-1	-16.3
14	C#-1	-15.2
15	D-1	-14.1
16	D#-1	-13.1
17	E-1	-12.1
18	F-1	-11.2
19	F#-1	-10.3
20	G-1	-9.5
21	G#-1	-8.7
22	A-1	-8.0
23	A#-1	-7.3
24	B-1	-6.6

Note No.	Note Name	Cents Deviation
25	C-2	-6.0
26	C#-2	-5.4
27	D-2	-4.8
28	D#-2	-4.3
29	E-2	-3.8
30	F-2	-3.3
31	F#-2	-2.9
32	G-2	-2.5
33	G#-2	-2.1
34	A-2	-1.8
35	A#-2	-1.5
36	B-2	-1.2
37	C-3	-1.0
38	C#-3	-0.8
39	D-3	-0.6
40	D#-3	-0.4
41	E-3	-0.2
42	F-3	-0.1
43	F#-3	0.0
44	G-3	0.0
45	G#-3	0.0
46	A-3	0.0
47	A#-3	0.0
48	B-3	0.0

Note No.	Note Name	Cents Deviation
49	C-4	0.0
50	C#-4	0.0
51	D-4	0.0
52	D#-4	0.0
53	E-4	0.0
54	F-4	0.0
55	F#-4	0.0
56	G-4	0.0
57	G#-4	0.0
58	A-4	0.0
59	A#-4	0.0
60	B-4	0.0
61	C-5	0.0
62	C#-5	0.0
63	D-5	0.0
64	D#-5	0.0
65	E-5	0.1
66	F-5	0.2
67	F#-5	0.4
68	G-5	0.6
69	G#-5	0.8
70	A-5	1.1
71	A#-5	1.5
72	B-5	2.0

Note No.	Note Name	Cents Deviation
73	C-6	2.5
74	C#-6	3.0
75	D-6	3.6
76	D#-6	4.2
77	E-6	4.9
78	F-6	5.6
79	F#-6	6.4
80	G-6	7.2
81	G#-6	8.1
82	A-6	9.0
83	A#-6	10.0
84	B-6	11.0
85	C-7	12.1
86	C#-7	13.2
87	D-7	14.4
88	D#-7	15.6
89	E-7	16.9
90	F-7	18.2
91	F#-7	19.6
92	G-7	21.0
93	G#-7	22.5
94	A-7	24.0
95	A#-7	25.6
96	B-7	27.2



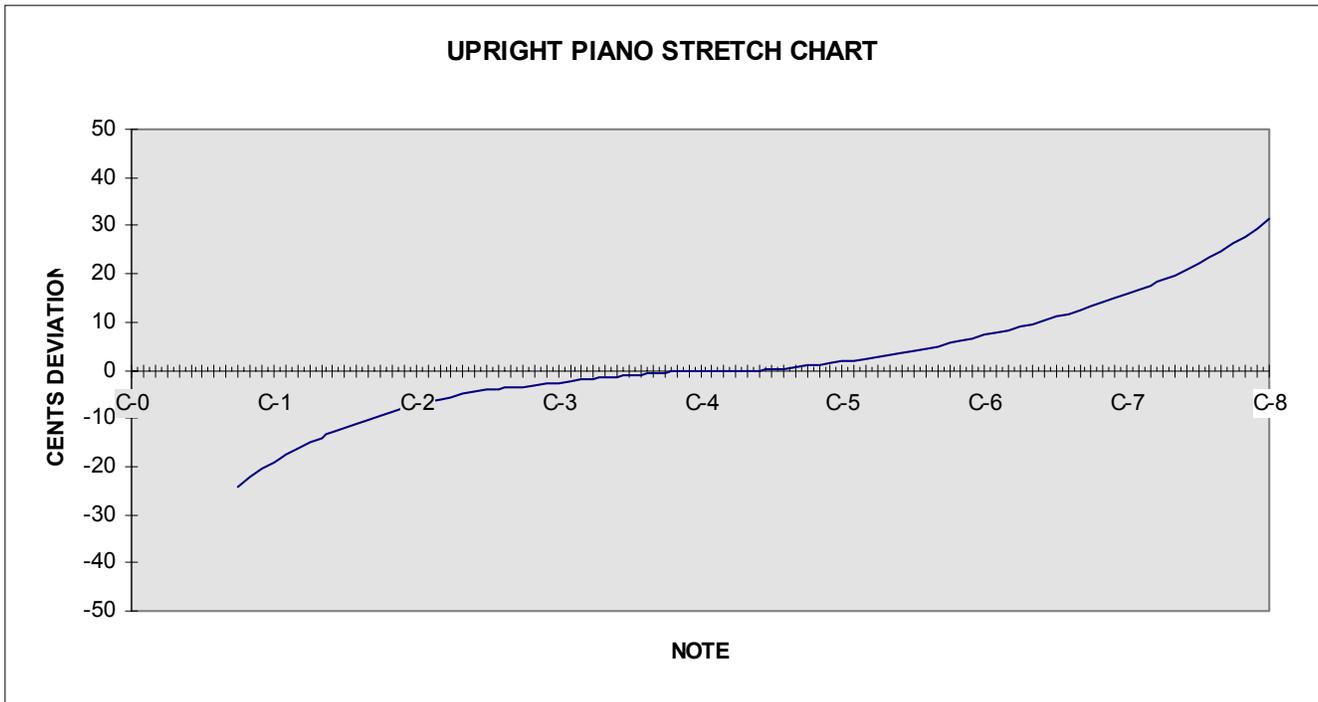
FILE: UPRT

Note No.	Note Name	Cents Deviation
1	C-0	-42.1
2	C#-0	-40.1
3	D-0	-38.1
4	D#-0	-36.1
5	E-0	-34.1
6	F-0	-32.1
7	F#-0	-30.1
8	G-0	-28.1
9	G#-0	-26.1
10	A-0	-24.1
11	A#-0	-22.2
12	B-0	-20.5
13	C-1	-19.0
14	C#-1	-17.6
15	D-1	-16.3
16	D#-1	-15.1
17	E-1	-14.0
18	F-1	-13.0
19	F#-1	-12.0
20	G-1	-11.1
21	G#-1	-10.2
22	A-1	-9.4
23	A#-1	-8.6
24	B-1	-7.9

Note No.	Note Name	Cents Deviation
25	C-2	-7.2
26	C#-2	-6.6
27	D-2	-6.0
28	D#-2	-5.5
29	E-2	-5.0
30	F-2	-4.6
31	F#-2	-4.2
32	G-2	-3.8
33	G#-2	-3.5
34	A-2	-3.5
35	A#-2	-3.2
36	B-2	-2.9
37	C-3	-2.6
38	C#-3	-2.3
39	D-3	-2.0
40	D#-3	-1.8
41	E-3	-1.6
42	F-3	-1.4
43	F#-3	-1.2
44	G-3	-1.0
45	G#-3	-0.8
46	A-3	-0.6
47	A#-3	-0.4
48	B-3	-0.2

Note No.	Note Name	Cents Deviation
49	C-4	0.0
50	C#-4	0.0
51	D-4	0.0
52	D#-4	0.0
53	E-4	0.0
54	F-4	0.0
55	F#-4	0.2
56	G-4	0.4
57	G#-4	0.6
58	A-4	0.9
59	A#-4	1.2
60	B-4	1.5
61	C-5	1.8
62	C#-5	2.1
63	D-5	2.4
64	D#-5	2.8
65	E-5	3.2
66	F-5	3.6
67	F#-5	4.0
68	G-5	4.5
69	G#-5	5.0
70	A-5	5.5
71	A#-5	6.0
72	B-5	6.6

Note No.	Note Name	Cents Deviation
73	C-6	7.2
74	C#-6	7.8
75	D-6	8.4
76	D#-6	9.0
77	E-6	9.7
78	F-6	10.4
79	F#-6	11.1
80	G-6	11.8
81	G#-6	12.6
82	A-6	13.4
83	A#-6	14.2
84	B-6	15.0
85	C-7	15.9
86	C#-7	16.8
87	D-7	17.7
88	D#-7	18.7
89	E-7	19.7
90	F-7	20.8
91	F#-7	22.0
92	G-7	23.3
93	G#-7	24.7
94	A-7	26.2
95	A#-7	27.8
96	B-7	29.5



FILE: VERT

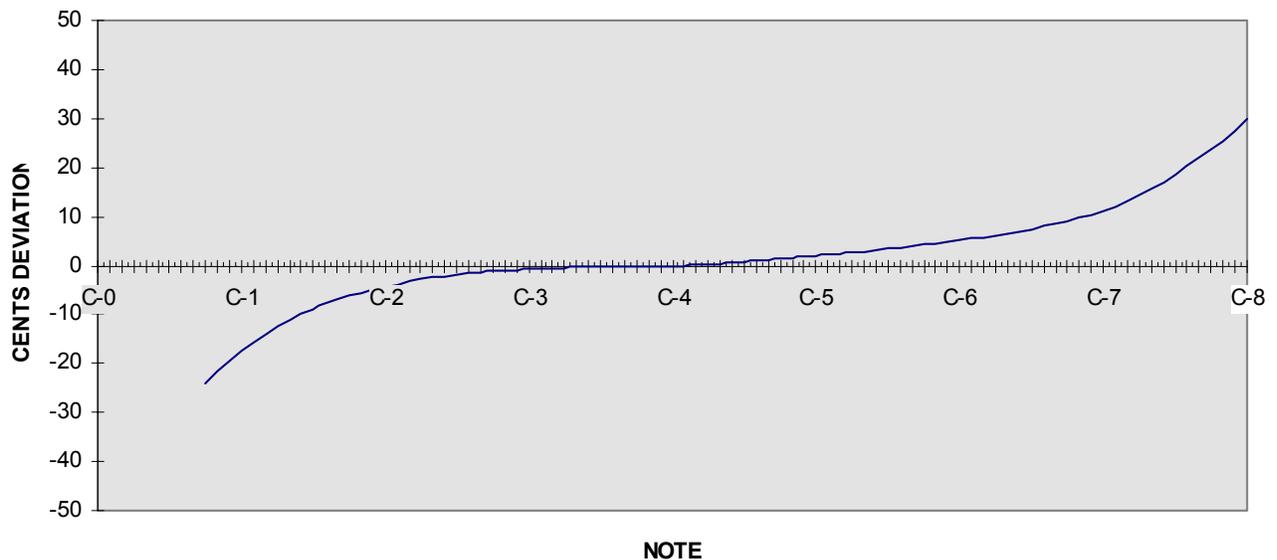
Note No.	Note Name	Cents Deviation
1	C-0	-46.5
2	C#-0	-44.0
3	D-0	-41.5
4	D#-0	-39.0
5	E-0	-36.5
6	F-0	-34.0
7	F#-0	-31.5
8	G-0	-29.0
9	G#-0	-26.5
10	A-0	-24.0
11	A#-0	-21.5
12	B-0	-19.3
13	C-1	-17.3
14	C#-1	-15.5
15	D-1	-13.9
16	D#-1	-12.5
17	E-1	-11.2
18	F-1	-10.0
19	F#-1	-8.9
20	G-1	-7.9
21	G#-1	-7.0
22	A-1	-6.2
23	A#-1	-5.5
24	B-1	-4.9

Note No.	Note Name	Cents Deviation
25	C-2	-4.3
26	C#-2	-3.8
27	D-2	-3.3
28	D#-2	-2.9
29	E-2	-2.5
30	F-2	-2.2
31	F#-2	-1.9
32	G-2	-1.6
33	G#-2	-1.4
34	A-2	-1.2
35	A#-2	-1.0
36	B-2	-0.9
37	C-3	-0.8
38	C#-3	-0.7
39	D-3	-0.6
40	D#-3	-0.5
41	E-3	-0.4
42	F-3	-0.3
43	F#-3	-0.2
44	G-3	-0.1
45	G#-3	0.0
46	A-3	0.0
47	A#-3	0.0
48	B-3	0.0

Note No.	Note Name	Cents Deviation
49	C-4	0.0
50	C#-4	0.0
51	D-4	0.1
52	D#-4	0.2
53	E-4	0.4
54	F-4	0.6
55	F#-4	0.8
56	G-4	1.0
57	G#-4	1.2
58	A-4	1.4
59	A#-4	1.6
60	B-4	1.8
61	C-5	2.0
62	C#-5	2.2
63	D-5	2.4
64	D#-5	2.6
65	E-5	2.8
66	F-5	3.1
67	F#-5	3.4
68	G-5	3.7
69	G#-5	4.0
70	A-5	4.3
71	A#-5	4.6
72	B-5	4.9

Note No.	Note Name	Cents Deviation
73	C-6	5.2
74	C#-6	5.5
75	D-6	5.8
76	D#-6	6.2
77	E-6	6.6
78	F-6	7.0
79	F#-6	7.5
80	G-6	8.0
81	G#-6	8.5
82	A-6	9.1
83	A#-6	9.7
84	B-6	10.4
85	C-7	11.2
86	C#-7	12.1
87	D-7	13.1
88	D#-7	14.3
89	E-7	15.6
90	F-7	17.0
91	F#-7	18.5
92	G-7	20.1
93	G#-7	21.8
94	A-7	23.6
95	A#-7	25.5
96	B-7	27.6

GENERIC VERTICAL PIANO STRETCH CHART



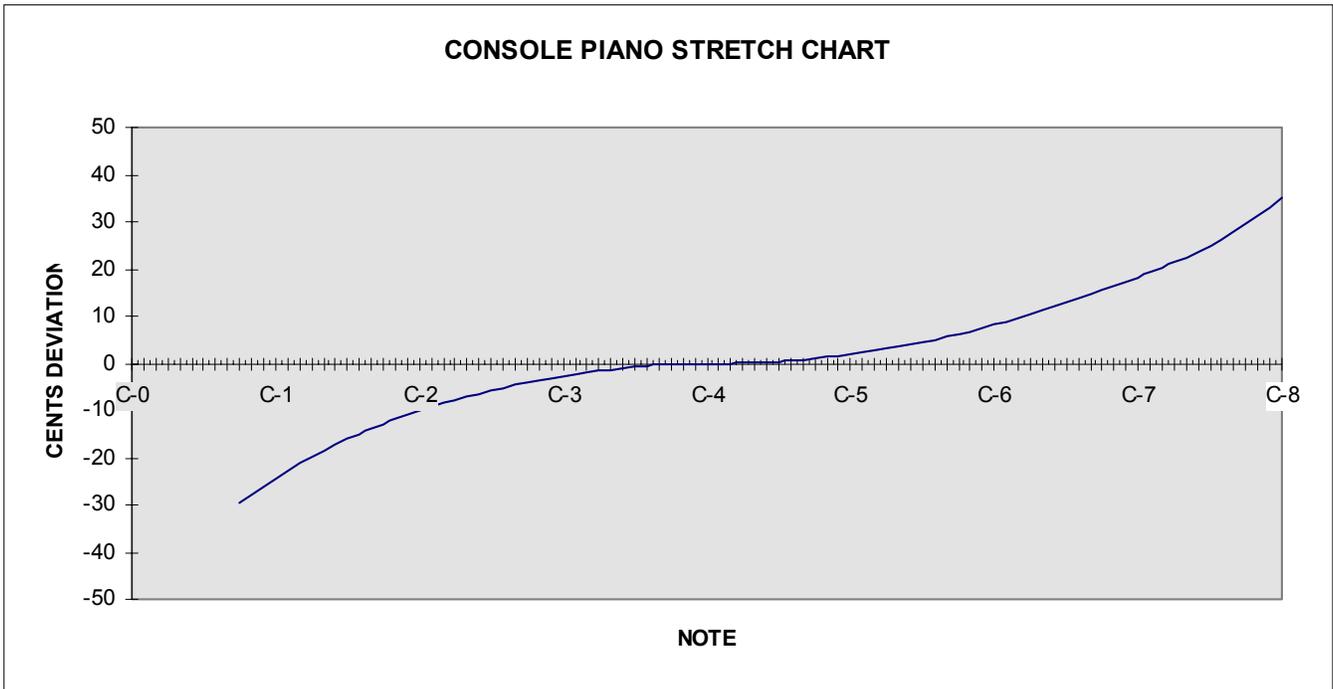
FILE: CNSL

Note No.	Note Name	Cents Deviation
1	C-0	-49.2
2	C#-0	-47.0
3	D-0	-44.8
4	D#-0	-42.6
5	E-0	-40.4
6	F-0	-38.2
7	F#-0	-36.0
8	G-0	-33.8
9	G#-0	-31.7
10	A-0	-29.7
11	A#-0	-27.8
12	B-0	-26.0
13	C-1	-24.3
14	C#-1	-22.7
15	D-1	-21.2
16	D#-1	-19.8
17	E-1	-18.5
18	F-1	-17.3
19	F#-1	-16.1
20	G-1	-15.0
21	G#-1	-13.9
22	A-1	-12.9
23	A#-1	-11.9
24	B-1	-11.0

Note No.	Note Name	Cents Deviation
25	C-2	-10.1
26	C#-2	-9.3
27	D-2	-8.5
28	D#-2	-7.8
29	E-2	-7.1
30	F-2	-6.4
31	F#-2	-5.8
32	G-2	-5.2
33	G#-2	-4.6
34	A-2	-4.1
35	A#-2	-3.6
36	B-2	-3.1
37	C-3	-2.7
38	C#-3	-2.3
39	D-3	-1.9
40	D#-3	-1.6
41	E-3	-1.3
42	F-3	-1.0
43	F#-3	-0.8
44	G-3	-0.6
45	G#-3	-0.4
46	A-3	-0.3
47	A#-3	-0.2
48	B-3	-0.1

Note No.	Note Name	Cents Deviation
49	C-4	0.0
50	C#-4	0.0
51	D-4	0.0
52	D#-4	0.1
53	E-4	0.2
54	F-4	0.3
55	F#-4	0.4
56	G-4	0.6
57	G#-4	0.8
58	A-4	1.1
59	A#-4	1.4
60	B-4	1.7
61	C-5	2.0
62	C#-5	2.4
63	D-5	2.8
64	D#-5	3.2
65	E-5	3.6
66	F-5	4.1
67	F#-5	4.6
68	G-5	5.1
69	G#-5	5.6
70	A-5	6.2
71	A#-5	6.8
72	B-5	7.5

Note No.	Note Name	Cents Deviation
73	C-6	8.2
74	C#-6	8.9
75	D-6	9.6
76	D#-6	10.4
77	E-6	11.2
78	F-6	12.0
79	F#-6	12.8
80	G-6	13.7
81	G#-6	14.6
82	A-6	15.5
83	A#-6	16.4
84	B-6	17.3
85	C-7	18.2
86	C#-7	19.2
87	D-7	20.2
88	D#-7	21.3
89	E-7	22.4
90	F-7	23.6
91	F#-7	24.9
92	G-7	26.3
93	G#-7	27.8
94	A-7	29.4
95	A#-7	31.1
96	B-7	32.9



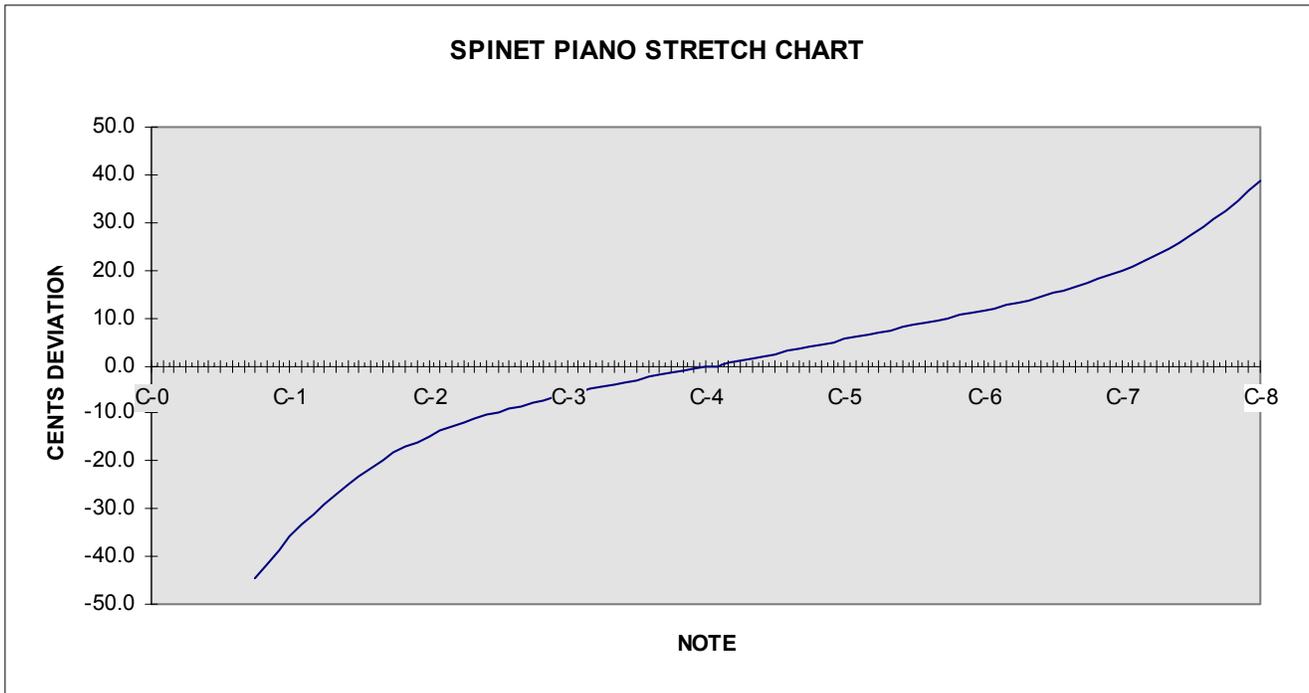
FILE: SPNT

Note No.	Note Name	Cents Deviation
1	C-0	-50.0
2	C#-0	-50.0
3	D-0	-50.0
4	D#-0	-50.0
5	E-0	-50.0
6	F-0	-50.0
7	F#-0	-50.0
8	G-0	-50.0
9	G#-0	-48.0
10	A-0	-44.7
11	A#-0	-41.5
12	B-0	-38.6
13	C-1	-35.9
14	C#-1	-33.4
15	D-1	-31.1
16	D#-1	-28.9
17	E-1	-26.9
18	F-1	-25.0
19	F#-1	-23.2
20	G-1	-21.5
21	G#-1	-19.9
22	A-1	-18.4
23	A#-1	-17.1
24	B-1	-15.9

Note No.	Note Name	Cents Deviation
25	C-2	-14.8
26	C#-2	-13.8
27	D-2	-12.9
28	D#-2	-12.0
29	E-2	-11.2
30	F-2	-10.4
31	F#-2	-9.7
32	G-2	-9.0
33	G#-2	-8.4
34	A-2	-7.8
35	A#-2	-7.2
36	B-2	-6.6
37	C-3	-6.0
38	C#-3	-5.5
39	D-3	-5.0
40	D#-3	-4.5
41	E-3	-4.0
42	F-3	-3.5
43	F#-3	-3.0
44	G-3	-2.5
45	G#-3	-2.0
46	A-3	-1.5
47	A#-3	-1.0
48	B-3	-0.5

Note No.	Note Name	Cents Deviation
49	C-4	0.0
50	C#-4	0.0
51	D-4	0.5
52	D#-4	1.0
53	E-4	1.5
54	F-4	2.0
55	F#-4	2.5
56	G-4	3.0
57	G#-4	3.5
58	A-4	4.0
59	A#-4	4.5
60	B-4	5.0
61	C-5	5.5
62	C#-5	6.0
63	D-5	6.5
64	D#-5	7.0
65	E-5	7.5
66	F-5	8.0
67	F#-5	8.5
68	G-5	9.0
69	G#-5	9.5
70	A-5	10.0
71	A#-5	10.5
72	B-5	11.0

Note No.	Note Name	Cents Deviation
73	C-6	11.5
74	C#-6	12.0
75	D-6	12.6
76	D#-6	13.2
77	E-6	13.8
78	F-6	14.4
79	F#-6	15.1
80	G-6	15.8
81	G#-6	16.5
82	A-6	17.3
83	A#-6	18.1
84	B-6	19.0
85	C-7	19.9
86	C#-7	20.9
87	D-7	22.0
88	D#-7	23.2
89	E-7	24.5
90	F-7	25.9
91	F#-7	27.4
92	G-7	29.0
93	G#-7	30.7
94	A-7	32.5
95	A#-7	34.4
96	B-7	36.5



# INDEX

+2/-1 DISPLAY .....	Page 6
power-up setting .....	Page 8
A440	
adjustment .....	Page 7
power-up setting .....	Page 8
cents	
definition .....	Page 11
fine control .....	Page 2
defaults	
changing .....	Page 6
factory defaults .....	Page 8
changing .....	Page 6
file menu	
temperaments .....	Page 12
front panel .....	Page 2
image	
hi/low band shifting .....	Page 6
image clarifier	
adjustment .....	Page 4
power-up setting .....	Page 5, Page 8
image visibility .....	Page 4
input voltage .....	Page 1
intonation	
training method .....	Page 9
key signature	
changing .....	Page 8
power-up setting .....	Page 8
line voltage .....	Page 1
menu	
stretch .....	Page 23
mute .....	Page 11
pitch	
fine control .....	Page 2
up/down .....	Page 2, Page 10
pitch standard	
change .....	Page 7
resolution	
cents .....	Page 10
enhanced .....	Page 10
stretch	
instruments .....	Page 22

stretch tuning	Page 22
access	Page 23
blank form	Page 37
charts	Page 38
copying	Page 33
creating	Page 26
deleting	Page 28, Page 32
naming	Page 27
preprogrammed	Page 24, Page 25
temperaments	
blank form	Page 36
changing	Page 12
copying	Page 19, Page 20
creating	Page 15
deleting	Page 16, Page 19
naming	Page 15
preprogrammed	Page 12, Page 13
resolution	Page 15
un-equal	Page 11
unequal	Page 37, Page 38
tuning	
silent	Page 11

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