

The Verituner 100



User Guide

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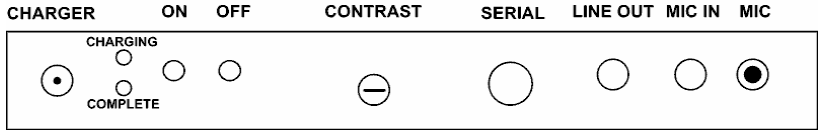
About This Guide

This user guide describes the features and operation of the Verituner 100. This guide assumes you are a piano technician and have at least basic piano tuning skills and that you are familiar piano tuning terminology.

A Note to Aural Tuners

A special note to those who have little or no experience using an Electronic Tuning Device (ETD): Be patient! Working with any ETD, including the Verituner, requires the use of *hand-to-eye* coordination while tuning, which is quite different from the *hand-to-ear* coordination that you are accustomed to. In addition, with an ETD you will be sounding only one note at a time instead of two, and *during tuning* the frequent aural checks you rely on in aural tuning are best done infrequently with the Verituner. This will most certainly require an adjustment period. Most first-time ETD users report that they actually tune slower—at first. After an adjustment period, we expect you'll be saving time *and* getting excellent results with greater ease.

The Verituner's Top Panel



- CHARGER** connection to external AC Power Supply
- CHARGING** [red light closest to the front panel] when lit, it indicates the battery is being charged
- COMPLETE** when lit, it indicates battery charging is complete
- ON** red button, powers on the Verituner
- OFF** black button, powers off the Verituner
- CONTRAST** adjustment for screen contrast
- SERIAL** serial port; used with optional PC & Macintosh software
- LINE OUT** line level audio output signal
- MIC IN** input for external microphone
- MIC** microphone

Chapter 1

Quick Start and Overview

Okay. Although much effort has gone into producing a guide that will help you get the most out of your Verituner 100, you might be one of those who just can't wait—who wants to tune first and read later. This chapter is for you. It's a barebones summary of the essential points of Chapter 2 (Verituner Basics), Chapter 3 (Tuning Preliminaries), the basic fine tuning procedure for a new tuning from Chapter 4 (Standard Tuning Procedures). Use it for a quick start or read it for an overview of those chapters. If you're going to try the quick start route but find you need more information, refer to these chapters.

Verituner Basics

(Chapter 2, page 11)

- When fully charged, the battery will power the Verituner for approximately 12 hours. However, it is recommended that **battery charges** be done after three hours or more of use or after a day of tuning.
- **Power** the Verituner by pressing and briefly holding the red power button on the top of the unit. The black button turns the unit off.
- If the display is not bright enough, turn on the **backlight** by pressing the left arrow key. There are two levels of brightness.
- If you wear **glasses** for reading or working at a computer, you'll probably find them helpful when using the Verituner.
- Use the four **MENU keys** (which are on the left and boxed) and the eight **command keys** to access various functions and features and to activate commands. When present, press the CMDS key to switch between both sets of available commands.
- **Files**—tuning, temperament, and style—are stored and edited in **directories**. Tuning files are saved automatically as you tune.

Tuning Preliminaries

(Chapter 3, page 23)

- The startup screen offers three options for starting a tuning: start a **New** tuning (one for which you will not use a saved tuning), load a **Saved** tuning file for a previously tuned piano, and **Resume** the last tuning that was loaded.
- The Verituner's **AutoNote** feature identifies the pitch it hears. Pressing the Auto command key cycles through six combinations of settings for *direction* (up or down), *distance* (random or step), and *sensitivity* of response. AutoNote can also be turned off. Use movement by step for the most accurate response.

◀▶ Random movement, medium sensitivity

◀▶ Movement up or down by step

- **Coarse Tuning** is used for pitch raising or lowering. **Overpull** targets are calculated with user-selectable overpull percentages. **Zoom** changes the scale (range) of the cents gauge. Change the scale with the ZOOM command which is in the CMDS2 set of commands.
- The **Fine Tuning** function is used to fine tune a piano.
- All **measuring** for inharmonicity is done automatically in the background as you tune.
- The tuning defaults are A4=0¢ (440 Hz), equal temperament, and stretch style designed for “average” pianos. Each of these—**pitch, tuning style, and temperament**—can be changed in the tuning setup procedure or via menus. (In general, use the “Clean” style for spinets and very small grands, and use the “Average” style for most other pianos.)
- In Fine Tuning, sharpness and flatness are indicated by the rotation of **the spinner blades** and by a flat or sharp symbol that appears when the blades rotate too fast to be read distinctly. The goal is to stop or slow the spinner *as much as possible*. The needle and spinner hub number also indicate deviation.

Tuning Procedures

(Chapter 4, page 40)

If you want to tune right now, follow these steps to fine tune a piano that is already very close to pitch (A440). If you are an aural tuner, delay doing aural checks until the tuning is finished.

1. Turn on the Verituner and wait for the startup screen to appear.
2. At the startup screen, press the NEW key to start a new tuning.
3. At the Tuning Setup screen, press the ACCEPT key to accept the default settings.
4. In the Filename dialog, press the ACCEPT key to accept the file name as it is.
5. At the Coarse Tuning screen press the CMDS \downarrow key.
6. Press the FINE key.
7. Tune each string of A4.
8. Tune each string of A3.
9. Tune A#3 and continue upward by half steps, tuning unisons as you go, until you have tuned C8.
10. Tune each string of G#3.
11. Tune downward by half steps, tuning unisons as you go, until you have tuned A0.

Chapter 2

Verituner Basics

In this chapter there will be some hands-on practice of basic Verituner operations, so have your tuner with you as you read. You don't need to be at a piano for the tutorial.

Care of the Verituner

The Verituner 100 is a high quality electronic instrument that has been designed to give years of dependable service with a minimum of care. Its case is rugged, but common sense guidelines include not exposing the unit to water or other liquids, excessive heat, or to shock from dropping, etc.

Cleaning

The tuner's case can be cleaned with a damp cloth. Should you need to clean the glass screen, three options are suggested: (1) the manufacturer of the liquid crystal display recommends a product available from www.klearscreen.com; (2) spray a lens cleaner (such as for eyeglasses) on to a clean, lint-free cloth, and wipe the glass gently; (3) wipe with a micro-fiber cleaning cloth.



The Battery

The Verituner 100 is powered by a Nickel Metal Hydride (NiMH) battery pack. NiMH batteries allow for fast charging, and unlike NiCad batteries, they do not have near the degree of the "memory" problem that can significantly reduce the time NiCads can power a device. Battery packs supplied by Veritune Inc. have been properly broken in prior to shipment.

When fully charged, the battery will power the Verituner for approximately 12 hours with the backlight off. With the backlight's low setting, an additional

10% of power is used. The high setting uses 20% more power. (See “Reading the Display” on page 14 for more about the backlight.)

Battery Indicator

When the unit is on, a gauge of the battery’s current charge state can be seen by pressing and holding down the right arrow key on keypad. The icon  appears at the top center of the screen. Four squares indicate a high level of charge. When the battery is drained to the point there are no squares, the empty outline of the icon  appears and stays visible until no charge is left or the charger is plugged in. As the battery gets close to a complete discharge, a BATTERY LOW warning message appears briefly at the center of the screen, indicating that less than 30 minutes of use remains before the battery must be recharged. During this remaining time the icon blinks as a reminder. Just before the unit shuts off, another warning, BATTERY VERY LOW, appears. At any point during this sequence, you can plug in the charger and continue tuning as the battery is charging.

Charging the Battery

To begin charging the battery, plug in the power cord of the AC power supply. The light on the charger should be lit. Plug the other end of the AC power supply into the Verituner’s charger jack. The Verituner’s top LED (Charging) should blink for a couple of seconds and then light steadily, indicating that the battery is charging. When the charging is complete, the Complete LED lights.


From a complete discharge, charging will bring the battery to almost half of its capacity in an hour, and to a full charge in less than three hours. (There is no harm in charging longer.) If you do not have time to finish the charge, you can interrupt the charging after an hour and still have a substantial capacity for tunings, until there is time for a complete charge.

Recommended Charging Routine

For maximum battery performance and to always have an ample charge while tuning, keep the battery at a higher state of charge rather than a lower one. So, in practical terms, if at the end of the day you have used the tuner for more than about three hours since the last full charge, recharge it that night. If possible, recharge weekly during an extended period of non-use. Maintaining a high state of charge will not only ensure a full capacity for a day of tuning, but it will contribute to the overall health and performance of the battery.

After approximately twenty of these partial charges, completely discharge the battery by leaving the tuner on until it shuts itself off; then, recharge it fully.

The Charging Monitor

The Verituner can be either on or off during charging. If you do not need to use the tuner while it is charging, you have the option of using the *charging monitor*. The tuner must be on and at the startup screen for the monitor to turn on. Plug in the battery charger and power on the unit. After the startup screen has appeared for a couple of minutes, the charging monitor icon  appears, indicating the monitor is functioning. The charging monitor automatically powers off the tuner after 3.5 hours—ample time for a complete recharge. If you need to use the tuner while the monitor is on—indicated by the icon—press any key at the bottom of the front panel to turn off the monitor and return to the startup screen. Charging will continue normally but the unit will not shut off automatically.

Restoring a Low Charge Capacity

In some cases, a battery may terminate its Charging mode far too early and therefore only accept a small portion of its normal capacity. This is more likely to occur if the tuner has not been used for several months or if the battery has been left in a low charge state too often. To remedy this problem, charge the battery while monitoring the Charging light (the red light closest to the front panel) to make sure it stays lit for at least 90 minutes. If the Complete light comes on early, force the battery to take an additional charge by removing and reinserting the charger plug. Repeat this procedure until the Charge light has been lit for a total of at least 90 minutes. *Stop charging if at any time the Charging light does not stop blinking.*

This procedure applies only to a battery that will not charge to its full capacity. In the regular charging routine, recommend above, in which the battery is charged after several hours of use, the Charging light may be lit less than 90 minutes simply because less than 90 minutes of charging is needed to bring it to a full charge.

Replacing the Battery

The Verituner 100's battery pack can be charged hundreds of times and should provide several years of reliable service. When it can no longer hold a sufficient charge, or it otherwise fails, you can order a replacement battery pack from Veritune, Inc. or another source and install it yourself. You do not have to

send your tuner to Veritune for normal battery installation. The battery pack specifications and installation instructions are in Appendix D.

Placement

On grand pianos and larger verticals, the Verituner can be supported on the attached accessory stand, tilted upward within its approximately 90° range. Hold the Verituner with your left hand and tilt it to the desired position, and then tighten the thumbscrew (at the center of the right side). Notice that the guide through which the rod passes is purposely not screwed into the tuner tightly. This allows it to swivel easily with the changing angle of the rod. Lest it gets loose and lost, snug the stand's thumbscrew when using, transporting, or storing the tuner.

On a vertical piano with a narrow pinblock, set the Verituner on its narrow bottom with the front panel facing straight forward. First, lower the back side of the tuner so it lies flat against its stand; tighten the thumbscrew, and then place the unit on the pinblock. This is the smallest “footprint” for the unit. As long as you can place it securely, the stand can also be used even on narrow pinblocks. Wherever you place the Verituner, be sure it is positioned securely!

Reading the Display

The Verituner's screen displays information and commands both as graphics and text. Under most conditions, normal room lighting should be sufficient for reading the display. If the display is not bright enough, turn on the **backlight** by pressing the left arrow key (at the lower left corner of the front panel.) The backlight can be turned on *after* the startup has completed. It cannot be turned on or off when the left arrow key is assigned for navigation of menus and dialogs. (More on that below.) Successive key presses switch between two levels of brightness and off. To conserve battery power, use the backlight only when needed.

Contrast

Contrast can be adjusted with the slotted knob at the center of the top panel. The factory setting should not need to be changed, unless perhaps, the ambient temperature is very warm or cold. The LCD darkens when warm and lightens

when cold. In addition, during or after fast charging the Verituner warms up quite a bit and may darken the display until it cools down. Please your eye, but the best setting is probably obtained when you see only slight shading in the background.

Glasses

If you normally wear glasses while reading or working at a computer, you'll probably want to wear glasses while tuning with the Verituner. Bifocals may be uncomfortable and your reading glasses may not be best, so here's a tip:

Sit or stand comfortably at the piano, and measure to determine the average distance from your eyes to the tuner when it is placed on a grand and on two or three sizes of uprights; then, try various strengths of reading glasses until you find the best strength for the average distance. The distance will probably be greater than for reading, so a weaker strength may work best. This could be an easy and inexpensive solution.

Menus and Commands

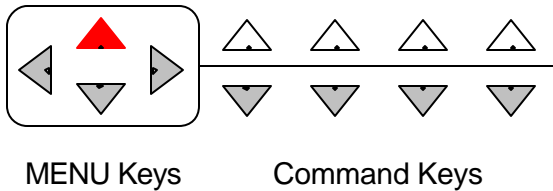
The Verituner's various screens generally present two things:

- **OPTIONS** for customizing tunings, for storing and editing tunings and other files, for selecting and/or modifying functions of the tuner, and selecting the pitch you want the tuner to read; and
- **INFORMATION** about what it hears and about the current settings for various options, presented as graphics and/or text.

Not all of the available options appear on the screen at the same time. Most are on a hidden menu and submenus and additional layers of commands. (A **menu** is a list of available options, as is a **submenu**, which is a menu within a menu) In this section, we will not be concerned with the options themselves, but rather the mechanics of finding, selecting, and manipulating and activating them. We'll begin with an overview of menus and commands, followed by a hands-on practice with the Verituner.

On the Verituner's front panel, just below the display, there are two sets of keys. The four boxed-in keys on the left are the MENU Keys. The two rows of

keys on the right—four white keys pointing up and four gray keys pointing down—are the Co mmand Keys.



MENU Keys

MENU keys are used to open and navigate the main menu and submenus in order to select menu items. They are sometimes used to activate commands. In file directories, they function as **navigation keys**, used to navigate lists and to move from one list to another. As navigation keys they are also used to select a *field*¹ in a *dialog*². A field is selected when a “selection box” encloses it.

Standard Tuning Setup

Pitch: cents **440.00** Hertz

Style: **Average**

When an item on a menu, a submenu, or a list is selected, it appears as “high-lighted” (inverse text and background).



¹ A *field* is an area on the screen where information can be manipulated.

² A *dialog box* is a rectangular “window” on the screen that conveys information to you, and/or requires a response from you. A dialog may contain several fields.

Command Keys

Command keys are used to initiate an action, make a change, or make a choice, e.g., activate a tuning function; change a numeric setting; name a file; or accept or cancel a choice. Commands are used to confirm or take action on a selected menu or submenu item, a file, or a field. Some commands initiate an action by themselves, without an open menu, directory, or dialog, e.g., changing the note you want the Verituner to listen to.

The names of the commands appear at the bottom of the screen, lined across in two rows. They correspond to the two rows of command keys. Depending on which Verituner function is being used, there will be eight or fewer commands available. To activate a command, *press* its corresponding key. Some commands have additional functionality that is accessed by pressing *and* holding the key down for a second or two. Pressing a command key for which there is no command has no effect. In addition to the eight command keys, the down MENU key is sometimes used to activate a command.

Rather than be limited to a maximum of eight commands per screen, the Verituner uses the **CMDS** (commands) key to display additional sets of commands for some screens. The CMDS command only appears when an additional set of commands is available. Each press of the CMDS key cycles through the available sets. Each set of commands for a screen (such as the Coarse Tuning screen) are distinguished numerically: **CMDS1** **CMDS2**.

Tutorial: Menus and Commands

Power on the Verituner now by pressing and briefly holding down the red button on the top of the unit. The red LED light in the upper left corner of the front panel lights up immediately and the startup screen appears in about 20 seconds. During the start up you will see a number, e.g., 100-7, which is the version of the installed *firmware*—the Verituner’s operating program. The Verituner will remain on until you turn it off (with the black button) or until the battery is depleted. The unit does not normally shut off automatically.

The **startup screen** gives three choices for how to begin tuning, but for this tutorial, we will use a “special” file. To open it, *press and* hold down the down arrow key at the right end of the front panel; hold the key down for a couple of seconds. (This key is unlabeled.) When pressing the MENU and Command

keys, press firmly enough that you feel and hear the click. Depending on where the Verituner is placed, you may need to support the backside of the tuner as you press keys.

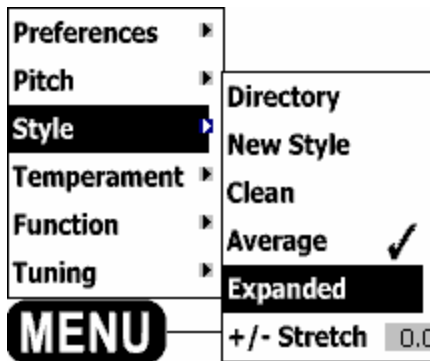
This short hands-on tutorial will familiarize you with menus and commands. The Coarse Tuning screen (named in the title bar at the upper left corner) should be showing.

1. Activate the NOTE+ command by pressing the up arrow key on the top row under NOTE+. If you started on A4 you should now see A#4 at the upper right of the display. Each press of the up or down arrow key advances the note by a step.
2. Try the up and down OCTAVE keys and observe the changes.
3. Now press *and* hold down the NOTE keys and observe that this command repeats until you release it or it reaches A0 or C8. The OCTAVE key also repeats when it is held down. (Not all keys have the repeat function.)
4. Although there are only eight command keys, more commands can be accessed via the CMDS key. Press CMDS¹ and notice that a different set of commands appears, labeled CMDS². The number at the end of CMDS indicates which set of commands is showing. Pressing the CMDS key cycles through the available sets of commands. If there is no command for a key, pressing the key has no effect.
5. Press the FINE command (in the CMDS² set) to go from Coarse Tuning to the Fine Tuning screen. Notice that “Fine Tuning” appears in the title bar, at the top left corner of the screen, and the CMDS¹ set of commands for Fine Tuning appears.
6. Return to the Coarse Tuning screen by pressing the CMDS key to show the CMDS² set of commands, and then press COARSE. Note that “Coarse Tuning” appears in the title bar.
7. Reveal the main MENU by pressing the red menu key once.
8. When a menu shows, the menu keys are used for navigating the menus. Navigate upward through the main menu items by pressing the red up arrow key repeatedly. With each key press the next item is *highlighted* (indicated by the inverse text and background). When Preferences is selected, notice that another up key press loops back to the bottom of the

list. The down arrow key functions similarly.

Note that each MENU item has a small black arrow ▶ at the right. It indicates that there is a **submenu** for that menu topic. When an item on the menu is selected, pressing the right menu key opens its submenu; the left menu key closes the submenu. Try it:

- a. Use the up or down menu key to select **Style**.
 - b. Open the **Style** submenu by pressing the right menu key.
 - c. Use the up or down menu key to navigate the **Style** submenu.
 - d. Now, close the submenu by pressing the left menu key or by pressing the CANCEL command key.
 - e. Press CANCEL to close the main menu.
9. Reopen the **Style** submenu once again. Select **Expanded** (the current setting is **Average**, which is checked).

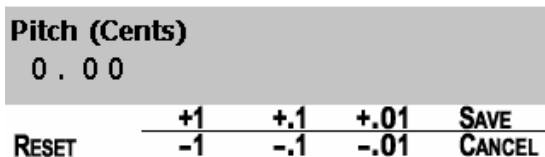


10. Having made a new selection, we now need to tell the Verituner to either “go” ahead and take action on our new selection, *or* “cancel” with no change. Both are done with commands. But, before taking action...

Notice that when you opened the menu the commands that were there (NOTE, OCTAVE, etc.) were replaced with only two commands in the fourth column: GO and CANCEL. Pressing the **GO** key puts the new selection (Expanded) into effect and closes both the submenu and menu.

Pressing **CANCEL** closes the submenu and menu with no change to the current setting (Average). For this practice, press **GO** and notice that Expanded now shows at the right side of the display, indicating the new style is in effect.

- Now, open the **MENU** and select **Pitch** and open its submenu. The Pitch submenu has two options for setting a deviation from the standard pitch of A440: in Hertz or in Cents. We'll use A4 Cents, which is already highlighted. Press the **GO** key.



- This time **GO** opens a **dialog**. The Verituner needs more information—the amount of deviation—before it can change the pitch. The dialog is the means for providing that information.

In the Pitch dialog there are plus and minus pairs of values in the first three columns above the command keys. Use the keys to set a value of -1.75 . The value is displayed at the left.

On second thought, press the down menu key to **RESET** the deviation back to 0.00¢ . Then, set a value of $+1.25$.

- Click **SAVE** to put the deviation into effect and exit the dialog. The deviation from A440 is saved in this tuning file. It is also displayed at the right side of the screen: $A=+1.25\text{¢}$.

In this Guide, a sequence of menu selections and commands is often expressed in a more concise format, as in the following example. This is the sequence of actions taken in steps 11-13:

MENU > Pitch > submenu > A4 Cents >
 [set value at -1.75] > RESET > [set value at $+1.25$] > SAVE

14. A tuning file can be restored to the same state as a brand new file. The **Clear** command erases data that has been saved in a file and restores all settings to the New tuning defaults. Since this is a rather drastic action, a “Clear Tuning?” prompt asks you to confirm that you really do want to do this. Use the Clear command now to reset the defaults for the tutorial tuning file.

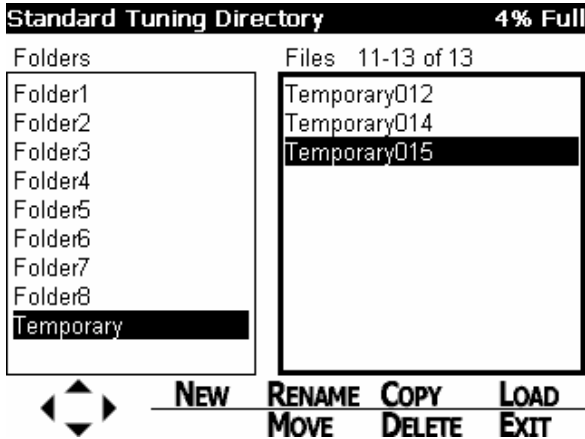
MENU > Tuning > Clear > [Clear Tuning?] > YES

Notice in the display that the default pitch and style are restored.

This tutorial concludes with a look at directories, files and folders. Think of a **directory** as a file cabinet in which files are stored. The Verituner has four file directories, each of which is accessed from the menus. Verituner **files** are records that store data and information for tunings, temperaments, and tuning styles. For organizational purposes, files are kept in **folders**. As indicated at the right side of the title bar, the practice file for this tutorial is named “Temporary,” and it was automatically saved in the Standard Tuning Directory. Since it has served its purpose, we will now delete it from the directory.

15. Note the number (###) in the file name (Temporary###), and then...
 - a. Open the main MENU.
 - b. Open the Tuning submenu.
 - c. Select Directory.
 - d. Press GO.

This displays the Standard Tuning Directory—a listing of the currently stored tuning files and the folders in which they are stored. The list of folders is on the left, and the currently selected folder is highlighted. On the right is the list of tuning files that are in the highlighted folder; one of the files is selected. (If there are no files in a selected folder, the file list on the right will be empty.)



Here's how navigation of the lists works:

- The “selected” list is the one with the thicker border.
- Commands affect the highlighted file or folder in the selected list.
- In a directory, the MENU keys function as navigation keys.
- Use the left and right MENU keys to select the list you want to navigate.
- Use the up and down MENU keys to navigate the selected list.
- Hold down the up or down MENU key and it repeats.

16. Practice navigating both lists.
17. Select the practice tuning file, which is in the Temporary folder.
18. Press the DELETE key. A prompt will open, and you will be asked to confirm that you want to delete it. Press the YES key to delete the file.
19. Press EXIT to leave the directory. Since no file is now open, the startup screen appears.

NOTE: More information on the Verituner's filing system is in Chapters 3, which includes a tutorial, and Chapter 6.

Chapter 3

Tuning Preliminaries

This is the first of two chapters dealing specifically with tuning with the Verituner 100. This chapter covers features and functions that you should be familiar with prior to your first tuning. Chapter 4 is a hands-on guide that walks you through the tuning procedures step-by-step. These two chapters focus on the nuts and bolts of tuning with the Verituner. Chapter 5 goes beyond basics, covering the how and whys of the Verituner's inner workings.

Starting a Standard Tuning

The startup screen offers three options for starting a standard tuning: start a New tuning, load a Saved tuning file for a previously-tuned piano, and Resume the last tuning that was loaded.

Start a New Tuning	Load a Saved Tuning	Resume Tuning Temporary007
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- A **New**tuning is one for which a new tuning file is being created. Even if you've tuned the piano many times before, it is considered a New tuning if are not using a previously saved Verituner file. *In this guide, the term New is capitalized to connote this meaning.*
- A **Saved**tuning is the Verituner's record of a previous tuning that is stored in the Verituner. *In this guide, the term Saved is capitalized to connote this meaning.* When you choose to use a Saved tuning you are first taken to the Standard Tuning Directory to select and load the file. The procedure for loading a saved file is in Chapter 4, "Saved Standard Tuning Procedure."
- **Resume** opens the last loaded tuning file. Select this option, for example, if you temporarily turned off the tuner and you are now ready

to resume tuning. To resume a tuning, press RESUME. You will be returned to the function—Fine or Coarse or Measured Tuning—that was in use when the unit was turned off.

The MENU is also available at the startup screen, providing direct access to other Verituner functions and the file directories.

Tuning Options

The tuning defaults are A4=0¢ deviation from 440 Hz, stretch designed for “average” pianos, and equal temperament. Each of these options—pitch, tuning style, and temperament—can be changed from the MENU. Generally, these choices for the tuning should be set *before* pitch raising or lowering or fine tuning a piano because changes made after you’ve begun tuning may invalidate the tuning targets of previously tuned notes.

The tutorial at the end of this chapter will give you practice changing these options in the New tuning procedure. Here’s a rundown of your choices.

- The **Pitch** option allows you to tune to a pitch other than the default standard of A440. An alternate pitch can be set in cents or frequency (Hz). The range is A392 to A466 Hz [–200¢ to +100¢ from A440]. After it is set, the deviation is expressed in cents on the main screen, e.g., A= +4.00¢. See page 74 for more information setting the pitch.
- **Style** options enable you to set your own stretch preferences for the style of tuning that you want. Pick from one of the three built-in stretch styles or create and save your own custom style(s) or those designed by others. Each style sets the widths for various octave types and where they are to be used, and they can be further adjusted by an overall stretch value. Keep in mind that regardless of what style is selected, stretch is automatically calculated by the Verituner for each piano, based on *its* inharmonicity.

The following guidelines may help in choosing a Style:

- **Average** style has moderate stretch. It is the most generic tuning and is probably the best choice for the majority of your tunings.

- **Clean** style has the least stretch. It may be better choice than Average for spinets and very small grands.
- **Expanded** style has the greatest amount of stretch. Use it on concert grands when wider octaves are desired.
- +/- **Stretch** fine adjusts the parameters of a Style's stretch with the +/- Stretch Adjust value. If this value is adjusted for the currently loaded style, it will be reset to its default setting of 0.0 if you select another style. *This feature works only with the three built-in styles. It is not available when a custom style is in use.*

The style that is currently in use is named on the tuning screen, e.g., Clean +1.5 (Clean style adjusted at +1.5 for somewhat wider octaves.) When a built-in style is being used, a checkmark ✓ appears by it on the Style submenu. For more about Styles see pages 75 and 117.

- An unequal **temperament** can be tuned by selecting from the built-in temperaments or from custom temperaments you installed by keying in the cents offset values. The current temperament is shown in the display, e.g., Equal. See Chapter 7 (page 77) and Chapter 8 (page 83) for more information on temperaments.

Functions

The Verituner has five primary functions:

- Coarse Tuning
- Fine Tuning
- Measured Tuning
- Interval Tuning
- Spectrum Display

Functions can be selected at the startup screen or on the Functions submenu:

MENU > Function > [select the desired function on the submenu] > GO

In addition to changing functions from the menu, you can switch between the Coarse and Fine Tuning functions by pressing the COARSE or FINE key in the CMD52 set of commands. Using the Function menu, you can switch between these functions at any time during a tuning. A checkmark ✓ appears on the submenu by the active function.

Most or all of your tunings will likely be Standard Tunings, which are done with the Coarse and Fine Tuning functions. Coarse is used for pitch raising and lowering, but a small, one-pass tuning with pitch raise can also be done in Fine Tuning. Both functions include an optional overpull function. Details of these tuning functions are covered below and in the tuning procedures in Chapter 4.

The Spinner

The most prominent feature on the tuning screens is the *spinner*—the large graphic in the center, which indicates the flatness or sharpness of a pitch in relation to its target frequency.



The spinner is comprised of five components:

- The **ring**, which is marked for measuring the cents deviation of the pitch
- The **needle**, which indicates pitch deviation on the ring's gauge
- The **spinner blades**, which rotate to indicate whether the pitch is flat, sharp, or on target.

- A large **flat** or **sharp**, which appears when the spinner blades rotate too fast to be read distinctly. (See illustration on page 32.)
- The **hub number**, at the center of the spinner, which is a precise read-out of the pitch's deviation from its target frequency.

The ring is always visible, but depending on its speed setting, the spinner only appears distinctly when the pitch is within about 10 cents (sharp or flat) of the target. If the pitch is outside of that range, the spinner's speed causes it to blur, so it is replaced by the sharp or flat. If there is no pitch for the tuner to respond to, the spinner blades do not appear. Sharpness and flatness are indicated by the rotation of the spinner: clockwise indicates sharp and counter-clockwise indicates flat. The faster the spinning, the greater is the distance of the pitch from its target.

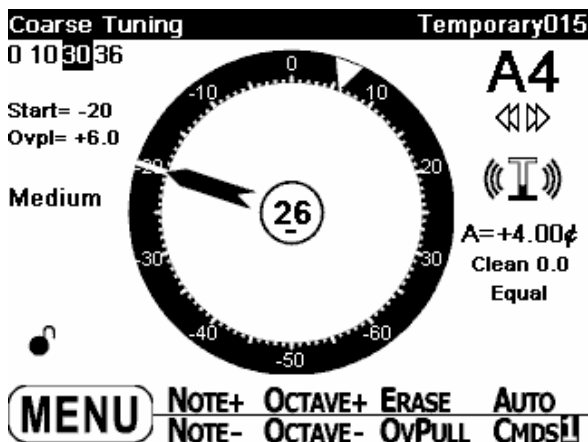
The precise distance of the pitch from its target is shown numerically in the hub of the spinner blades. This measurement is updated several times a second. The number is expressed in a whole number when it is 10 cents or greater (+12, -72). When the deviation is less than 10 cents, values are expressed in tenths of a cent (+5.7, -2.4). Regardless of the value displayed, *the precision of the values used in all Verituner measurements and calculations is hundredths of a cent.*

A hub reading of 0.0 would indicate the pitch is precisely on the target. However, in tuning a piano this is an unrealistic expectation, considering the complex nature of piano tone. Therefore, *the goal is to stop or slow the spinner blades as much as possible and/or get the needle and the number in the hub as close to zero as possible.* If there are pronounced variations in the pitch, from attack through decay, tune the string so the spinner blades are slowest or the zero target is closest, just following the attack.

The spinner can be configured to suit personal preferences or a particular tuning situation. For example, in Coarse tuning you could have the needle without the spinner. As you accustom yourself with the tuner and the tuning procedures, we suggest you use the default settings. See page 72 for more on setting spinner preferences.

Coarse Tuning

If a piano is excessively flat or sharp, a tuning with the correct pitch will only be achieved by first doing a pitch raise or lower. When the tuning setup procedure is completed, you are taken to Coarse Tuning to determine if pitch raising or lowering is needed. The Verituner's Coarse Tuning function is designed to help you accomplish this task quickly and accurately. Fine tuning is then done with the Fine Tuning function. The essential features and functions of Coarse and Fine Tuning are covered in this chapter. Additional features are covered in Chapters 5.



In a Nutshell...

When you play a note, the Verituner measures the pitch in relation to the target it has calculated. Two markers appear on the ring—one marks the starting pitch and the other marks the destination target. If, for example, a string is 20 cents flat of its target, both the needle and a *start marker* (the narrow line that appears as a break in the ring) are at -20 cents on the gauge. If no overpull has been set, the *overpull marker* (triangular shaped) will be at 0 on the gauge. If an overpull percentage (other than 0) is selected, the Verituner calculates the amount of overpull and positions the overpull marker on the gauge accordingly. (Additionally, the start pitch and the overpull amount are displayed numerically at the left of the ring.) In this example, a 30% overpull sets the overpull target

and marker at +6.0¢. The number in the hub is how far and in what direction the start pitch is from the *overpull* target: 26¢ below the target, in this example.

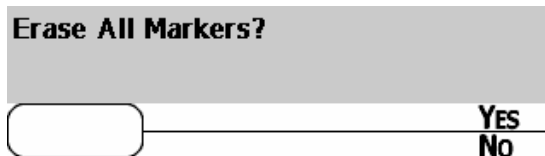
As the string is tuned, there are three indicators that the string is on target: (1) the needle is aligned with the overpull marker; (2) the value in the hub is 0.0 (or as close as possible); and (3) the spinner will be stopped (or rotating as slow as possible). Practically speaking, “close” is good enough for a coarse tuning.

As has been said, when a target includes overpull, the position of the overpull marker on the gauge indicates it (+6.0 in the example). However, the value in the hub is 0.0 when the pitch is at the overpull target. *The target is always 0.0 in the hub*, which includes the calculated amount of overpull.

Erasing Markers

Once the start and overpull markers appear, they are locked in place. However, if you change the overpull percentage, the overpull marker’s position will adjust accordingly. After an overpulled string begins to settle, the markers and what they represent are no longer valid. Therefore, *both markers are automatically erased and the overpull target is canceled two minutes after moving to the next note*. If you retune one or more notes later, the markers are reset based on the current pitch of the note. The ERASE command enables you to erase markers manually. Occasionally a note may be measured incorrectly, indicated by the needle not being aligned with the start marker (before you move the string, of course). If this happens, press ERASE to clear the markers and then play the note again.

Markers, for all notes that have them, can be erased simultaneously by holding down the ERASE key until a dialog opens and prompts:



When a saved or resumed tuning is loaded, no markers are set for any notes. This information is not saved in the tuning file.

Overpull Percentages

The Verituner calculates a tuning target based on a number of factors (see Chapter 5). An overpull amount is added *beyond* the target to compensate for the settling of strings in pitch raising or lowering. The amount of overpull is calculated as a percentage of the difference between the actual pitch and the target. For example, if a note is 12 cents sharp, and the overpull is set at 36%, the overpull marker will be at -4.3 cents.

Because the amount of settling of strings varies in different sections of the piano and for different types of strings, three overpull percentages can be set to accommodate these differences.

- **Wound** The lowest percentage. For all wound strings—A0 through the last wound string (even if it is in the mid-section)
- **Plainwire** A medium-high percentage for the plainwire strings in the mid-section
- **Treble** The highest percentage, for use in the treble section, beginning around F5

Setting Overpull Preferences

The default percentages are Wound-10%, Plainwire -30%, & Treble -36%. These are merely suggestions, perhaps a starting point. Use the defaults if they work well for you or experiment to determine the values—and where they are used—that give you the best results. These percentages can be changed at any time. The values you specify are stored as the defaults for all Coarse tunings. To modify the current values, press and hold down the OVPULL key until the Overpull Preferences dialog opens. (This dialog can also be accessed from the Preferences menu.)

Overpull Preferences

Wound:
Plainwire: 30%
Treble: 36%



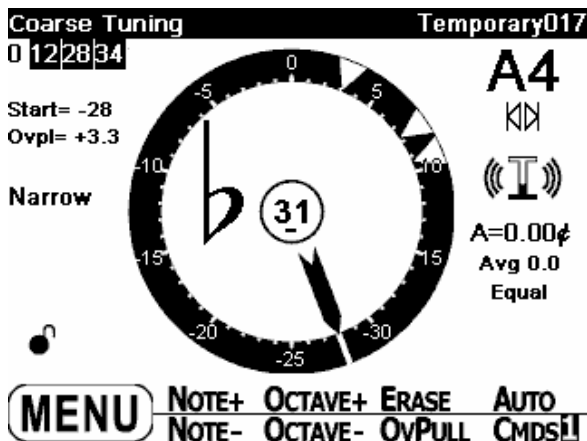
Use the arrow keys to select the field you want to change. (The selected field is the one enclosed in the box.) Use the +1 and -1 keys to change the percentage. When you are finished, press SAVE to make these percentages the new defaults, or press CANCEL to exit the dialog with no change. The current percentages are shown on the Coarse tuning screen: **0 10 36**

Using Overpull Targets

At the tuning screen, each press of OVPULL advances to the next percentage

0 ▶ 10 ▶ 30 ▶ 36 ▶ [All]

After **0**, the first percentage is Wound, the second is Plainwire, and the third is Treble. If you have chosen to show all three overpull markers and you are *lowering* pitch, the left marker indicates the treble overpull target, and the right arrow indicates the bass target—the reverse of pitch *raising*! You may find that *showing only one marker will be less confusing when you are pitch lowering.*



Zoom

In Coarse Tuning the gauge on the ring can be set to one of three scales:

Medium	-65¢ to +35¢
Wide	-130¢ to +70¢
Narrow	-32.5¢ to +17.5¢

Medium is the default. Press ZOOM (CMDS²) to change the scale. Each key press selects another scale. In Coarse, the scale that is currently in use is named at the left of the spinner. In Fine Tuning the scale is always -25¢ to +25¢.

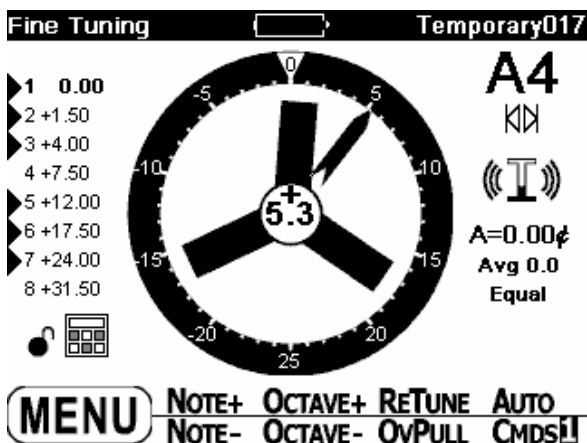
Fine Tuning

To go from Coarse Tuning to Fine Tuning, press the COARSE key (in the CMDS² set of commands). Fine Tuning can also be accessed through the menu:

MENU > Function > Fine > Go

The Fine Tuning screen is similar to the Coarse screen. The notable differences are the function name in the upper left corner; the targets list on the left, which

replaced the overpull and zoom information; and there are some differences in the commands.



Fine Tuning with Overpull

Although Fine Tuning is aptly named for its function, there may be situations in which a small pitch correction in a one-pass fine tuning with overpull is desired. For example, you might want to fine tune a piano that is 5-10¢ flat and you want to compensate for a little settling.

Press the OVPULL key in Fine Tuning to activate this functionality. When activated, the overpull percentages appear at the upper left, and under them the labels for the start and overpull numbers. The targets list that was at the left of the spinner is now hidden.

As in Coarse Tuning, each press of OVPULL cycles through the percentages, but in Fine Tuning with overpull, selecting 0 reverts to Fine Tuning *without* overpull. Press OVPULL again and the overpull graphics reappear.

Tuning Targets, Etc.

Chapter 5 covers in detail how the Verituner reads a piano's inharmonicity, how it calculates tuning targets for the Coarse and Fine tuning functions, and how you can alter a note's tuning targets. The partial & targets list, the calculator and lock symbols, and the (T) symbol are explained, as well.







AutoNote

As you play various notes, the Verituner's AutoNote feature identifies the pitch it hears and displays the note name in the upper right corner of the display.

AutoNote Settings

You can select the direction and the distance of AutoNote's movement and the sensitivity of its response. AutoNote can also be turned off. The current AutoNote setting is displayed on the tuning screen (at the upper right, under the note name) with one of the symbols in the table below. The arrow indicates *direction* of movement (up, down, or both). The *distance* of the movement is indicated by the presence or absence of a vertical line at the arrow tip—with a line, movement is by step; without a line, movement is random. In random movement, AutoNote will identify any note played in any order. In the random settings, the number of arrows indicates the *sensitivity* of response:

more arrows = more sensitivity

Symbol	Movement, Sensitivity	Suggested Use
	Random, Medium	Moderate ambient noise
	Up or down by one half or one whole step	Accurate response when tuning by step or noisy
	Off	When AutoNote response is not wanted
	Random, High	Faster response in a quiet environment
	Random, Low	Noisy environment
	Up by one half step	Pitch raising or lowering
	Down by one half step	Pitch raising or lowering

The AutoNote settings are selected with the **AUTO** key. Each key press switches to another setting. Regardless of the AutoNote setting, notes can be selected manually with the **OCTAVE** and **NOTE** keys.

AutoNote Response

AutoNote responds best to a single string and to notes played in stepwise order. Sometimes, particularly at the highest and lowest ends of a piano, AutoNote may not identify a note correctly. In addition, it can be confused by “white noise,”—a constant, uniform noise, such as from running water, a motor, or a machine. *Be alert to any discrepancies between what note you are playing and what note the Verituner indicates it is hearing!* This is especially important when pitch raising or lowering.

If AutoNote’s response is unsatisfactory, it is most likely that a *random* movement setting is selected. In random mode, AutoNote is more influenced by ambient sounds and even strong partials in the note being played. AutoNote’s random response may also be less than satisfactory if skips are played consecutively in legato style. *When random movement is selected, and you are playing noncontiguous notes, for better response, allow a second or so of musical silence before playing each note.*

For the best response with any AutoNote setting—including random—play notes in stepwise succession. The most reliable response—especially at the extreme ends of a piano—will be with one of the movement-by-step settings. TIP: before switching from random to a step setting, play the note you want to start with so it is displayed on the screen; then, switch to the step setting.

If AutoNote fails to identify a note correctly, select it manually with the NOTE and OCTAVE keys. Remember, AutoNote can be turned off, and troublesome notes can be selected manually. If the pitch is over 50 cents flat or sharp of its target, AutoNote will display the name of the note a step below or above. When pitch raising a very flat piano in which the Verituner consistently identifies the note *below* the one you are tuning, turning off AutoNote and manually changing the note may be the best solution.

Generic Tunings

Unlike other electronic tuning devices, the Verituner does not have a library of generic tuning files for various models of pianos. As you tune a piano, the Verituner measures up to eight partials of 76 of the piano’s notes—a total of 464 partials! Armed with this richly detailed picture of the piano’s unique inharmonicity, the Verituner is able to calculate a highly *individualized* tuning

that is superior to an inherently compromised generic tuning. Using a generic tuning would offer no advantage—just a compromised tuning. (See Chapter 5 for more information on how the Verituner calculates tunings.)

Now, having said that, there may be situations in which you would want to use a Saved tuning to tune another piano; for example, tuning two identical models for a two-piano performance where you want both pianos tuned identically. Or, if you tune a number of the same model pianos for a store, it might be practical to tune one piano, and use its file as a generic tuning for floor tunings of that model. The benefit would be that memory is not taken up with tunings for pianos you might not tune again.

Tutorial: Starting a New Tuning

This tutorial will walk you through the procedure for setting up a New tuning. The setup consists of two tasks:

- **SELECT TUNING OPTIONS**—select the Pitch, Style, and Temperament you want to use for the tuning.
- **MANAGE THE FILE** by naming it and then moving it to the folder you want it saved in.

When you start a New tuning, the Verituner automatically saves a record of the tuning in the Temporary folder which is in the Standard Tuning Directory. The default name of a New tuning file is the word “Temporary” followed by a three-digit number that is generated sequentially. It is displayed in the title bar at the top right of the screen, e.g., Temporary024. The file is automatically saved as you tune. The Temporary folder stores up to fifteen files. When a sixteenth file is saved in the Temporary folder the oldest file there is automatically deleted to make room for the new one. Therefore, any tuning file you want to save indefinitely for future use should be moved to another folder. There is no limit to the number of files that can be stored in the other folders. A well-chosen file name can provide a positive identification and facilitate future retrieval. File management is easily done during tuning setup.

1. At the startup screen, press the NEW key to start a new tuning. The Standard Tuning Setup screen appears with the default settings for Pitch, Style, and Temperament.

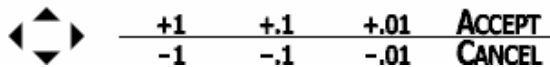
Standard Tuning Setup

Pitch: cents **440.00** Hertz

Style: **Average**

+/- Stretch: **0.0**

Temperament: **Equal**

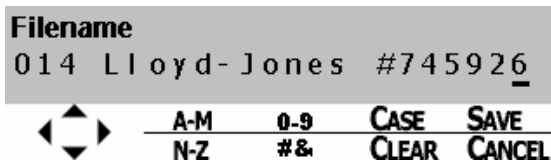


Changing a setting consists of selecting a *field* and then using commands to change the setting. (A selected field is enclosed in a box.) Changes made in the Setup dialog are applied only to this tuning. You use the navigation keys to select the setting you want to change.

Since you can specify your own defaults for New tunings (page 73), the need for making changes in the new tuning setup will normally be infrequent. For this tutorial, however, we will change all four settings.

2. Change the settings for the following tuning options:
 - a. Change the **Pitch** standard to -10 cents: select the cents field and use the $+$ and $-$ number keys to set the desired value.
 - b. Select the **Style** field and press CHANGE. The Style Directory opens. In the Built-In folder, select the Clean style, and then press LOAD. Notice that Clean is now displayed in the Style field.
 - c. Modify the style's **Stretch** by using the $+/-$ keys to enter a stretch value of $+0.5$. Remember, this feature is only available for the three built-in styles.

- d. Select the **Temperament** field and press CHANGE. In the Temperament Directory, select the “Almost Equal” temperament in the Well folder, and then press LOAD.
3. When all of the tuning options are set, press ACCEPT. The Standard Tuning Directory and the Filename dialog open.
 4. Now change the default filename “Temporary###”. Press RENAME to enter the **Filename dialog**. Read about the editing features below and practice entering a name of your choosing.



Filename Editing

- Press the **CLEAR** key to clear the character at the cursor. Press and hold the CLEAR key to back up, deleting one character at a time, until you release the key.
 - Use the right and left MENU keys to move the cursor to the desired space. Use the A-M, N-Z, 0-9, #& keys and the up and down MENU keys to enter characters.
 - The A-M, N-Z, and the 0-9 command keys cycle through only *a few select letters or numbers* within the indicated range:

A-M: a e i k m
N-Z: o r u w y
0-9: 0 3 6 9

Use these keys to quickly select one of these characters. (Notice that all of the vowels are included for faster access.) To select other characters, use these keys to *skip* close to the character you want, and then use the up and down MENU keys to *step* through the complete list to the desired character.

- Letters are entered in lower case. To capitalize a letter, position the cursor under it and then press the **CASE** key. Each key press toggles between upper and lower case.
- Symbols available with the **#&** key are: **# & , ' - .**
- A filename may be up to 24 characters and spaces long. Long filenames will, however, be truncated when displayed in the title bar in Fine, Coarse, and Measured Tuning.

TIPS: In naming files, include useful information—such as a name and serial number—and record the name of the file in your written record of the piano. If you want to use the default number at the beginning of filenames *and* have the files listed in numerical order in a directory folder, use all three digits at the beginning of each filename, e.g., 006, 027, 143.

5. With the cursor positioned at the end of the name you entered, press the **CLEAR** key repeatedly (or hold it down) to erase the file name.
6. Enter this name: 083 East-Lake H.S. #7159
7. Press **SAVE** to save the new name and close the Filename dialog. We are still in the Tuning Directory, where the **MOVE** command is prompting you to select a folder into which to move the file.
8. Select Folder8 and press **MOVE**. The file is moved into Folder8 and the Coarse Tuning screen appears.
9. Open the Standard Tuning Directory and select the practice file in Folder8:

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MENU > Tuning > Directory > [select Folder8]
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10. Press the **DELETE** key and, at the confirmation prompt, press **YES**.
11. Press **EXIT** to leave the directory. Since no file is now open, the startup screen appears. Note that because the last loaded file (the practice file) has been deleted, the Resume option is not available.

Chapter 4

Standard Tuning Procedures

The Verituner's functions for performing standard tunings are Course and Fine Tuning. This chapter presents step-by-step procedures for New and Saved tunings. Both procedures cover pitch raising (and lowering) and fine tuning, including the option to fine tune with overpull. It is assumed that you are familiar with the Verituner's menu and commands system and with the tuning functions and features covered in Chapters 2 and 3.

Aural Checks

The Verituner is designed to listen to a single note at a time. It filters out and ignores other notes while reading inharmonicity. Unlike aural tuning, in which the note being tuned is adjusted according to the beat rate produced by its sounding against an already-tuned note, the Verituner compares the partials of the single note you are sounding against a set of internal, digitally-generated reference pitches. During tuning, playing one note at a time is recommended.

Aural checks are important—please do listen to your tuning! But because of how the Verituner works, the frequent playing of intervals during the tuning process can potentially cause some problems. Therefore, we recommended that aural checks be delayed until a substantial section or the entire piano has been tuned. Give your Verituner a chance to gain your trust. Trust and delay! If you do want to tweak the tuning, the Verituner's style options and the RETUNE, RECALC, and ALTER commands enable you to do so.

Tuning Unisons

Tuning unisons as you go is recommended. You can tune each string of a note individually to the tuner, but if you have the skill, tune unisons aurally for greater speed and accuracy.

New Standard Tuning Procedure

1. **Turn on the Verituner and wait for the startup screen to appear.** If the tuner is already on but at a different screen, select Startup on the Tuning submenu:

MENU > Tuning > Startup > Go

2. **At the startup screen, press the NEW key to Start a New Tuning.**
3. **Set tuning options.** In the Tuning Setup dialog, change the default Pitch, Style, and Temperament selections if you want. (Changes are applied only to this tuning.) Use the navigation keys to select the setting you want to change. The four options are:

- a. To change the **Pitch** standard, select the **cents** or **Hertz** field and use the +/- number keys to set the desired value.
- b. Select the **Style** field and press the CHANGE key. In the Style Directory, select the desired style and press LOAD.

If you want to modify a built-in style's **Stretch**, enter a stretch value with the +/- keys.

- c. To change the **Temperament**, select the Temperament field and press CHANGE. In the Temperament Directory, select the desired temperament and press LOAD.
4. When you are done with the Tuning Setup dialog, press ACCEPT to accept the current settings, or press CANCEL to go back to the startup screen, thus canceling the New tuning.
 5. **Name the file.** In the Filename dialog, either press ACCEPT to accept the file name as it is, or press RENAME and change the name. To save a renamed file, press SAVE. (Pressing CANCEL will take you back to the Tuning Setup screen.)

What happens next depends on the file name:

- *If you accepted the name without change*, the tuning file is automatically saved in the Temporary folder, and the Coarse Tuning screen opens.
- *If you renamed the file*, you are prompted to select the folder in which you want it stored. In the directory, select the desired folder and then press **MOVE**. The Coarse Tuning screen then opens.

6. Check the pitch level of the piano to determine whether pitch raising or lowering is needed. Here is the procedure:

- a. Play A4.** *A4 must be first!* Mute the left and center strings of A4 and play the note's right string while you check its pitch. If the string is off by 50¢ or more, tune it close to 0¢ and continue to play it until the \mathbb{I} (on the right) is as full as possible **I**.¹
- b. Play A3** and check its pitch. Then, play several additional notes in various sections of the piano and check their pitch deviation. If needed, press **ZOOM** (in the **CMDS2** set of commands) to change the gauge of the spinner ring.

NOTE: If the pitch is off by more than 50¢ and AutoNote is not consistently displaying the notes you are actually playing, turn AutoNote off and use the **NOTE** and **OCTAVE** keys to set notes manually.

7. Decide how you want to proceed. Choose the best procedure for the situation:

- Two passes, coarse tuning followed by a fine tuning. If the piano requires a coarse tuning to raise or lower pitch, go to step 8.

¹ Why the right string? It is assumed it is the last string you would normally tune for this note. When the note is tuned in a later step, overpull will be correctly calculated since it will be based on the deviation of the center or left string, which was not moved.

- One pass, fine tuning. If the pitch is close enough, switch the Verituner to Fine Tuning [press FINE in the CMDS² set] and go to step 9.
- One pass, fine tuning with a small pitch raise or lower. If the pitch is close enough for a single pass but you want overpull to compensate for anticipated settling, switch the Verituner to Fine Tuning [press FINE in the CMDS² set] and go to step 10.

Coarse Tuning

8. Raise or lower the pitch in one or more coarse passes.

As you tune, monitor the note name and pitch deviation. Be alert to any discrepancies between the note you are playing and the note the Verituner indicates it is hearing.

- a. **Erase All Markers** by pressing and holding the ERASE key. At the prompt press YES.
- b. **Set AutoNote.** Set the Verituner to the lowest note in the tenor section. Then, for the best response, set AutoNote to move by step, unless you turned it off in step 6b.
- c. **Set the overpull** percentage for the lowest tenor note. As you tune, change overpull percentage at the recommended points.
- d. **Coarse Tuning Sequence²**

It is *essential* that the Verituner has inharmonicity information from A4 and A3 before beginning this sequence. (See step 6.)

1. Tune each string of the lowest tenor note.

² Other tuning sequences can be used. The sequences for New tunings are designed to work with the Verituner's three built-in styles—Average, Clean, and Expanded. They may or may not work well with custom styles. See page 4.


2. From there, tune upward by half steps, tuning unisons as you go, until you have tuned C8.
 3. Tune from the top of the bass section down to A0, tuning unisons as you go.
- e.** Switch the Verituner to Fine Tuning [press FINE in the CMDS2 set] and go to step 9.

Fine Tuning

9. Fine tune the piano.

- a. Set AutoNote** Set the Verituner to A4. Then, for the best AutoNote response, set AutoNote to move by step.

b. Fine Tuning Sequence

1. Tune each string of A4.
2. Tune each string of A3.
3. Tune A#3 and continue upward by half steps, tuning unisons as you go, until you have tuned C8.
4. Set the Verituner to G#3 and tune each of its strings.
5. Tune downward by half steps, tuning unisons as you go, until you have tuned A0.
6. Set AutoNote to random movement .
7. Check the completed tuning and touch it up if needed. If desired, use the RETUNE command to unlock an individual note, reread its inharmonicity, and recalculate its targets.


Fine Tuning with Overpull

10. Fine tune the piano with a small pitch raise or lower.

- a. **Set AutoNote** Set the Verituner to the lowest note in the tenor section. Then, for the best AutoNote response, set AutoNote to move by step.
- b. **Set the overpull** percentage for the lowest tenor note by pressing the OVPULL key. Change the overpull percentage at the recommended points as you tune.

c. Fine Tuning Sequence with Overpull

It is *essential* that the Verituner has inharmonicity information from A4 and A3 before beginning tuning sequence. (See step 6.)

1. Tune each string of the lowest tenor note.
2. From there, tune upward by half steps, tuning unisons as you go, until you have tuned C8.
3. Tune from the top of the bass section down to A0, tuning unisons as you go.
4. Press the OVPULL key until there is no overpull.
5. Set AutoNote to random movement  .
6. Check the tuning and touch it up if needed. If desired, use the RETUNE command to unlock an individual note, reread its inharmonicity, and recalculate its targets.

Saved Standard Tuning Procedure

- 1. Open the Tuning Directory:** At the startup screen, select Load a Saved Tuning, *or* open the directory from the Menu:

MENU > Tuning > Directory > GO

- 2. In the Standard Tuning Directory, select and Load the file:**
 - a.** Navigate the folder and tuning file lists and select the file you want. Press the LOAD key to load the file.
 - b.** In the dialog that asks whether you want to **Recalculate** the tuning being loaded, select YES if you are going to retune the piano. Select NO if you are only checking or touching up a tuning, or if you are using this file as a template for a different piano. (See page 57.)
 - c.** If a deviation from standard pitch was in effect when the file was last used, you'll be asked whether you want to keep the offset. If you select NO, A=0.00¢ will be reset.

After the file loads, the Coarse Tuning screen appears.

- 3. Set tuning options.** Change the current settings for Pitch, Style, and/or Temperament, if you want.
- 4. Check the pitch level of the piano.** Check the pitch of selected notes to determine whether pitch raising or lowering is needed. If the pitch is off by more than 50¢ and AutoNote is not consistently displaying the notes you are actually playing, turn AutoNote off.
- 5. Decide how you want to proceed.** Choose the best procedure for the situation:
 - Two passes, coarse tuning followed by a fine tuning. If the piano requires a coarse tuning to raise or lower pitch, go to step 6.

- One pass, fine tuning. If the pitch is close enough, switch the Verituner to Fine Tuning and go to step 7.
- One pass, fine tuning with a small pitch raise or lower. If the pitch is close enough for a single pass but you want overpull to compensate for anticipated settling, switch the Verituner to Fine Tuning and go to step 8.

Coarse Tuning

6. Raise or lower the pitch in one or more coarse passes.

As you tune, monitor the note name and pitch deviation. Be alert to any discrepancies between the note you are playing and the note the Verituner indicates it is hearing.

- a. **Erase All Markers** by pressing and holding the ERASE key. At the prompt press YES.
- b. **Set AutoNote** Set the Verituner to the lowest note in the tenor section. Then, for the best AutoNote response, set AutoNote to move by step, or turn it off **Set AutoNote**. Set the Verituner to the lowest note in the tenor section. Then, for the best response, set AutoNote to move by step, unless you need turned it off in step 4.
- c. **Set the overpull** percentage for the lowest tenor note. As you tune, change overpull percentage at the recommended points. (If you want to raise pitch in more than one coarse tuning, consider no overpull for the first pass.)
- d. **Coarse Tuning Sequence²**

² To learn more about tuning sequences, see page 4.


1. Begin with the lowest tenor note and tune upward by half steps to C8, tuning unisons as you go.
 2. Tune from the top of the bass section down to A0, tuning unisons as you go.
- e. Switch the Verituner to Fine Tuning and go to step 5.

Fine Tuning

7. Fine tune the piano.

a. **Set AutoNote** Set the Verituner to the lowest tenor note. Then, for the best AutoNote response, set AutoNote to move by step.

b. Fine Tuning Sequence


1. Begin with the lowest tenor note and tune upward by half steps to C8, tuning unisons as you go.
2. Tune from the top of the bass section down to A0, tuning unisons as you go.
3. Set AutoNote to random movement  .
4. Check the completed tuning and touch it up if needed. If desired, use the ReTune command to unlock an individual note, reread its inharmonicity, and recalculate its targets.

Fine Tuning with Overpull

8. Fine tune the piano with a small pitch raise or lower.

- a. **Set AutoNote** Set the Verituner to the lowest note in the tenor section. Then, for the best AutoNote response, set AutoNote to move by step.
- b. **Set the overpull** percentage for the lowest tenor note by pressing the OVPULL key. Change the overpull percentage at the recommended points as you tune.

c. Fine Tuning Sequence with Overpull

1. Begin with the lowest tenor note and tune upward by half steps to C8, tuning unisons as you go.
2. Tune from the top of the bass section down to A0, tuning unisons as you go.
3. Press the OVPULL key until there is no overpull
4. Set AutoNote to random movement  .
5. Check the tuning and touch it up if needed. If desired, use the RETUNE command to unlock an individual note, reread its inharmonicity, and recalculate its targets.

Chapter 5

Inharmonicity and Tuning Targets

The tuning procedure presented in Chapter 4 emphasizes what to do. In this chapter we'll broaden the context to explain more about how the Verituner works and *why* things are done the way they are. There are insights and specific recommendations that will help you get the best results from the Verituner, especially when doing New tunings.

The following Verituner features are covered in this chapter:






- Inharmonicity Measuring
- Target List
- ReCalc
- ReTune


Measuring Inharmonicity

One of the unique and powerful features of the Verituner is its ability to measure a piano's inharmonicity¹, automatically and in the background, *while you are tuning*. By the time you finish tuning the piano, the Verituner will have measured the partials of 76 notes—464 partials in all—to determine its inharmonicity. This wealth of data—all of which is automatically stored in the tuner—is used to determine how much stretch is required to “fit” the tuning to the piano's inharmonicity. Tuning targets are calculated for all 88 notes, using

¹ **Inharmonicity** is the discrepancy between the theoretical frequencies of partials and their actual frequencies. With the exception of the first partial (the fundamental), the partials of piano tone are sharper than their theoretical frequencies, which would be exact multiples of the fundamental. This necessitates tuning octaves wider than theoretical in order to obtain an acceptable compromise of these discrepancies. The first partial of A4 is tuned to 0 cents deviation, but all notes above it are tuned increasingly sharper, and all notes below it are tuned increasingly flatter than what they would be theoretically. The result is the piano's *stretch*.



well-established principles used by aural tuners. The Verituner can help you obtain superior tunings with greater ease and less fatigue.


Measuring partials to determine a piano's inharmonicity is done in the Verituner's Coarse and Fine Tuning functions. Both screens display the  icon, which has animated "sound waves" () when it is measuring successfully. The  is "empty" at first, but as you play the note several times, the  begins to fill in from the bottom to the top, indicating the amount of information it is getting. Inharmonicity readings are not taken on C#7–C8, though their first partials are measured. They are not read for inharmonicity because no notes higher than their first partials are tuned, so their inharmonicity has no affect on the tuning. When tuning these notes, the  does not appear in the display.

When inharmonicity reading is on, waves () will be visible. If there are no waves, inharmonicity reading is off. Use the INHARM command key in Coarse and Fine Tuning to turn inharmonicity reading off and on.

A4 First!


When you first tune a piano with the Verituner (a "New" tuning), it is *essential* that the Verituner hears A4 first. In the New tuning procedures outlined in Chapter 4, this is done in Coarse Tuning (step 6). Obtaining as good a reading as possible is more important with A4 than with other pitches because this is the Verituner's first inharmonicity information, and it is the basis for the initial calculation of the piano's stretch.

Ideally, when the Verituner measures A4, the  should fill completely black and do so reasonably quickly. When this happens, it indicates that the note has a full set of strong, clear partials and that a set of accurate and consistent readings was taken. If it does not fill quickly, check that the non-speaking strings are properly muted, and then strike the key a few more times to see if a better reading can be achieved. For strings with weak partials or a false beat, the  may fill up more slowly or may never fill completely. If this is the case, try another string of A4.

At least some weak partials are normal in piano tone, and since readings are taken on many notes, less inharmonicity information with some notes is quite acceptable. After A4, the  does not need to be closely monitored.

Tuning Targets and Recalculation

Tuning targets are the cents offsets from theoretical pitch that are the “ideal” frequencies of each note of an individual piano. The Verituner uses the inharmonicity information it gathers, and the style and temperament parameters, to calculate tuning targets for all 88 notes. They are compared with the note you are sounding to produce the motion of the spinner and the needle’s position.

Whenever the filling of the II jumps substantially—indicating that additional information has been obtained—the tuning targets for all untuned notes are calculated using all of the information the Verituner currently has. In other words, as the Verituner learns more about the piano’s inharmonicity, it updates and refines the stretch. This recalculation, indicated by the calculator symbol, takes only a second or two. As with measuring, it is done automatically while you tune. 

In Fine Tuning, the targets for the measured partials are listed in a column on the left side of the display. The digits on the left are the partial numbers, and the values next to them are the calculated targets expressed in cents.

▶ **1 -1.70**
▶ **2 -1.38**
▶ **3 -0.94**
4 -0.01
▶ **5 +0.86**
▶ **6 +2.39**
7 +3.25
8 +5.73

Which partials are being read varies in different sections of the piano. For example:

<u>Pitch Played</u>	<u>Partials Measured</u>
A4 & A3	1, 2, 3, 4, 5, 6, 7, 8
A5	1, 2, 3, 4
A6	1, 2
A7	1 (no inharmonicity is measured)
A2	2, 3, 4, 5, 6, 7, 8
A1	3, 4, 5, 6, 7, 8, 9, 10
A0	6, 7, 8, 9, 10, 11, 12

Theoretical pitch is what the frequency of a partial would be if there were no inharmonicity, i.e. the frequency of a partial would be an exact multiple of the fundamental—with 0 cents offset. A4 is the only note that is tuned to exact theoretical pitch; i.e., partial 1 of A4 is always set to 0.00 cents. The targets for all other notes are offset to fit the piano.

The *offset*, then, is the discrepancy or difference in pitch between the theoretical and the tuning target for the partial *as calculated by the Verituner*. It is not the actual measurement of the partial. Targets are calculated based on the measured inharmonicity, stretch choices (Style), temperament, and on the targets of other, previously calculated targets.

The Verituner does not set a single partial and offset. The spinner reacts dynamically to the *combined* targets of multiple partials of the note you are tuning. The relative strength and weakness of the partials also influence the motion of the spinner.² These and other variables are used by the Verituner's proprietary algorithm to determine the 0 point at which the spinner stops.

When you first play a note, a single partial on the list appears in bold type. After some inharmonicity is measured and a recalculation is done, all of the partials that could be read are bold. Only bold targets are used to drive the spinner.

While a note is sounding, you will see small arrows ► appear to the left of the partial numbers: These arrows indicate the presence or absence of each partial in the sound. A dark arrow indicates a strong partial, a gray arrow indicates a weaker partial, and a missing arrow indicates little or no presence of a partial. These arrows flicker on and off as you sound the note, typically showing a strong presence of all the partials when you first sound the note and the higher partials dropping off as the sound decays.

Tuning Sequences

The recommended tuning sequences, given in Chapter 4, are designed to accomplish two goals: (1) help the Verituner optimize its calculated stretch

² If you would like to *see* the relative strength of the partials on the targets list, go to Spectrum Display [MENU > Function > Spectrum]. As you play a note, the Verituner displays the relative strength of each partial in a bar graph in real time. See Chapter 13, page 4, for more information on the Spectrum Display.

during a New tuning, and (2) support a close-to-target outcome when raising or lowering pitch.

Because the Verituner accumulates inharmonicity information *as you tune*, its calculation of targets for a New tuning are based on somewhat less information than it will have for subsequent tunings. A carefully chosen tuning sequence can provide the Verituner with new information *when* it will be most useful. Tuning order also has a determining effect of the outcome of pitch raising and lowering due to the effects of tension changes in the piano. The best order for each goal is not the same, so in some situations a compromise must be made.

THE PRINCIPLES The Verituner's recommended sequences are based on the following three principles:

- *For optimizing stretch in a New tuning*, the Verituner should first gather inharmonicity information from its temperament in this order: A4, then A3, and then all of the notes in between, in stepwise order.
- *For supporting the outcome of pitch raising and lowering*, begin tuning at one end of a bridge, moving in half steps to the other end.
- *For tuning stability*, tune unisons as you go.

From these principles, the recommended tuning sequences may be summarized as follows:

- **For a New, one-pass fine tuning in which the present pitch is very close**, follow this sequence:
 1. Tune each string of A4.
 2. Tune each string of A3.
 3. Tune A#3 and tune upward by half steps, tuning unisons as you go, until you have tuned C8.
 4. Tune G#3 and tune downward by half steps, tuning unisons as you go, until you have tuned A0.

NOTE: Since the pitch is very close, this sequence gives priority to optimizing the stretch by tuning the entire temperament octave first.

VARIATIONS: Steps 3 and 4 can be reversed with one modification: tune G#4 down to A0; then tune A#4 up to C8.

- **For a New tuning in which pitch is raised or lowered**, use this sequence for the *first* pass of a Coarse tuning and for a one-pass fine tuning with overpull:
 1. Play A4 until the \mathbb{I} is as full as possible \mathbb{I} .
 2. Play A3 to at least partially fill the \mathbb{I} .
 3. Tune each string of the lowest tenor note.
 4. From there, tune upward by half steps, tuning unisons as you go, until you have tuned C8.
 5. Tune from the top of the bass section down to A0, tuning unisons as you go.

NOTE: The Verituner initially gets inharmonicity information from only the outside notes of its temperament (A4 & A3). By first playing A4 and A3, rather than tuning them, overpull calculations will be correct when these notes are tuned later in the sequence.

- **For all Saved tunings—coarse and fine—and for the final pass of a two-pass New tuning**, this sequence is recommended:
 1. Begin with the lowest tenor note and tune upward by half steps to C8, tuning unisons as you go.
 2. Tune from the top of the bass section down to A0, tuning unisons as you go.



NOTE: Since, in the course of an earlier tuning or pitch raise, the inharmonicity of the entire piano has already been read, this sequence favors supporting the outcome of pitch changes. For fine tuning where the pitch is very close, any sequence can be used.

VARIATIONS: Steps 1 & 2 can be reversed. Another sequence is to tune A0 to C8.

IMPORTANT: These tuning sequences, with their goal of optimizing the stretch of New tunings, work with the Verituner's built-in styles: Average, Clean, & Expanded. *They may or may not work for custom styles.*

Locked Targets

Automatic recalculations are done continuously as new inharmonicity information is gathered. In Coarse Tuning, *all* targets are potentially recalculated, but in Fine Tuning, only the targets of *untuned* notes are recalculated. This is so that if you want to check or retune a previously tuned note, its target will not have moved. Targets that are changed after a recalculation are updated on the target list.

In Fine Tuning, as you tune a note, the Verituner measures the inharmonicity, recalculates (assuming it got sufficient new data), sets the targets for the partials of the note, and then *locks* the targets. The lock symbols   indicate the status—unlocked or locked. This process takes place in just a few seconds.

ReTune

Occasionally, you may want to try to improve an individual note's tuning. After more of the inharmonicity of the piano has been discovered, the Verituner may be able to make a slight adjustment to a note, resulting in a better fit with the rest, just as in aural tuning. The RETUNE command, available in Fine Tuning, unlocks an individual note, clears and rereads its inharmonicity, and then recalculates its targets. (RETUNE rereads inharmonicity on the assumption that if the targets for the note are not right, inaccurate inharmonicity information—from ambient noise, for example—may be the problem.)

To retune a note, press ALTER and then press RETUNE. The lock symbol changes to unlocked; the $\bar{\bar{I}}$ is emptied and then refilled as you play the note; and the calculator appears briefly to indicate that recalculation of the targets is taking place. The note can then be retuned to the new targets. Only the current note is affected by the RETUNE command. If you are still not satisfied with the note's tuning, tune it by ear and save the altered targets with the ALTER command (page 57).

ReCalc

In some cases, it is desirable to manually recalculate *all* of the tuning targets:

- You are retuning a piano using a Saved tuning file

- You are fine tuning the piano in more than one pass
- You are not satisfied with a section, or more, of the piano
- You want to retune the entire piano with a different Style or +/- Stretch

Using the RECALC command tells the Verituner to recalculate the tuning targets of all notes, using all of the inharmonicity information that it has collected. (Unlike the RETUNE command, no inharmonicity information is thrown out.) A recalculation may result in an even smoother, more refined tuning. To recalculate a tuning, choose:

MENU > Tuning > ReCalc

When you load a Saved tuning, you are asked, “**Recalculate Tuning?**”. Depending on your response to the prompt, here’s what happens, in both Coarse and Fine Tuning:

YES results in a recalculation of the tuning, INHARM is on, and all targets are unlocked.

NO locks all targets with no recalculation and turns INHARM off.

Select NO in a situation in which you do not want any change to the current targets, i.e., you want to tune the piano to exactly the same pitches as before. If you load a Saved tuning to check a very recent tuning or touch it up, you would probably not want the targets you used to tune the piano to be changed. If you want to tune two or more pianos exactly alike, you would not ReCalc the first tuning before tuning the other piano(s). In this situation, you would also want inharmonicity reading off while tuning the other piano(s), so no automatic recalculations and revisions to targets are made. You can, of course, ReCalc or turn on Inharm at any time.

Altering Calculated Targets

The ALTER command, available in Fine Tuning, enables you to override the Verituner’s calculated tuning targets for a pitch. You simply adjust the pitch to your ear’s preference and then have the Verituner measure it and store the note’s altered targets. For example, if you want the temperament octave (A3-A4) somewhat wider, you could use +/-Stretch, experimenting until you got

the result you wanted, or, you could aurally tune A3 downward until your ear is satisfied with the width and use the ALTER command to store it.

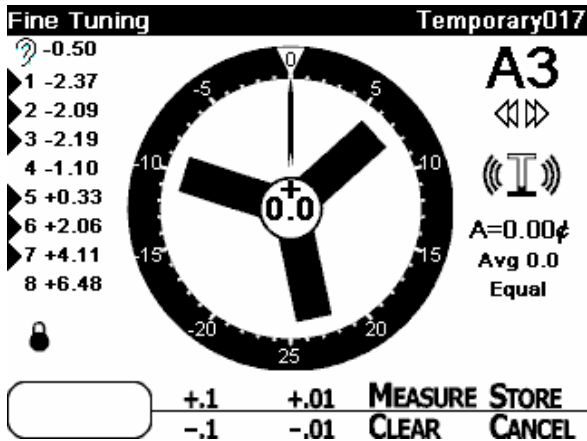
The procedure for using the ALTER command is:

1. Tune the note aurally to the pitch you want.
2. In Fine Tuning, press ALTER. The commands will change to

+.1	+.01	MEASURE	STORE
-.1	-.01	RETUNE	CANCEL

3. Press MEASURE, and immediately play the note while observing the spinner. The targets (which are displayed at the left side of the screen) change in response to the pitch that is being played. The change is in parallel—all of the note's targets move in the same direction, the same distance.
4. If necessary, use the + & – number keys to stop or slow the spinner as much as possible. Each adjustment is reflected in the tuning targets.
5. At this point, you may want to double check that the desired pitch has held.
6. Press STORE. An alteration is stored as an *adjustment* of the Verituner's calculated targets for the note, e.g., –0.50 cents for each of the targets. An altered note is signified (above the targets list) by an **ear** symbol and the adjusted value, expressed in cents.

To exit the alteration procedure with no change, press **CANCEL** at any time before storing (step 6). To erase a stored alteration, thus restoring the Verituner's calculated targets: Display the note to be changed; press ALTER, and then press RETUNE. Only the targets of the altered note are changed by this procedure. RETUNE also erases the inharmonicity information for the note. As you play the note to retune it, inharmonicity is reread and the new targets are calculated.



During a tuning— after measuring and storing—altered targets are used by the Verituner all recalculations that determine the targets for the yet untuned notes. The rule regarding locked notes in recalculations is the same for both unaltered and altered notes: The already locked notes are unaffected, but the yet untuned notes could be.

If there are any altered notes in the tuning, when you load a Saved file you will be prompted to answer two questions: **Recalculate Tuning?** If you respond NO, the alterations are left untouched. If you answer YES, you will be asked: **Keep Alterations?** If YES, the recalculation will use the alterations, and the newly calculated targets for the altered note(s) will be adjusted by the stored amount. If you respond NO, the alterations will be permanently erased.

Summary of Recalculation

In Coarse Tuning, no targets are locked, and as new inharmonicity information is obtained, recalculation of *all* targets is automatic. In Fine Tuning, the targets of tuned notes are locked, and automatic recalculation is done only on untuned notes. The targets of altered notes are used in all recalculations. The INHARM command (Tuning submenu) turns inharmonicity reading off or on. When INHARM is off, no automatic recalculations are done. The RETUNE command throws out inharmonicity information, unlocks, and recalculates the current note only. The RECALC command unlocks and recalculates *all* targets and keeps all inharmonicity information.

More about Measuring

When the Verituner measures for inharmonicity it measures *ratios* of partial frequencies. It is, therefore, not necessary that a string be at pitch for an accurate measurement to be obtained. During a pitch raise, the Verituner can still get a valid reading even though the pitch is changing as it is being measured. Furthermore, the Verituner is constantly evaluating the quality of the signal from each partial, and it only measures inharmonicity at those moments when the partials are clear and consistent. During unison tuning when there are fast beats, readings are not being taken.

As long as the Verituner's inharmonicity reading function is enabled (the default), it will continue to take inharmonicity measurements even after a target is locked *and* during subsequent tunings (if you chose to ReCalc when loading the file). If it gets a better reading, the Verituner updates its information accordingly. If you opt to ReCalc when loading a Saved tuning, the latest information will be used in the recalculation of the targets. The INHARM command can be used to turn off inharmonicity reading, and with it, automatic recalculations.

Without the need for any measuring step on your part, the Verituner gathers sufficient information about the inharmonicity of the piano to extrapolate tuning targets and stretch for a very good tuning the first time you tune the piano (a New tuning). In the process of tuning A0 through C7, all of the collected inharmonicity information for the piano is saved and can be used in subsequent tuning. Armed with a much more complete picture of the piano's inharmonicity, the Verituner can calculate an even more refined tuning. This is why doing a ReCalc before using a Saved tuning file is normally recommended.

Chapter 6

Managing Files in Directories

This chapter covers the creation, storage, and management of files in the Verituner and with a PC. Familiarizing yourself with the Verituner's filing system will help ensure that you will have and can find the files you want when you need them.

Creating and Storing Files

When you start a new tuning the Verituner creates a record of the tuning called a *file*. Tunings are saved automatically as you work and as information about the tuning changes. Among the data in a standard tuning, for example, are the tuning options you chose and the Verituner's measurements of inharmonicity for the piano. The Verituner includes built-in temperaments and tuning styles, and you can create and save additional ones as well. They, too, are files. A temperament file is a record of offsets, and a style file is a record of the parameters that determine the stretch of a tuning. Custom temperaments and styles are saved when you choose to save them—typically, after creating or changing the file.

Files are stored in directories, and for organizational purposes, they are stored in folders in the directory. Think of a *directory* as a collection of files that are organized in *folders*. The Verituner has four file directories: Standard Tuning Directory, Measured Tuning Directory, Temperament Directory, and the Style Directory. Each of the four directory names corresponds to the type of file that is stored in it: Standard Tuning files are stored in the Standard Tuning Directory, etc. Commands in each directory enable you to manage files in a number of ways.

Storing New Tunings

When a New tuning is started, the Verituner opens a Tuning Setup dialog in which you choose tuning options, and name the file and select a folder for it.. In the setup procedure, after accepting your tuning option choices, you are

prompted to either accept the default file name, e.g., Temporary 009, or rename the file. If you accept the temporary name, the file is put in the Temporary folder in the directory. It will automatically be deleted when approximately 15 more recent files have accumulated there. To ensure that tuning files you want are saved indefinitely and are easily identified, choose to rename the file in a useful way rather than accept the default name. (You can rename a temporary file later, as long as it has not been deleted.) After renaming the file, you are prompted to select a folder in the directory in which to store the file.

Accessing Directories

Directories are accessed through the menu. A Directory menu is available on the Standard and Measured startup screens, enabling access to any directory without having to open a file.

MENU > Directory > Standard Temperament Style Measured

If a tuning file is open, the directory for that file type (standard or measured) is opened from the Tuning submenu. Open the Temperament and Style directories from their respective submenus.

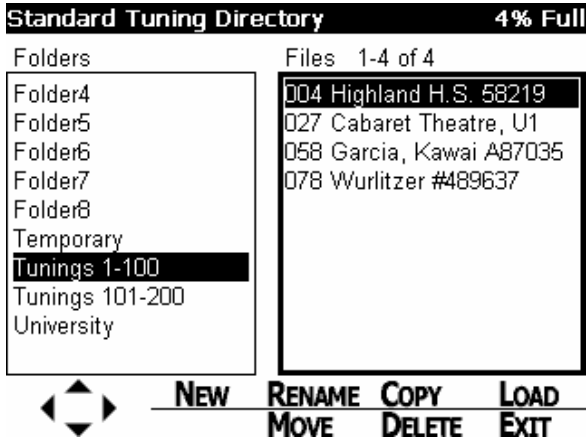
MENU > Tuning > Directory

MENU > Style > Directory

MENU > Temperament > Directory

The Directory Layout

The four directories are very similar in their arrangement. The Standard Tuning Directory will serve to illustrate.



The name of the directory is in the **title bar** (at the top of the screen). At the right corner, an approximate percentage of the memory for file storage that is in use is given. NOTE: This percentage includes files from all four directories. Approximately 400 files can be stored.

Each directory has two lists: **folders** on the left and **files** on the right. The listed files are in the highlighted folder. If no files are listed, it is because the folder is empty. Above the files list is the total number of files in the selected folder and the range of files in the list that are currently displayed. For example, **43-52 of 65** indicates that there are 65 files in the selected folder and the 43rd through the 52nd files in the list are currently displayed.

Navigating and Selecting a Folder and File

Both lists are enclosed in a “box.” In a directory, the MENU keys are used for navigating the folder and file lists and for selecting which list to navigate.

- The selected list box is the one with the thicker border.
- Use the left and right MENU keys to select the list to navigate.
- Use the up and down MENU keys to navigate the selected list. Hold the key down to repeat its movement. To move quickly through long lists of files, repetition moves a “page” (of 10 files) at a time.

- A folder or file is *selected* when it is *highlighted* (inverse text and background).
- Commands affect the highlighted file or folder in the selected list.

Managing Files in Directories

File management consists of a variety of tasks: naming, filing, copying, modifying, deleting, retrieving, etc. Each directory has an appropriate set of commands for managing its particular files. Most tasks and commands are common to each directory, but some are specific to one file type. For example, only the temperament directory has the View command.

Directory Commands

The following commands are available in the Verituner directories. The Rename, Move, Copy, and Delete functions are also available in the VTsync PC software, which is covered in the next section.

COPY Use the COPY command to make a duplicate copy of a file. Select the file you want to copy—a tuning, temperament, or style—and then press COPY.

After pressing COPY, the Rename dialog opens. By default, the copy is given the same name as the original but with the addition of a number at the end to distinguish it from the original, e.g., Original filename, Original filename2. (Keep this in mind if your file name ends with a number, such as a serial number.) Copies of built-in temperament and style files are saved in the Custom folder. Only a copy of a built-in temperament and style file can be renamed, edited, or deleted. The original file cannot be altered.

DELETE Use DELETE to delete the selected file. Only tunings and custom temperament and custom style files can be deleted.

1. Select the folder that contains the file you want to delete.
2. Select the file.

3. Press DELETE.
4. At the confirmation prompt, press YES or NO.

EDIT The EDIT command—available in the Temperament and Style directories—opens the Style Editor or Temperament Editor, a dialog for editing custom styles or temperaments. When a built-in temperament is selected, the EDIT command is replaced with the VIEW command. This difference in names reflects this difference in the two dialogs: You can *edit* a custom temperament file's offsets, but only *view* the offsets of a built-in style. The range of the widest and narrowest major thirds in the selected temperament is given in both the Temperament Editor and Viewer.

EXIT Press EXIT to return to the tuning screen. Changes made in the directory, such as renaming a file, are saved, but no file is loaded.

LOAD In the tuning directories, LOAD opens a saved tuning file for use. In the Temperament and Style directories, LOAD loads the selected temperament or style in the current tuning. A temperament or style cannot be loaded unless a tuning file is open.

1. Select the folder that contains the file you want.
2. Highlight the file.
3. Press LOAD. (If you are opening a tuning file, you will be asked if you want the tuning to be recalculated; and, if the file was saved with a pitch deviation from A440, you are asked if you still want to use it.)

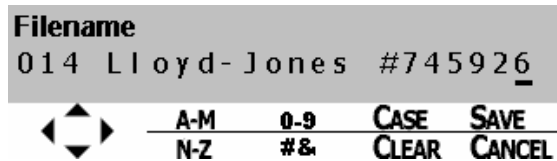
MOVE Folders can be helpful for organizing tuning files. With the MOVE command, files in the Standard Tuning and Measured Tuning directories can be moved to any folder but the Temporary folder. To move a file from one folder to another, follow these steps:

1. Select the folder that contains the file you want to move.
2. Select the file.

3. Press the MOVE key.
4. Select the folder into which you want to move the file.
5. Press the MOVE key.

NEW In the Standard and Measured Tuning directories, NEW opens the Tuning Setup screen to begin setting up the New tuning. In the Temperament Directory, the NEW command starts a new custom temperament file (see page 78). In the Style Directory, the NEW command starts a new custom style file (see page 117). **NOTE:** The Custom folder must be selected for the NEW command to be available. All custom files are saved in the Custom folder.

RENAME Tuning files and files in Custom folders can be renamed. Folders with the default names Folder1, Folder2, etc. can be renamed. Folders that cannot be renamed are: all temperament folders and folders with the names Temporary, Custom, Master and Examinee and Built-In.



To edit a file name:

1. Select the folder or file you want to rename. To rename a folder, no file should be highlighted.
2. Highlight the folder or file.
3. Press the RENAME key.
4. In the **Filename dialog**, use these editing functions to name the file:
 - Press the **CLEAR** key to clear the character at the cursor. Press and hold the CLEAR key to back up, deleting one character at a time, until you release the key.

- Use the right and left MENU keys to move the cursor to the desired space. Use the A-M, N-Z, 0-9, #& keys and the up and down MENU keys to enter characters.
- The A-M, N-Z, and the 0-9 command keys cycle through only *a few select letters or numbers* within the indicated range:

A-M: a e i k m
N-Z: o r u w y
0-9: 0 3 6 9

Use these keys to quickly select one of these characters. (Notice that all of the vowels are included for faster access.) To select other characters, use these keys to *skip* close to the character you want, and then use the up and down MENU keys to *step* through the complete list to the desired character.

- Letters are entered in lower case. To capitalize a letter, position the cursor under it and then press **CASE**. Each key press toggles between upper and lower case.
- Symbols available with the #& key are: # & , ' - .
- A filename may be up to 24 characters and spaces long. Long filenames will, however, be truncated when displayed in the title bar in Fine, Coarse, and Measured Tuning.
- To exit the Rename dialog, press **SAVE** to save the new name, or press **CANCEL** to leave the name unchanged.

TIPS: In naming files, include useful information, such as a name and serial number, and record the name of the file in your written record of the piano. If you want to use the default number at the beginning of filenames *and* have the files listed in numerical order in a directory folder, use all three digits at the beginning of each filename:

004 Highland H.S. 586219

027 Cabaret Theatre, U1
064 Garcia, Kawai A87035
158 Wurlitzer #489637

NOTE: When you rename a tuning file that is in the Temporary folder, you will be prompted to select a folder to move it into.

VIEW In the Temperament Directory the **VIEW** command opens the Temperament Viewer, a dialog for viewing the offsets of the built-in temperaments. The offsets of the built-in temperaments cannot be modified. (If you want to modify a built-in style, use the **COPY** command to make a copy of the file, which can be edited.) When a custom temperament is selected, the **VIEW** command is replaced with the **EDIT** command. The difference in names reflects this difference in the two dialogs: You can *edit* a custom file's offsets but only *view* the offsets of a built-in style. The range of the widest and narrowest major thirds in the selected temperament is given in both the Viewer and the Editor.

File Management with VTsync

VTsync is a PC software application that provides PC-based file management, transfer, and storage capabilities for the Verituner 100. The software is currently available only for Windows PCs. With VTsync, you can copy, rename, move and delete tuning files on your Verituner using the PC's mouse and keyboard. You can also transfer files (e.g., saved tunings, custom temperaments and styles) to and from your PC, effectively extending the storage capacity of your tuner. VTsync can be downloaded from the Veritune website:

<http://www.veritune.com/>

Using VTsync

Install VTsync on your PC by following the instructions on the download page.

To use *VTsync* ...

1. Connect the Verituner to your PC's serial port with the supplied serial cable.
2. Turn on the PC and the Verituner after making the connections. Leave the Verituner's display on the "Startup" screen (NEW, LOAD, RESUME).
3. Run *VTsync* from the Windows "Start" menu under

Program Files > Veritune > *VTsync*

VTsync will automatically find all available serial ports on your PC, and display the message "Waiting for Connection... COM1 COM2" (listing all available ports) in the upper right corner. Once it establishes a connection with your Verituner, the message will change to "Verituner 100".

VTsync Features

The PC display operates similarly to your Windows Explorer application. *VTsync* displays two windows. Your PC's files are displayed on the left, and the Verituner's files are displayed on the right. On the Verituner side, you can select a directory (Tuning, Measured Tuning, Temperament, and Custom Style), a folder within a directory, and individual files within a folder. Choose a directory from the drop-down; open a folder by double clicking it; and navigate file lists using the arrow keys. Click on a file to select it, and use the Verituner buttons (on the right-side) to Rename, Move, Copy or Delete or delete the file. Some folders can also be renamed. These file management functions are the same as on your Verituner.

Transferring Files

The Copy function makes a duplicate of the selected file on the Verituner, not on the computer. To copy files to and from the computer and Verituner, use the transfer buttons that are located in the center between the two displays. To transfer a file from the Verituner to store it on a computer disk (hard disk, floppy, removable media), press the transfer button with the left-pointing arrow. To transfer a file from a computer disk to the Verituner, use the transfer button with the right-pointing arrow.

NOTES:

- While a file operation is in progress, the Verituner spinner will appear, indicating a transfer is in progress.
- Pointing on certain features in the *VTsync* window will open a small box with tips or explanations.
- In the Rename dialog, press “Cancel” to exit with no change.
- Because you are editing files on the Verituner, file names cannot be longer than a total of 24 characters and spaces, and only these symbols are allowed: # & , ' - .

Chapter 7

Menus

Many of the Verituner's features and functions are accessed through its menus. Menus are available from the main screen in each of the primary functions and the startup screen—Fine, Coarse, Measured, and Interval Tuning, and Spectrum Display—although the available items vary depending on the function from which the menu is accessed. Except for the Standard and Measured directories, which are covered in Chapter 6, this chapter provides a detailed description of each submenu of the following menus:

- **Directory**
- **Function**
- **Pitch**
- **Preferences**
- **Style**
- **Temperament**
- **Tuning**

Not all menu items are available in each function. For example, Style is not available in Measured Tuning, and neither Temperament nor Style is available in Interval Tuning.

The Directory Submenu

MENU > Directory > Standard | Temperament | Style | Measured

The Directory menu is available on the Standard and Measured startup screens, enabling access to any of the Verituner's four directories—Standard Tuning, Measured Tuning, Style, and Temperament — without having to open a file.

The Function Submenu

MENU > Function > Fine Coarse Measured Interval Spectrum

Each of the Verituner's primary functions—Fine Tuning, Coarse Tuning, Measured Tuning, Interval Tuning, and Spectrum Display—can be accessed from the Function submenu. A checkmark ✓ appears beside the active function. Additionally, FINE and COARSE commands provide handy switching between these functions when you are doing a standard tuning. Fine Tuning and Coarse Tuning are covered in Chapters 3 and 4. Measured Tuning and Interval Tuning are the topics of Chapters 10 and 12, respectively, and Spectrum Display is the focus of Chapter 13.

More than one type of tuning—Standard, Measured, and Interval—can be open at the same time. Use the Function menu to switch between them.

The Preferences Submenu

MENU > Preferences > Overpull

Defaults can be set for the overpull percentages used in pitch raising and lowering. In the dialog use the arrow keys to select the field you want to change. Use the +1 and -1 keys to change the percentage. Press SAVE to make the percentages the new defaults, or press CANCEL to exit the dialog with no change. The Overpull Preferences dialog can also be accessed by holding down the OVPULL key in Coarse and Fine Tuning.

MENU > Preferences > Spinner

Preferences can be set for the configuration of the spinner, the speed of the spinner's rotation, and the point at which the sharp or flat symbol replaces the spinner blades. To change a setting, use the up and down arrows to select the "Preferences for" field, and then press the CHANGE key to select the tuning function for which you want to set preferences. Next, select the preference field—Configuration, Speed, Maximum—and use the CHANGE key to select the configuration; use the + and - command keys to change values. Press SAVE when all preferences are set. Press CANCEL to exit the dialog with no changes.

Configuration *Options:* Blades & Needle; Blades Only; Needle Only
When the needle shows, the marked gauge is used.
Blades Only is available in Fine and Measured Tuning.
Needle Only is available in Coarse Tuning.

Speed *Range:* 2 – 32 *Default:* 8 rpm/cent
Sets the number of *revolutions per minute* for each *cent* of deviation; e.g., set at 8 rpm, if the pitch is 3 cents from target, the spinner will revolve at the rate of 24 rpm.

Maximum *Range:* 5 – 100 *Default:* 10 cents
Sets the maximum pitch deviation, beyond which the sharp or flat symbol appears; e.g., set at 10¢, the sharp or flat symbol appears (replacing the blades & needle) when the pitch deviation is >10¢ from target.

Guidelines for Setting Speed and Maximum

When the note you are tuning is sharp or flat, the spinner blades rotate at speeds in proportion to the amount the pitch is off from the target. The proportion can be changed, which has the effect of changing the sensitivity of their response to the deviation. A higher speed setting, for example, will result in higher sensitivity, i.e., its rotation will be relatively fast for small pitch deviations. However, its useful range will be narrower because it will more quickly pick up speed at greater deviations, to the point that it is unclear which direction it is rotating. The point at which the blades become too indistinct to be helpful—the point of “maximum” deviation—would be the logical place to set the sharp and flat symbols to appear.

A lower spinner setting results in a lower sensitivity of response, i.e., slower rotation at small pitch deviations, but a wider range in which the clear enough to be useful. At slower speeds, the blades display more cleanly, with less of the “streaking” that is characteristic of fast animations in LCD displays.

MENU > Preferences > Tuning

Tuning Preferences are the defaults for Pitch, Style, +/- Stretch, and Temperament for all New standard tunings. When you start a New tuning, the defaults

appear in the Standard Tuning Setup dialog. Changes you make in the Setup dialog affect only the current tuning.

The process of changing defaults in the Standard Tuning Preferences dialog is the same as changing settings in the Standard Tuning Setup. Use the up and down arrows to select the field you want to change, and then, depending on which field is selected, either press the CHANGE key (which opens the Style or Temperament Directory) or use the + and – command keys to change values for pitch or stretch. Press SAVE when all preferences are set, or press CANCEL to exit the dialog with no change.

MENU > Preferences > Decimal

The Verituner uses values at a precision of two decimal places (hundredths of a cent) for all measurements and calculations. In Fine and Coarse Tuning, the *display* of some values on the screen—in the spinner hub and for Start and Overpull—are at a precision of one decimal (tenths of a cent). The display of these numbers cannot be changed.

In Measured Tuning, you can set your preference for 1 or 2 decimals for the hub number and for the offset and CHANGED and DETUNE values that appear at the left side of the screen. The decimal preference affects “Normal” Measured tunings. Because the PTG tuning exam records values in tenths of a cent, the decimal preference is automatically set at “1” when a new Master or Examinee tuning file is created or a saved file in either of these folders is loaded. The preference for 1 decimal remains in effect for all Measured tunings until it is changed in the decimals dialog.

The Pitch Submenu

MENU > Pitch > A4 Cents A4 Hz

The Verituner’s default standard pitch is A4=0¢ (A440 Hz). You can set a deviation from this standard, expressed in either **Hz** (Hertz, cycles per second) or **cents** ($1\text{¢} = \frac{1}{100}$ of a semitone). The Verituner display uses the ¢ symbol for cents.

Pitch (Cents)				
0 . 0 0				
RESET	+1	+1	+01	SAVE
	-1	-.1	-.01	CANCEL

A deviation from A440 can be set from A392 to A466 [–200¢ to +100¢]. In the Pitch dialog, use the + and – command keys to set the deviation. As you make changes, the new value is displayed at the left. Precision is to one hundredth (0.01) of a cent or Hertz. The default setting is 0.00—no deviation from 440 Hz. Press the RESET key to set the value to 0.00 cents deviation. Press SAVE to put a change into effect. Press CANCEL to leave the dialog with no change.

The new pitch deviation is shown in the tuning display expressed in cents, e.g., A= +4.00¢. If you set the pitch at 442 Hz, it is displayed as A= +7.85¢. The amount of the deviation also appears on the Pitch submenu, expressed in both cents and Hertz. Be aware that if you change the pitch standard *after* a fine tuning has been started, previously tuned notes may be invalid, unless you retune them.

If you set a deviation from the A440 standard of pitch, the offset is saved in the tuning file. When you load the file later, you will be asked whether you still want to use the offset. If you don't, the setting will default to 0.00¢. If you want a different deviation, go to the Pitch editing dialog and set it.

The Style Submenu

The Verituner's Style function enables you to alter the rules that are used to adjust the width of octaves. These parameters are combined with the piano's inharmonicity information to calculate target frequencies for each note. (Targets are listed on the left of the Fine Tuning display.) By changing the Style, you change the amount of "stretch" that is calculated into the tuning. This is mostly a matter of tuner or player preference, although you may find that certain styles work better with certain types of pianos.

The Verituner's three pre-defined, built-in styles are Clean, Average, and Expanded. The current style is checked. To select a different style, highlight your choice on the Style submenu and press GO. Style choices are saved as part of the tuning file and are in effect when the saved file is loaded.

Because all notes are affected, it is best to choose a tuning Style and/or +/- Stretch Adjust before you begin tuning. If you do make a change after a tuning is underway, the notes you have already tuned (i.e., the *locked* notes) will not be affected, but the notes that have not yet been tuned will use the new style's parameters calculated against what you have already tuned. Alternatively, you can recalculate the entire tuning (with the ReCalc command), but this would require retuning, because *all* notes will be affected.

MENU > Style > Directory

The Style Directory can also be opened from the Directory submenu at the startup screen.

Using a Custom Style

To use a saved custom style in the current tuning:

1. Choose Directory on the Style submenu.
2. Select the desired style on the Custom Styles list on the right.
3. Press the LOAD key. The tuning screen shows the custom style you are using, although the name may be truncated.

MENU > Style > New Style

The creation of custom styles is subject of Chapter 9 (page 117).

MENU > Style > Clean

The Clean Style has the least amount of stretch and is the most conservative. It may be a better choice than Average for spinets and very small grands.

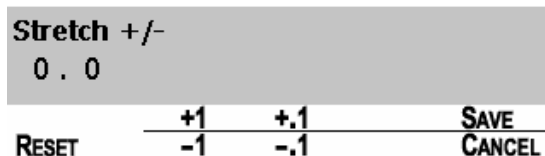
MENU > Style > Average

The Average Style has a moderate degree of stretch. It is the most generic tuning and is probably the best choice for the majority of tunings you will do. Average is the default style unless you set a new default preference.

MENU > Style > Expanded

The Expanded Style gives the greatest amount of stretch. It should be used on concert grands when wider octaves are desired.

MENU > Style > +/-Stretch



The stretch parameters of the built-in styles—Clean, Average, Expanded—can be fine adjusted with the +/- Stretch *adjust value*. (This is not a “cents” value.) The default value is 0.0, which can be adjusted from -2.0 to +2.0. Negative values reduce the amount of octave stretch somewhat, and positive values increase the width somewhat. Press the RESET key to set the value to 0.00, the default setting. Press SAVE to put a change into effect. Press CANCEL to leave the dialog with no change.

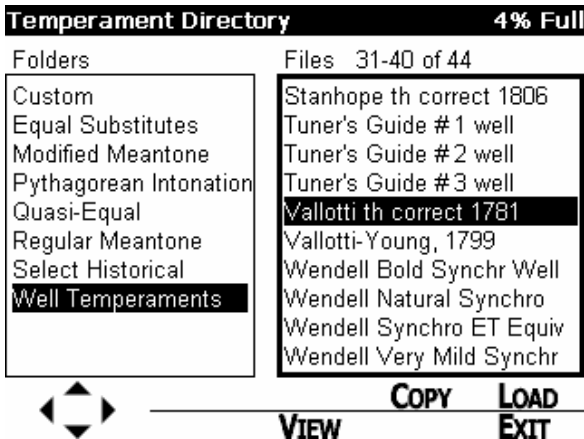
After style changes are made, the selection is shown on the tuning screen, e.g., **Clean +0.5**—Clean style adjusted at +0.5 for slightly wider octaves. *If this value has been adjusted, it will be reset to its default setting of 0.0 if you select another style.*

The Temperament Submenu

MENU > Temperament > Directory

The Verituner’s default temperament is Equal. You can also tune with any of the approximately 90 unequal, historical and modern temperaments that are stored in the Temperament Directory. You can also design, store, and tune with your own unequal temperaments or other historical temperaments you add to the temperament file. If you select an unequal temperament, it will be loaded and saved in the current tuning, and it will be in effect the next time you load the tuning file.

For information on managing files in the Directory, see Chapter 6.



Loading an Unequal Temperament

To load an unequal temperament in the current tuning:

1. Open the Temperament Directory.
2. Select the desired folder.
3. Select the temperament file you want to use.
4. Press LOAD. The tuning screen shows the name of the currently loaded temperament, and on the Temperament submenu Equal is unchecked. (The temperament name may be truncated on the tuning screen.)

When you change the temperament, any *previously set tuning targets are recalculated immediately* for the current tuning file. Be aware that if you change the temperament *after* a fine tuning has been started, many of the notes you have already tuned may be invalid, unless you retune them. For information on selecting unequal temperaments, see Chapter 8.

MENU > Temperament > New Temp

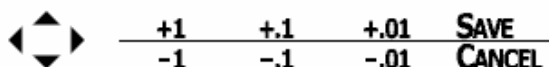
With the Verituner, you can enter and save additional temperaments—your own custom temperaments, temperaments designed by others, or additional historical temperaments. (Following the steps below, there are offsets for two temperaments you can practice entering.)

1. Open the Temperament Directory and press NEW. *Or*, select New Temp on the Temperament submenu:

A new temperament file, named Unequal###, is added to the Custom folder and the Filename dialog opens. Accept the name or press RENAME to rename the file. After renaming, press SAVE, which saves the new name and opens the Temperament Editor.

The Temperament Editor dialog lists the twelve notes of the chromatic scale. (It also gives the range of the widest and narrowest major thirds in the temperament.)

Temperament Editor		Unequal001	
A	0.00	D#	+1.80
A#	+2.61	E	-1.20
B	-1.50	F	+3.00
C	+3.00	F#	-0.81
C#	-0.39	G	+2.01
D	+1.20	G#	+0.81
Major 3rds range: 9.5 to 17.1 cents			



Initially, all values are set to zero, which results in equal temperament. Create an unequal temperament by entering offsets for all or some of the twelve notes. (Values are in cents.) The offsets are deviations from equal temperament, and the result in an unequal temperament.

2. To change an offset, use the MENU keys to move the highlight box to the desired note. Then, use the + & - keys to change the offset as desired. Hold the key down to enable repeat.
3. Repeat step 2 for all other notes that have a deviation.
4. Check that all entries are correct.

5. Press SAVE to save the custom temperament.
6. If you wish, Select and LOAD it for use in the current tuning; press EXIT to leave the directory without loading the style; select the file and press EDIT to reenter the editor; Press NEW to create another custom style.

Practice Adding Custom Temperaments

If you'd like to try the above steps, here are two useful, very mild well temperaments you can add to your Verituner.

Coleman 10 (2001)

A	-0.50
A#	1.00
B	-2.00
C	1.50
C#	0.00
D	0.00
D#	0.00
E	-1.50
F	2.00
F#	-1.00
G	1.00
G#	0.00

Koval Variable 1.0 (2002)¹

A	0.00
A#	0.87
B	-0.50
C	1.00
C#	-0.13
D	0.40
D#	0.60
E	-0.40
F	1.00
F#	-0.27
G	0.67
G#	0.27

¹ Ron Koval's Variable temperament is a single temperament which can be modified to make additional temperaments of various 'strengths' while retaining the best qualities of the original. An indication of the relative 'strength' of a temperament is the difference between its narrowest and widest major thirds. (In equal temperament, all major thirds are 13.7¢ wide of pure.) In a very mild temperament such as KV1.0, the difference is not great: 12.3–14.8¢. To make this temperament stronger, multiply each offset by a value up to 5. (The higher the value, the stronger the resulting temperament.) For example, use 2 as the multiplier and the resulting temperament (KV 2.0, which is in the Verituner's Well temperament folder) has major thirds ranging from 10.9–16¢. In the opposite procedure, Jim Coleman RPT suggests *dividing* the Coleman 11 offsets in half, resulting in Coleman 10.

MENU > Temperament > Equal

Equal is the default temperament. When equal temperament is in use, a checkmark ✓ appears beside it on the submenu. If an unequal temperament is in use in the current tuning, selecting Equal on the Temperament submenu will cause *an immediate recalculation of all tuning targets*. Be aware that if you change the temperament *after* a fine tuning that is in progress, many notes you have already tuned may be invalid, unless you retune them.

A growing number of piano tuners are becoming interested in alternative temperaments. See Chapter 8 for information and resources for selecting and using historical and modern unequal temperaments.

The Tuning Submenu

The Tuning submenu is different between Standard and Measured Tuning. With one exception, the submenu items below are available for one or both of these functions. Score, which is on the Measured submenu, is used for the PTG tuning exam and is covered in Chapter 11.

MENU > Tuning > Directory

Select Directory and press GO to open the directory for the current tuning function (Standard or Measured).

MENU > Tuning > Clear

Clear erases all of the inharmonicity information and the tuning targets in the current tuning file. It also restores the default settings for pitch, style, and temperament. After clearing, the file is restored to the state New tuning file. Only the name is unchanged. Use Clear if you want to completely restart a tuning or if you want to reuse a file on a different piano. After initiating the command, you are prompted to confirm that you want to clear the file.

MENU > Tuning > ReCalc

As you tune a piano in Coarse or Fine Tuning, recalculation is done automatically as new inharmonicity information is obtained. With the ReCalc command, you can recalculate the entire tuning at any time.

See the thorough discussion of this command in Chapter 5, pages 52 & 56.

MENU > Tuning > New

Selecting **New** opens the tuning setup screen for the type of tuning file (standard or measured) that was in use when you went to the menu.

MENU > Tuning > Startup

Selecting **Startup** returns you to the Standard Tuning startup screen, where there are three options: start a New tuning, load a Saved tuning, and resume the most recently loaded tuning. If the most recently loaded file has been deleted, Resume will not be available.

If you're at the Standard Tuning startup screen and want to start a new or saved Measured Tuning, open the Measured Tuning startup screen:

MENU > Function > Measured Tuning > GO

To return to the Standard Tuning startup screen from the Measured tuning startup screen, select

MENU > Function > [choose Fine or Coarse] > GO

Chapter 8

Unequal Temperaments

The mechanics of working with temperament files—opening, managing, and creating—are covered in Chapters 7 (page 77). This chapter provides a complete listing of the Verituner’s approximately 90 built-in unequal temperaments, and it offers resources and suggestions for getting started using alternative temperaments for tuning pianos, fortepianos, harpsichords, and clavichords.

Why We Temper

Just intervals (also called *pure*) are completely in tune and do not produce beating. Ideally, keyboard tuning would result in all *just* intervals. Unfortunately, given the division of the octave into 12 notes for keyboards, this is not possible. *No stack of any type of just intervals will add up to a just octave.* Here are two examples: Stack three contiguous just Major 3rds (C-E, E-G#, G#/Ab-C); the C-C octave is 41 cents short of being just! (This is why all Major 3rds in equal temperament are widened by 13.7 cents.) Stack seven just octaves and twelve just fifths, both beginning on the same note, and the top note of the last fifth is almost 23.5 cents higher than that of the octaves’ top note.

Because just intervals in a 12-note octave do not fit evenly within the octave, compromises in tuning are necessary to reconcile unacceptable mismatches. Some or all of the intervals (except the octave) must necessarily be altered from just, either by widening or narrowing them. This process is called *tempering*, and the result is a *temperament*. One might say that to temper is to purposely “mistune” intervals. Beating, which is so important in aural tuning, is produced by tempered intervals.

Various schemes for tempering have evolved over many centuries according to various aesthetic goals and priorities, such as

- Obtain just fifths, at the expense of the Major 3rds (Pythagorean Intonation temperaments)

- Obtain a large number of just and/or very consonant Major 3rds at the expense of a few keys which are sacrificed as unusable (Meantone temperaments)
- Create a temperament in which all keys can be used and in which there are contrasts in harmonic “color” resulting from tempering the Major 3rds to varying degrees of consonance and dissonance (Well temperaments)
- Temper all intervals equally from just, resulting in a uniformity of harmony that lacks the harmonic and key contrasts of unequal temperaments (Equal temperament)

A Growing Interest in Unequal Temperaments

For most piano tuners, equal temperament has been the only temperament they have ever tuned or thought they would tune. Early music performers, however, have routinely used historical temperaments for tuning harpsichords and other early keyboard instruments. In recent years interest in the viability of using unequal temperaments as an alternative to equal has been growing among piano tuners. Several factors have brought this about, including:

- **INFORMATION** – increased knowledge, largely through the research and writings of Owen Jorgensen, RPT.
- **AUTHENTICITY** – a growing interest in historically-authentic “period” performances during the past 50 years.
- **ETDs** – Electronic Tuning Devices enable tuners to tune any unequal temperament as easily as equal temperament.
- **PROponents** – enthusiastic piano tuners who cite a number of advantages for alternative temperaments.

This chapter is organized in four main sections:

- A list of the Verituner’s built-in temperaments (page 85)
- Selecting temperaments for historical authenticity (page 89)
- Getting started using unequal temperaments as an alternative to equal temperament (page 107)
- Temperament resources (page 116)

Unequal Temperaments List¹

Select Historical Temperaments (selected by Claudio Di Veroli)²

Pythagorean Intonation, circa 900–1500

One-quarter syntonic comma meantone, wolf G#–Eb
(Standard or Pietro Aron, 1523), circa 1500–1670

One-quarter syntonic comma meantone, wolf C#–Ab
(wolf shifted counterclockwise), circa 1500–1670

One-quarter syntonic comma meantone, wolf D#–Bb
(wolf shifted clockwise), circa 1500–1670

Early French temperament, circa 1650–1710

Standard French: D’Alembert-Rousseau, 3 pure Major thirds,
circa 1700–1810

Shifted Vallotti-Young (same as Vallotti-Young in the
Well folder), c. 1700–1810

Equal Substitutes

14th-century Pythagorean (Boulliau, 1373)

Augustus De Morgan unequal temperament of 1843

Anton Bemetzrieder Pythagorean temperament #2, 1808

Charles E. Moscow equal-beating temperament of 1895

H Grammateus Pythagorean of 1518 (Bemetzrieder #1)

Johann G. Neidhardt fifth temperament #3 of 1732

Neidhardt-Marpurg-De Morgan temperament of 1858

¹ The offsets for sixty temperaments in the Veriutner are from *Tuning* by Owen Jorgensen (Michigan State University Press, 1991. Out of print). They are gratefully used with permission of the author. Temperaments bearing their names are used with permission of designers Paul N. Bailey RPT, Bill Bremmer RPT, Jim Coleman, Sr. RPT, Claudio Di Veroli, Ron Koval, and Robert Wendell. NOTE: Most temperament names in the Temperament Directory are modified to fit in the display.

² Claudio Di Veroli lives in Bray, Rep. Ireland, where he teaches harpsichord and interpretation of early music in his Bray Baroque center <http://www.braybaroque.ie>. He is the author of the treatise *Unequal Temperaments* (Buenos Aires, 1978. Out of print). In October 2002, Dr. Di Veroli made a full update of his book available on his temperament Web site <<http://temper.braybaroque.ie>>, which includes “a full list of useful temperaments for historically-informed performances of all Western music written from the Middle Ages to the present.” He designates the seven temperaments in this folder as “really necessary in practice.” Dates are for their approximate period of intensive historical use. His offsets are gratefully used with permission.

Modified Meantone Temperaments

Modified equal-beating one-fifth syntonic comma
meantone temperament of 1797 (fifths ratio=1.49627972)
(Encyclopedia Britannica, 1797 edition)
17th-century irregular equal-beating meantone, corrected
17th-century irregular equal-beating meantone
Alexander Metcalf Fisher modified meantone of 1818
Jean-Le Rond D'Alembert modified meantone of 1752
Standard French: D'Alembert-Rousseau, 2 pure Major
thirds, circa 1700–1810
Wendell Synchronous Modified Meantone/Well, 2003
William Hawkes modified meantone temperament of 1798
William Hawkes improved modified meantone of 1807

Pythagorean Intonation

Pythagorean-Just Intonation, c. 1450–1500
Standard Just Intonation, c. 1450–1500

Quasi-Equal Temperaments

A. Merrick, 1811
Alexander John Ellis in 1875 (Imitation Equal)
Alexander John Ellis in 1885 (New Equal Beating)
Ellis tuner number 5 (a Broadwood tuner)
Factory tuners of 1840
Howard Willet Pyle equal-beating, 1906
Jean Jousse quasi-equal temperament of 1832 (bearing plan #2)
Johann Christian Gottlieb Graupner equal-beating, 1819
Johann Nepomuk Hummel equal-beating, 1829,
(second bearing plan)
Mark Wicks equal-beating, 1887
Tuner's Guide, Becket and Company bearing plan, 1840
Tuner's Guide, John Marsh's bearing plan, 1840
Viennese temperament (Hummel's first bearing plan
tuned according to the rules of Viennese tuners in 1829)

Regular Meantone

Christiaan Huygens (31 tones), 1661
Giuseffo Zarlino equal-beating ($^2/3$ syntonic), 1558

Gottfried Keller ($\frac{1}{5}$ ditonic), 1707
 John Marsh ($\frac{4}{25}$ syntonic), 1809
 One-fifth syntonic comma meantone, wolf G#-Eb
 (Homogeneous), Abraham Verheijen, c. 1600,
 c.1500–1670 [Listed by Jorgensen as John Holden
 $\frac{1}{5}$ syntonic, 1770; 5ths=1.49627787]
 One-quarter comma meantone (Pietro Aaron [Aron], 1523)
 One-sixth comma meantone (G. Silbermann, Ramarin-Beer), 1714
 Robert Smith (50 tones) “Equal Harmony” temperament, 1749
 William Hawkes ($\frac{1}{6}$ mercator comma meantone), 1808

Well Temperaments

Almost Equal (Claudio Di Veroli, 1978)
 Aron-Neidhardt (Neidhardt’s temperament #2 of 1732)
 Bailey Equal Beating Well Temperament, 2003
 Barnes-Bach (John Barnes, 1979)
 Bremmer Equal Beating Victorian Temperament (EBVT), 1992
 Broadwood Best (Ellis tuner number 4), 1885
 Broadwood Usual (Ellis tuner number 2), 1885
 Coleman 11, 1999
 Coleman 16, 2001
 Jean-Le Rond D’Alembert (English equal-beating well using
 D’Alembert’s rules of 1752)
 Early 18th-century well (equal-beating Vallotti)
 George Frederick Handel (published in 1780)
 Jorgensen’s Idealized Prinz³
 (Kirnberger III, Aron-Neidhardt) A=0
 Jorgensen’s Idealized Prinz³
 (Kirnberger III, Aron-Neidhardt) A=−3.42
 Jean Jousse well temperament of 1832 (bearing plan #1)
 Herbert Anton Kellner’s Wohltemperirt-Bach, 1978

³ In 2002 Owen Jorgensen proposed a modified version of theoretically correct Prinz (1808) as “an idealized temperament” that would authentically represent Prinz, Kirnberger III, Aron-Neidhardt, and others of that type, thus completely restoring the perfect harmonic balance for tonality (as in the Thomas Young and Francesco Vallotti temperaments) that was originally intended for this type. Since A at 0¢ deviation from equal results in the whole piano becoming rather sharp, Jorgensen also calculated a second set of offsets that maintains the overall tension on the bridges and soundboard, hence the two versions. [Personal correspondence July 22, 2002]

Kirnberger equal-beating ($1/2$ syntonic comma), 1771
 Kirnberger III, circa 1779 (published in 1808)
 Koval Variable 2.0, 2002
 Koval Variable 3.0, 2002
 Moore (Representative Victorian temperament), 1885
 Peter Prelleur, 1731
 John Preston equal-beating well temperament of 1785
 John Preston theoretically correct temperament of 1785
 Prinz equal-beating well temperament of 1808
 Prinz theoretically correct⁴, 1808
 (representative of Kirnberger III, Aron-Neidhardt)
 Jean-Jacques Rousseau equal-beating, 1768
 Jean-Jacques Rousseau theoretically correct, 1768
 Secor #2 Well Temperament, 1975
 Charles Earl Stanhope equal-beating (improved Kirnberger) 1806
 Charles Earl Stanhope theoretically correct
 (improved Kirnberger), 1806
Tuner's Guide well temperament number 1, 1840
Tuner's Guide well temperament number 2, 1840
Tuner's Guide well temperament number 3, 1840
 Vallotti (Francesco Antonio Vallotti's theoretically correct temperament of 1781; DiVeroli gives its heyday as c. 1680–1810)
 Vallotti-Young, (transposed Vallotti tuned according to Young's rules of 1799)
 Wendell Bold Synchronous Well, 2002
 Wendell Natural Synchronous Well, 2002
 Wendell Synchronous ET Equivalent, 2002
 Wendell Very Mild Synchronous Well, 2003
 Wendell Well 2002
 Werckmeister III (Correct No. 1), 1691
 William Tans'ur, 1746
 Th. Young's representative 18th-century well temperament #1 of 1799, c. 1700–1810

⁴ Prof. Jorgensen: "The Prinz, Kirnberger III, and Aron-Neidhardt temperaments are theoretically distinct from each other, but they are so similar in musical effects that they have been classed together as a single temperament for practical purposes. For historical accuracy, this is excellent to use because the Prinz was documented in 1808, and it is a culmination of all the previous examples of this type of temperament." [Personal correspondence July 22, 2002]

Selecting Temperaments for Historic Authenticity

Unequal temperaments were used in tuning keyboard instruments for centuries. With the exception of early music performers striving for authentic performance practice, the use of unequal temperaments was largely abandoned by piano tuners in the twentieth century—perhaps much earlier.

There are two quite different views as to when equal temperament came into widespread use as an explicit goal, if not precise in outcome:

- **EARLIER** With the universal acceptance of the piano after 1770 came universal acceptance of equal temperament. After 1800 (and c. 1850 in England), equal temperament was by far the most widely used tuning. From 1800 to the present, most music was composed and intended for performance in equal temperament. Most musicologists and early music specialists hold this view.
- **LATER** Equal temperament was not fully developed and in common practice and could not have been in common use until 1917. Furthermore, composition in the 19th century was influenced by considerations of the effects of various unequal temperaments. “Equal temperament” was commonly used in the 19th century to describe what were actually “well” temperaments. “Only the 20th-century style of piano music sounds most effective when it is performed in equal temperament. All other music sounds best in the appropriate authentic temperaments that were in use when the music was composed.”⁵

The discrepancy in these views—a difference of over a century, encompassing the entire Romantic period—has significant implications for tuning authentically for nineteenth-century piano music. If authenticity is the objective, a position must be taken that will guide the selection of temperament(s)—equal or unequal—during this era. The following two sections present guidelines and specific recommendations for selecting temperaments for historically-informed tunings.

⁵ Owen Jorgensen, “The Historical Temperaments: An Introduction,” *Piano Technicians Journal*, November 1994, pp. 35-38.

Guidelines and Recommendations of Owen Jorgensen

From point of view that equal temperament was not predominant until the early twentieth century, Owen Jorgensen offers this guiding principle for making temperament choices:

Only the 20th-century style of piano music sounds most effective when it is performed in equal temperament. All other music sounds best in the appropriate authentic temperaments that were in use when the music was composed.⁶

He gives the following time periods during which specific types of temperaments were predominant. These dates are extremely general and somewhat arbitrary because there was much overlapping between the categories. They should be considered only as a “rough guide.”

15 th -c. – 1690	Meantone & variants
1691 – 1721	Modified Meantone
1722 – 1818	Well Temperaments
1819 – 1901	Victorian Well Temperaments
1902 – 1916	Quasi-Equal Temperaments
1917 – present	Equal Temperament

The names of many of the temperaments on the Unequal Temperaments List (page 85) include a date, which may be helpful in selecting “temperaments that were in use when the music was composed.” *This guideline should not, however, preclude using temperaments that do not meet this criterion.* There are other considerations as well. Although not historically authentic, a modern temperament might well serve music written over 100 years ago, particularly when its “finished tuning results and color effects adhere...closely to the known nineteenth-century principles and rules...”⁷

To narrow the selection of a temperament for the 1722–1916 period, Prof. Jorgensen suggests this procedure: Tune the piano with the chosen temperament and then play it sufficiently to become accustomed to the new sounds. Play the music for which the temperament was chosen and concentrate on

⁶ Ibid., p. 35.

⁷ Personal correspondence, June 13, 2003

comparing the qualities of the major thirds, tenths, and seventeenths in the context of the vertical harmonies. These intervals will contrast in width and “color.” One’s personal taste and knowledge of the music can help determine whether less or greater color contrast is desired. If so, another temperament can be tried. (Well temperaments and their characteristics are discussed more fully beginning on page 107)

THE 19TH CENTURY Selecting historically-authentic temperaments for nineteenth century piano music poses a special difficulty. Prof. Jorgensen explains: “In the nineteenth century...any temperament in which one could freely modulate through all the keys was commonly called equal temperament no matter how unequal it might be.”⁸ This creates a great semantic problem with the result that, with regards to temperament, “we know less about the performance practice of the nineteenth century than we do of the centuries previous to it.”

“During the nineteenth century, all of the various temperament forms were used except our modern exact equal temperament. The only thing that is certain about the nineteenth century is that the meantone temperament forms were in the minority of usage in common practice, but they nevertheless still existed in practice. The nineteenth century was a transitional century leading to the equal temperament of the twentieth century.”⁹

On the next page, Owen Jorgensen offers a selected list of thirteen “historical landmark temperaments.” Each temperament is in the temperament directory folder that corresponds to the temperament form in the list. Here again, for convenience, are the very *approximate* time periods for the listed forms.

15 th -c. – 1690	Meantone & variants
1691 – 1721	Modified Meantone
1722 – 1818	Well Temperaments
1819 – 1901	Victorian Well Temperaments

⁸ Owen Jorgensen, “Understanding Keyboard Temperament,” *Piano Today*, Summer 2003.

⁹ Owen Jorgensen, personal correspondence, May 20, 2003.

LANDMARK HISTORICAL TEMPERAMENTS

Selected by Owen Jorgensen¹⁰

Meantone Temperaments

One-quarter comma meantone (Pietro Aaron, 1523)

Gottfried Keller ($\frac{1}{6}$ ditonic), 1707

One-sixth comma meantone (G. Silbermann, Ramarin-Bear), 1714

Modified Meantone Temperaments

Jean-Le Rond D'Alembert modified meantone of 1752

Modified equal-beating one-fifth syntonic comma meantone, 1797

William Hawkes improved modified meantone of 1807

Well Temperaments

Prinz, 1808 (Kirnberger III, Aaron-Neidhardt)

Werckmeister III (Correct No. 1), 1691

Francesco Antonio Vallotti theoretically correct, c. 1754

Th. Young's temperament No. 1 of 1799

Victorian Temperaments

Broadwood Best (Ellis tuner number 4), 1885

Broadwood Usual (Ellis tuner number 2), 1885

Moore (Representative Victorian temperament), 1885

¹⁰ Personal correspondence, June 13, 2003. See also Prof. Jorgensen's series of articles in the *Piano Technicians Journal*, August 2003 – January 2004

A Concise Guide by Claudio Di Veroli

Claudio Di Veroli—harpsichordist, early music specialist, and author of the treatise *Unequal Temperaments*—has compiled a Concise Guide to selecting temperaments, which in his judgment are the most useful for historically-informed performances of all Western music written from the Middle Ages to the present.¹¹ His recommendations will be particularly useful for early music performances: from earlier than 900 to the early nineteenth century. He holds the view that equal temperament was predominant from the late eighteenth century onward.

Dr. Di Veroli designates seven temperaments as “really necessary in practice.” They are in the Select Historical Temperaments folder in the Temperament Directory. He describes an additional five temperaments, included in the Concise Guide, as “interesting variants.” These are located in other directory folders according to their type. (In the Concise Guide table, the folder location for each temperament is in the last row.)

¹¹ “A Concise Guide to the Most Useful 12-Note Unequal Temperaments” is copyrighted by Claudio Di Veroli and distributed exclusively by Veritune, Inc. and may not be reproduced without permission.

A Concise Guide to the Most Useful 12-Note Unequal Temperaments

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<i>Preferred name</i>	Pythagorean Intonation	Pythagorean-Just Intonation
<i>Alternative name</i>		Ramos Just Intonation
<i>Technical name</i>	Pure-fifths tuning	Pythagorean-Just Intonation
<i>1st described Author</i> ¹	Ancient Greeks, St. Odo	Bartolomé Ramos
<i>1st described Place</i>	Cluny (France)	Spain (published in Italy)
<i>1st described Year</i>	c. 935	1482
<i>Heyday</i>	before 900 – c. 1500	c.1450 – c. 1500
<i>Place of main use</i>	All Europe	Possibly Spain and Italy
<i>Typical styles/ Ideal use</i>	Medieval Music	[Late Gothic and Early Renaissance]
<i>Typical composers— those ideally served by the temperament</i>	de la Halle, Machaut, Landini	Josquin des Prez [?]
<i>Basic description. Circle of Fifths</i>	11 pure fifths, leaving a small wolf to close the circle	Pythagorean shifted: the wolf is now a diatonic 5th, retuned to a Syntonic comma rather than Pythagorean
<i>Circle of Major Thirds</i>	Most M3rds are very wide; much more so than in Equal Temperament	Few diatonic pure major thirds. All the others are very wide.

(Continued on next page)

	Pythagorean Intonation	Pythagorean-Just Intonation
<i>Main Features</i>	Beautiful pure fifths. The very wide thirds are not a problem in Medieval music: they are used as dissonant intervals in Medieval counterpoint.	Transitional system. For Renaissance harmony — good thirds — the modulation scope is very restricted indeed. There are reasons to believe this system was rarely if ever used in musical practice.
<i>Variants</i>	Wolf shifts	Wolf shifts etc. Our preferred version follows Agricola, Wittenberg (Germany) 1539.
<i>Comments</i>	This tuning method, i.e. tuning by consecutive pure fifths, was known by many cultures (e.g. the Chinese) in very ancient times.	This and the "just" intonations, with their many pure intervals, deserved a totally out of proportion attention by theoreticians. But musicians knew that too many useful intervals were also thrown hopelessly out of tune.
<i>Verituner folder</i>	Select Historic	Pythagorean Intonation

NOTE:

[†] Earliest written account; sometimes earlier but often later than historical heyday!

A Concise Guide to the Most Useful 12-Note Unequal Temperaments

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<i>Preferred name</i>	Standard Meantone, wolf G#-Eb	Standard Meantone, wolf shifted counterclockwise
<i>Alternative name</i>	Aron's Meantone, wolf G#-Eb	Aron's Meantone, wolf C#-Ab
<i>Technical name</i>	1/4 Syntonic comma meantone, wolf G#-Eb	1/4 Syntonic comma meantone, wolf C#-Ab
<i>1st described Author</i> ¹	Pietro Aron	Pietro Aron
<i>1st described Place</i>	Florence (Italy)	Florence (Italy)
<i>1st described Year</i>	1523	1523
<i>Heyday</i>	c. 1500 – c. 1670	c. 1500 – c. 1670
<i>Place of main use</i>	All Europe	All Europe
<i>Typical styles/ Ideal use</i>	Renaissance and Early Baroque	Renaissance and Early Baroque
<i>Typical composers— those ideally served by the temperament</i>	Attaignant, de Victoria, Lassus, Monteverdi, English Virginalists	Attaignant, de Victoria, Lassus, Monteverdi, English Virginalists
<i>Basic description. Circle of Fifths</i>	11 fifths are equally-tempered by an amount such that the intervening major thirds are exactly pure.	11 fifths are equally-tempered by an amount such that the intervening major thirds are exactly pure.
<i>Circle of Major Thirds</i>	8 pure major thirds, 4 wolf major thirds	8 pure major thirds, 4 wolf major thirds

(Continued on next page)

	Standard Meantone, wolf G#-Eb	Standard Meantone, wolf shifted counterclockwise
<i>Main Features</i>	A most beautiful sounding system, but limited to 8 excellent major triads and 8 minor ones, the remaining wolf-ridden ones severely precluding modulation.	A most beautiful sounding system, but limited to 8 excellent major triads and 8 minor ones, the remaining wolf-ridden ones severely precluding modulation.
<i>Variants</i>	Other sizes of fifth (typically 1/5, 1/6 S.c. and many others), but 1/4 S.c. was almost always the preferred one.	Other sizes of fifth (typically 1/5, 1/6 S.c. and many others), but 1/4 S.c. was almost always the preferred one.
<i>Comments</i>	Modulation range was increased by split-sharp keyboards and string and wind players differentiating sharps from flats. Standard meantone remained in use in England until Classical times and sometimes later also.	Though there is evidence that the wolf fifth would sometimes be shifted as convenient, it is however a fact that the vast majority of the music was written for the standard wolf at G#-Eb.
<i>Verituner folder</i>	Select Historic	Select Historic

NOTE: ¹ Earliest written account; sometimes earlier but often later than historical heyday!

A Concise Guide to the Most Useful 12-Note Unequal Temperaments

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<i>Preferred name</i>	Standard Meantone, wolf shifted clockwise	Homogeneous Meantone, wolf G#-Eb
<i>Alternative name</i>	Aron's Meantone, wolf D#-Bb	Verheijen Meantone, wolf G#-Eb
<i>Technical name</i>	1/4 Syntonic comma meantone, wolf D#-Bb	1/5 Syntonic comma meantone, wolf G#-Eb
<i>1st described Author</i> ¹	Pietro Aron	Abraham Verheijen
<i>1st described Place</i>	Florence (Italy)	Amsterdam (Holland)
<i>1st described Year</i>	1523	c. 1600
<i>Heyday</i>	c. 1500 – c. 1670	c.1550 – c.1730
<i>Place of main use</i>	All Europe	All Europe
<i>Typical styles/ Ideal use</i>	Renaissance and Early Baroque	Late Renaissance and Early Baroque
<i>Typical composers— those ideally served by the temperament</i>	Attaignant, de Victoria, Lassus, Monteverdi, English Virginalists	Monteverdi, English Virginalists, Praetorius
<i>Basic description. Circle of Fifths</i>	11 fifths are equally-tempered by an amount such that the intervening major thirds are exactly pure.	11 fifths are equally-tempered so that the intervening major thirds are as good as the fifths.
<i>Circle of Major Thirds</i>	8 pure major thirds, 4 wolf major thirds	8 major thirds as good as the fifths, 4 wolf major thirds

(Continued on next page)

	Standard Meantone, wolf shifted clockwise	Homogeneous Meantone, wolf G#-Eb
<i>Main Features</i>	A most beautiful sounding system, but limited to 8 excellent major triads and 8 minor ones, the remaining wolf-ridden ones severely precluding modulation.	Not so beautiful sounding as 1/4 S.c., and still limited to 8 good major triads and 8 minor ones, the remaining wolf-ridden ones severely precluding modulation.
<i>Variants</i>	Other sizes of fifth (typically 1/5, 1/6 S.c. and many others), but 1/4 S.c. was almost always the preferred one	Wolf shifts. Also other sizes of fifth, but 1/4 S.c. was almost always the preferred one
<i>Comments</i>	Though there is evidence that the wolf fifth would sometimes be shifted as convenient, it is however a fact that the vast majority of the music was written for the standard wolf at G#-Eb.	Modulation range was increased by split-sharp keyboards and string and wind players differentiating sharps from flats. Wolf shifts away from G#-Eb were comparatively rare.
<i>Verituner folder</i>	Select Historic	Regular meantone

NOTE:

¹ Earliest written account; sometimes earlier but often later than historical heyday!

A Concise Guide to the Most Useful 12-Note Unequal Temperaments

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<i>Preferred name</i>	Early French	Standard French
<i>Alternative name</i>	Modified Meantone with 3 large fifths	Tempérament Ordinaire
<i>Technical name</i>	Modified Meantone with 3 large fifths	D'Alembert-Rousseau with 3 pure thirds
<i>1st described Author</i> ¹	(modern)	d'Alembert
<i>1st described Place</i>		Paris (France)
<i>1st described Year</i>		1752
<i>Heyday</i>	c. 1650 – c. 1710	c. 1700? – c. 1810
<i>Place of main use</i>	France and England	France and Italy
<i>Typical styles/ Ideal use</i>	Early Baroque French music	Late Baroque French music
<i>Typical composers— those ideally served by the temperament</i>	L. Couperin, D'Anglebert, Purcell, young F. Couperin	F. Couperin, Rameau, D. Scarlatti, A. Soler
<i>Basic description. Circle of Fifths</i>	9 standard meantone fifths, the 3 remaining ones wide, "sharing the wolf"	The six fifths from C to F# are standard meantone, the others less tempered, three actually wide.
<i>Circle of Major Thirds</i>	6 pure, 2 acceptable, 2 Pythagorean, 2 wolves	3 pure (C-E,G-B,D-F#), 6 good, 3 very bad (but not wolves)

(Continued on next page)

	Early French	Standard French
<i>Main Features</i>	A meantone modification achieving greatly-expanded, but not unlimited, modulation scope and enharmonic capability.	A meantone modification achieving unlimited modulation and enharmony, but some tonalities (e.g. F#, C# and G#/Ab major) sound really bad.
<i>Variants</i>	Few	Many. All the historical descriptions are approximative.
<i>Comments</i>	Never described in Baroque times, this temperament has been shown to be the ideal fit for F. Couperin's Organ Masses [Di Veroli and Leidemann, 1985]	New asymmetrical reconstruction with 3 pure thirds by C. Di Veroli 2002. Standard French has been proved best for Domenico Scarlatti [J. Sankey 1997]. Inadequate for many works by J. S. Bach.
<i>Verituner folder</i>	Select Historic	Select Historic

NOTE:

† Earliest written account; sometimes earlier but often later than historical heyday!

A Concise Guide to the Most Useful 12-Note Unequal Temperaments

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Veritune, Inc.

<i>Preferred name</i>	Vallotti	Vallotti-Young
<i>Alternative name</i>	Francesco Antonio Vallotti	Shifted Vallotti
<i>Technical name</i>	Contiguous 1/6 P.c. good temperament	Shifted Vallotti
<i>1st described Author</i> ¹	Tartini	Young
<i>1st described Place</i>	Padova (Italy)	England
<i>1st described Year</i>	1754	1799
<i>Heyday</i>	c. 1680 – c. 1810	c. 1680 – c. 1810
<i>Place of main use</i>	Germany and Italy	Germany and Italy
<i>Typical styles/ Ideal use</i>	Late Baroque German music	Good average for Late Baroque
<i>Typical composers— those ideally served by the temperament</i>	Pachelbel, J. S. Bach, Handel	Pachelbel, J. S. Bach, Vivaldi
<i>Basic description. Circle of Fifths</i>	Diatonic 5 ^{ths} (F-B) tempered by 1/6 P.c. each. The six other 5 ^{ths} are tuned pure.	Vallotti shifted clockwise: the tempered fifths are now from C to F#.
<i>Circle of Major Thirds</i>	Oscillate from quite good to quite bad	Oscillate from quite good to quite bad

(Continued on next page)

	Vallotti	Vallotti-Young
<i>Main Features</i>	Thirds vary smoothly, from distinctively better than Equal Temperament to quite bad in tonalities with many accidentals.	Thirds vary smoothly, from distinctively better than Equal Temperament to quite bad in tonalities with many accidentals.
<i>Variants</i>	Barnes-Bach, Kellner-Bach	Vallotti, Barnes-Bach
<i>Comments</i>	The ideal universal temperament for non-French Baroque music. Easier to tune aurally—and to check—than any other Baroque temperament.	A better variant for tonalities with sharps, and also for French Baroque. This is the ideal average temperament for Baroque music from different countries.
<i>Verituner folder</i>	Well	Select Historic

NOTE:

† Earliest written account; sometimes earlier but often later than historical heyday!

A Concise Guide to the Most Useful 12-Note Unequal Temperaments

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<i>Preferred name</i>	Barnes-Bach	
<i>Alternative name</i>	Barnes	
<i>Technical name</i>	Barnes	
<i>1st described Author</i>	Proposed by John Barnes	
<i>1st described Place</i>	Edinburgh, Scotland	
<i>1st described Year</i>	1979	
<i>Heyday</i>	c. 1690 – c. 1750	
<i>Place of main use</i>	Germany	
<i>Typical styles/ Ideal use</i>	J. S. Bach	
<i>Typical composers— those ideally served by the temperament</i>	J. S. Bach	
<i>Basic description. Circle of Fifths</i>	Similar to Vallotti; only B changes: E-B is pure and B-F# is tempered.	
<i>Circle of Major Thirds</i>	Oscillate from quite good to quite bad	

(Continued on next page)

	Barnes-Bach	
<i>Main Features</i>	An intermediate between the two Vallotti variants, slightly favouring the sharps. Almost undistinguishable from Vallotti in practice.	
<i>Variants</i>	Vallotti, Kellner-Bach (proposed by H. A. Kellner in 1978)	
<i>Comments</i>	Statistically a better fit than Vallotti for Bach's keyboard works. Not proven so for other composers. There are no historical sources for it, so for general non-French Baroque music, Vallotti is preferable.	
<i>Verituner folder</i>	Well	

NOTE:

A Concise Guide to the Most Useful 12-Note Unequal Temperaments

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<i>Preferred name</i>	Almost Equal	Equal Temperament
<i>Alternative name</i>	Almost Equal	Equal Temperament
<i>Technical name</i>	Almost Equal	Equal Temperament
<i>1st described Author</i> ¹	(modern)	Salinas ³
<i>1st described Place</i>		Spain
<i>1st described Year</i>		1577
<i>Heyday</i>	c.1750 – c.1880	Lutes & viols: c. 1550–1650. General: c.1780–present
<i>Place of main use</i>		Lutes & viols: mainly Italy. General: all Europe (England late)
<i>Typical styles/ Ideal use</i>	Classic & Romantic music ²	Late Renaissance lutes and viols. Classic, Romantic & Modern music ²
<i>Typical composers— those ideally served by the temperament</i>	Haydn, Mozart, Beethoven, Chopin, Schumann, Liszt, Brahms	Late Renaissance viol consorts; Mozart, Haydn, Beethoven, Chopin, Schumann, Liszt, Brahms, Debussy, Stravinsky, Bartók, Britten, Schönberg
<i>Basic description. Circle of Fifths</i>	8 fifths slightly narrower than Equal Temperament, 4 fifths slightly wider	All the 12 fifths equally tempered 2 cents narrow
<i>Circle of Major Thirds</i>	5 major thirds slightly wider than ET, 5 slightly narrower, and 2 very slightly narrower	All 12 thirds equally tempered 13.7 cents wide

(Continued on next page)

	Almost Equal	Equal Temperament
<i>Main Features</i>	Thirds vary smoothly and quite imperceptibly, from slightly better than Equal Temperament to slightly worse in tonalities with many accidentals.	Fifths uniformly good; major thirds uniformly “average” (actually quite bad).
<i>Variants</i>	Koval Variable 2.0	Approximative ancient methods like the “18”-rule and temperaments alternating pure and tempered fifths, described in Baroque times by both Marpurg and Neidhardt.
<i>Comments</i>	Historically very vaguely described, and variants were surely in widespread use. First precise description in 1978 by Claudio Di Veroli. Almost Equal cannot be considered a variant of ET; even less so the very-slightly more unequal Koval Variable 2.0	Even before its widespread use from the Classical period on (1750–), ET had many important but isolated advocates, like Frescobaldi and the mature Rameau.
<i>Verituner folder</i>	Well	[Select Equal on the Temperament submenu]

NOTE:

¹ Earliest written account; sometimes earlier but often later than historical heyday!

² Although not supported historically, there are some circumstances in which a well temperament might be used advantageously for performances of Classic era music, i.e. for the performance of predominantly diatonic music in keys that are favored by the temperament.

³ Earlier sources (e.g. Lanfranco, 1533) give descriptions that, quoting Barbour, “might be interpreted” as ET.

The Well Temperament as an Alternative to Equal¹²

The issue of authenticity aside, a growing number of piano tuners are exploring and using both historic and modern unequal temperaments and are sharing their knowledge and enthusiasm with others. They have found that well temperaments are an attractive alternative for many of their customers.

Advantages of Well Temperaments

Proponents of using alternative temperaments cite several advantages:

- Unequal temperaments are based on aesthetic considerations, versus the mathematical origin of equal temperament. Many find unequal temperaments musically and emotionally more satisfying.
- The expressive qualities of the music are enhanced by the variety of dissimilar interval widths and harmonic variation.
- In the more remote keys, wider intervals enhance the “singing” quality in melodies and emotional feeling in harmonies with greater intensity. Greater richness and warmth may be apparent in the lower register—greater sparkle and brilliance in the upper register.
- Key “color” and contrast—sacrificed in equal temperament—restore musical qualities composers may have intended by their key choices.
- For pianists who mostly play in keys with few or no sharps or flats, an unequal temperament can increase their piano’s overall consonance.
- Pianists whose pianos are tuned in an unequal temperament often sense an increased resonance in their instruments.
- If equal temperament was not predominant until the 20th century, the use of appropriate unequal temperaments will more accurately reflect composers’ intentions.
- In offering alternative temperaments, you distinguish your tuning services and give yourself a competitive edge. In the words of a leading proponent, Ed Foote, RPT: “It is an opportunity to deliver epiphanies

¹² Paul Bailey RPT, Ed Foote RPT, Ron Koval, and Bob Wendell contributed to this section.

to pianists. It is an opportunity to increase the emotional value of the music and to increase the attraction in the piano itself.”

- Exploring and using alternative temperaments can breathe new life into a tuner’s work.

Well Temperaments Defined

The use of *well* as a label for a class of temperaments is relatively recent. Owen Jorgensen says the well temperament was “the leading harpsichord and piano-forte temperament of the eighteenth and nineteenth centuries.” He defines it as an “unrestrictive temperament in which one can modulate freely through all the keys.... Unlike equal temperament (another unrestrictive temperament), well temperament contains key-coloring that supports the ‘character of the keys’, harmonic balance, and a pleasing and orderly variety while modulating.”¹³

As an alternative to equal, proponents of unequal temperaments usually suggest well temperaments for their harmonic, sensual, and emotional qualities and for their suitability for playing in all keys. Furthermore, they are effective for a wide variety of musical styles, although in some cases equal temperament may be preferred.

Characteristics of Well Temperaments

CONSONANCE AND DISSONANCE In equal temperament, all intervals of the same type are tempered equally (adjusted wide or narrow from pure), resulting in uniform widths. In unequal temperament, the interval widths are varied. In equal temperament, all major thirds are 13.7 cents wider than pure. Considering pure as perfect consonance, one might regard these thirds as equally out of tune and dissonant. In well temperaments, the major thirds can range from pure to as wide as a Pythagorean third—21.5 cents wide and regarded as the threshold for modern ears—resulting in a mixture of intervals that includes both more consonant and more dissonant intervals than in equal temperament. The most frequently used major chords (C, G, F) are the most consonant, and the most dissonant chords (Gb/F#, Db/C#, Cb/B) are those that are least used. Keys with the fewest sharps and flats are the most consonant, and the remote keys with the most sharps and flats are the most dissonant.

¹³ Owen Jorgensen, *Tuning*, Michigan State University Press, East Lansing, 1991, p. 779.

KEY COLOR AND CHARACTER The major third is the interval that contributes most to the perceived character of a temperament. Because the major thirds in a well temperament include ones that are both more consonant and more dissonant than equal, harmonic variety—tempered out of equal—results in the key character and color that is so valued by proponents. Consonance and dissonance are, of course, relative terms. The thirds that are wider than in equal might not be considered harsh as much as they are valued for their “spiciness”—the intensity they add to the harmonic and expressive palettes. Just as filters can enhance a photograph’s color and contrast, unequal temperaments can enrich chord and key colors compared to their monochromatic sameness in equal temperament.

HARMONIC BALANCE Another aspect of this broadened tonal spectrum is the orderly progression of consonance to dissonance in key signatures with few sharps or flats to those with the most, i.e., typically the major keys of C, G, and F are the most consonant, while F# or Db has the greatest overall dissonance. Following the circle of fifths, the general pattern is this: the narrowest major third is on C (at the top of the circle), and the widest is on F# (at the bottom) or Db; the major thirds become increasingly wider progressing from C to F# or Db and increasingly narrower in the progression from the bottom of the circle back to C. A temperament that follows such a scheme is said to have good “harmonic balance.” (A graphic representation of harmonic balance can readily be seen in Jason Kanter’s temperament charts, which are available at his website, listed in the resources section at the end of this chapter.)

Strength

There are many varieties of well temperaments, sufficient to suit a wide range of needs and tastes. They are distinguished by several qualities—some subtle, others more obvious. Among them are harmonic balance, equal beating, tempering of the fifths, synchronicity, and strength.¹⁴ The most apparent difference in these temperaments is their relative “strength,” i.e., the degree of contrast between the narrowest (the most consonant) and widest (the most dissonant) major thirds. The greater the difference, the “stronger” the temperament.

Strength refers to the perceived consonance and dissonance of a temperament and is, therefore, relative. As a means for describing and comparing strength, a

¹⁴ Owen Jorgensen defines an *equal beating temperament* as “any temperament that contains two or more intervals that beat exactly the same speed.” *Synchrony* is the result of tempering in such a way as to synchronize the beats within a chord with each other.

quantitative expression can be helpful. This can consist of simply stating the range of the narrowest and widest major thirds. In the first example the narrowest and widest thirds deviate modestly from the 13.7¢ of equal temperament thirds, making this a mild temperament. The second example is moderately strong.

Major 3rds range: 10.7 to 15.7 cents

Major 3rds range: 7.4 to 17.6 cents

Once again, in a well temperament the greatest contrast in the widths of the major thirds is typically in C-E and F# -A# (or Db-F). This single piece of information does not, of course, represent a complete picture of a temperament's sound and effect, but it does give an indication of its mildness or strength—in terms of overall consonance and dissonance—compared to equal temperament and to other well temperaments. For a more complete picture of temperament qualities, in graphic format, see Jason Kanter's charts.

The Verituner gives the major thirds range for all installed temperaments. In the Temperament Directory, press VIEW (for a built-in temperament) or EDIT (for a custom temperament). The range of major thirds for the temperament is displayed in the Temperament Viewer and Editor.

Owen Jorgensen describes a sub-variety of well temperament called **Victorian Temperament** that was most commonly practiced during the lifetime of Queen Victoria (1819–1901) “by those tuners who thought that they were tuning equal temperament.”¹⁵ Because they are relatively mild in their deviation from equal, this type temperament could be classified as a quasi-equal temperament. However, there is an important difference: the Victorian form of temperament follows the rules of tonality that result in harmonic balance and produce the ‘character of keys’ that is characteristic of well temperaments in general; quasi-equal temperaments do not. Victorian temperaments, and modern designs of this type and mildness, are particularly well suited as “starter” alternatives to equal temperament. Very mild ones are subtle enough in their effects that many listeners will notice only a vague difference in the tuning, if that. Here are a few examples of Victorian and modern temperaments in this category. These range from very mild to moderate in strength.

¹⁵ Owen Jorgensen, “The Historical Temperaments: An Introduction,” *PTG Journal*, November 1994, p. 36.

Temperament

Range of Major 3rds

Almost Equal	12.6 to 15.9
Koval Variable 2.0	10.9 to 16.0
Moore (Representative Victorian)	9.7 to 15.7
Wendell Well 2002	7.8 to 17.6
Coleman 11	7.7 to 17.7
Broadwood Best (Ellis Tuner #4)	6.7 to 17.7

Perception and Preference

For modern listeners, accustomed to equal temperament because of its prevalence, an unequal temperament can be an ear opener. Some effects of unequal temperaments will be perceived objectively, others subjectively. Where one listener might hear greater intensity of expression, another might hear harshness. For some, the appeal will be immediate; for others, an acquired taste and appreciation will develop over time; and for still others, equal will be preferred. A number of variables determine one's perception, but in general it is perhaps sufficient to say that with temperaments, beauty is in the ear of the beholder, and one's preferences will emerge through exposure and familiarity. For the proponents, alternative temperaments have added a wonderful dimension to their piano tuning work. The Verituner gives you many options for exploring the world of alternative temperaments.

Getting Started Using Alternative Temperaments

We conclude this section with some practical considerations for getting started using alternative temperaments.

Q *Where do I begin?*

A Genuine enthusiasm for alternative temperaments and conviction for their value can only come from a first-hand *musical* experience. If possible, tune a mild well temperament on a piano which you can play (or hear played) and allow ample time to become familiar with it. Do what your customers will do: *play music—not aural checks!* Play music in a variety of styles and keys. Focus on the qualities of color and key. Be sensitive to the varied degrees of consonance and dissonance. Above all, listen to the overall musical effect as compared to equal temperament. Has it been enhanced by the qualities of the well temperament?

When you are ready, move on to a somewhat stronger temperament and

take the time necessary to familiarize yourself with its qualities. If possible, compare the effects of the well temperament with equal temperament. As time allows, continue to explore additional mild and moderate strength temperaments.

From this experience you will form your opinions about well temperaments and whether you want to offer them to your customers. If you are “sold,” you will be able to confidently recommend temperaments that you are personally familiar with.

Q *Which of my customers might benefit from an alternative temperament?*

A In a typical clientele, a large percentage might come to prefer a well temperament to equal. The most important consideration is the type of music being played on the piano. If the preponderance is pre-twentieth century music, a recommendation for an alternative temperament would be appropriate.

Q *Are there circumstances in which equal temperament would be preferred to a well temperament?*

A Opinions on this vary among tuners, as do the preferences of individual pianists. Eventually your experience will be the best guide, but until then, a conservative approach would be prudent. Equal (or very mild well temperaments) may be preferred for popular and classical styles of twentieth-century music. Vocal music, which is often freely transposed to accommodate different voice ranges, may be unfavorably affected by arbitrary changes in key color and character, especially with moderate and strong temperaments. In performance situations, consider seeking the approval of the musician(s).

Q *How might I propose an alternative tuning to my customers?*

A [The response to this question is by Ed Foote.]

First, find out what kind of music is being played on the piano. If it is predominantly 20th-century American show tunes, or modern pop standards, etc., I don't even suggest changing it out of ET on first call. If there is a lot of pre-1900 music, I usually tell the customer that I think a slight change of temperament would be an improvement. They rarely question my judgment and I leave a mild WT like the Moore and Co. on the piano. If there are questions, I let them know that there is more than

one way to tune a piano and the clinically accurate ET is just one of them. Then I tell them that the vast majority of my customers, professional and non-professional, have come to prefer a more organic “equal” that is not really exactly equal but biased to favor the keys most often used. This is enough.

After the tuning, the music will do the heavy lifting and sell the concept for you. If they are really enthused, I tell them that there is an entire family of well temperaments that we can investigate in subsequent tunings. It gives them something to look forward to while they become acquainted with key color.

Since the differences between equal and well temperament are sensual differences, I find that verbal, intellectual descriptions are a poor substitute for the actual artifact and can lead to confusion. This is a new subject to most musicians today, and it begins to sound very complicated, very quickly.¹⁶ Many musicians are so set in their ways that suggesting a major change is viewed as a challenge, so you want to avoid that direction if possible. It is often helpful to describe temperaments such as the Broadwood tunings as the version of “equal temperament” used by master tuners of the 1800s. Customers respond to words like “organic,” or “increased resonance.” They often like to think they can appreciate “historical” anything. Comparing ET and WT is often most easily done by analogy, such as:

Equal temperament is like an architect’s drawing, very accurate, etc.; well temperament is more like an artist’s painting. Equal temperament has only one “color” or “in-tuneness” for all like intervals; well temperaments offer a palette of harmonic “shades.” Historically, the palette ranged from perfectly in tune to almost too far out of tune.

Q *How can I encourage a customer who is hesitant?*

A This is a matter of risk. If the customer is hesitant and you are optimistic about the potential gain for them, consider guaranteeing their satisfaction by offering to retune the piano after, say, two or three weeks if they are

¹⁶ For an introduction to the technical aspects of temperaments, consider referring interested customers to the website with Ed Foote’s CD liner notes, listed in the resources section following this section.

not satisfied. This shifts the risk from them to you, but if you have chosen the temperament wisely, the experience of other tuners suggests you are not likely to have to retune because of dissatisfaction with the temperament. Your confidence in presenting the suggestion of an alternative can make the difference in their acceptance. Testimonials of the satisfaction of your other customers can also reduce a feeling of risk.

Q *How do I go about choosing a temperament “wisely”?*

A The important thing is to not shock the customer with an extreme change. Ed Foote advises: “Err on the side of caution as they progress. It is easy to go further later, but almost impossible to reclaim the pianist who is offended by a change.” Begin with a mild well temperament of approximately the strength of Moore. Over time, the pianist(s) may come to prefer a stronger temperament, but too much too soon can spoil their potential appreciation and acceptance.

If the piano is used for music of a particular composer or period of music history, consider the guidelines, presented earlier in this chapter, for selecting temperaments that are appropriate for historically-informed performance.

Temperament Resources

An Introduction by Ed Foote

<http://www.uk-piano.org/edfoote/>

Ed Foote, RPT, has produced two CDs of piano music using several unequal temperaments. His liner notes for *Beethoven In The Temperaments — Historical Tunings on the Modern Concert Grand* is an excellent introduction to temperaments, addressing both technical and aesthetic considerations.

Jason Kanter’s Temperament Charts

<http://www.rollingball.com/>

Jason Kanter’s “graphic view of historical temperaments” is an informative visual presentation of the statistics and characteristics of a large number of temperaments, most of which are in the Verituner.

Claudio Di Veroli’s Temperament Page

<http://temper.braybaroque.ie>

Claudio Di Veroli lives in Bray, Rep. Ireland, where he teaches harpsichord and the interpretation of early music in his Bray Baroque center <<http://www.braybaroque.ie>>. His temperaments website includes downloadable spreadsheets and a full update of his book, *Unequal Temperaments*.

Pianotech Archive

<http://www.ptg.org/> [click the “Pianotech archive” link]

The Piano Technicians Guild maintains a list for piano technicians covering a wide range of topics, including temperaments. The archive can be searched.

Verituner User Forum

<http://www.veritune.com/> [click the Forum link under Customer Support]

Veritune’s user forum can be used by Verituner users to post temperament questions and to share knowledge, advice, and experiences. Previous posts can be searched.

Chapter 9

Creating Custom Styles

MENU > Style > Custom

The Verituner Custom Styles feature gives you exact control of how a tuning is calculated. When you create a custom style, you specify the type and degree of interval stretch throughout the range of the piano. This is done by selecting intervals and the desired beat rates.

Getting Started

Perhaps the most practical approach is to copy a built-in style or a custom style and modify the copy. To start with a copy of another style, open the Style Directory, select the style, and press COPY. To start a new style, select New Style from the Style menu, *or* open the Style Directory and press NEW. In the Filename dialog, press RENAME and name the file and SAVE it. The new file is saved in the Custom folder, and the Style Editor opens:

Style Editor		Style006	
A0	A3	A4	C8
A0			
6:3 OCT	4:2 OCT	4:2 OCT	4:1 DO
+0.33	+0.33	+0.33	0.00
100%	100%	100%	100%



EDIT

INSERT

SAVE

DELETE

CANCEL

The style display consists of a set of stretch points that identify the desired stretch at various points in the scale. (If you started a new style, the file will have only the four required starting stretch points—A0, A3, A4, & C8—to which you will add others. You are free to change their parameters.) The style is customized by adding, moving, adjusting, and/or deleting stretch points. To adjust a stretch point, first select it using the four arrow keys. A stretch point is selected when it is enclosed in a box:

A4
4:2 OCT
+0.33
100%

Editing Stretch Points

To edit the stretch point, press the **EDIT** key. This will display the stretch point alone on the screen. Each stretch point consists of four parameters:

<i>Note:</i>	<table border="1"><tr><td>A4</td></tr></table>	A4
A4		
<i>Interval:</i>	4:2 OCT	
<i>Beats:</i>	+0.33	
<i>Weight:</i>	100%	

Use the up and down arrow keys to select the parameter you want to edit.

- **Note** defines the position of the stretch point in the scale. Change the note with the NOTE and OCTAVE keys. When you change the note, the stretch point will move left and right on the screen relative to the scale bar on the top.
- **Interval** defines what type of interval is being tuned, listed by its size and coincident partials:

OCT	=	Single Octave	(2:1, 4:2, 6:3, 8:4, 10:5, 12:6)
DO	=	Double Octave	(4:1)
TO	=	Triple Octave	(8:1)
12th	=	Twelfth	(3:1)

To change the interval, press the CHANGE key. Each press of CHANGE selects another interval. Not all intervals are available in all parts of the scale.

- **Beats** is the number of beats per second present in the interval. Positive numbers indicate intervals that are wider than pure, and negative values indicate narrower than pure. Use the + and – keys to change this parameter.
- **Weight** is a weighting percentage used to set up a compromise among multiple stretch points on the same note. If there is only one stretch point on a note, this value is ignored.

Once you have made the desired changes to a stretch point, press the SAVE key to save your changes.

Inserting Stretch Points

To insert a new stretch point, press the Insert key. This will create a copy of the selected stretch point that you can edit. Initially the newly inserted stretch point will be on the note where you inserted it, but it can be reassigned to any note by editing it in EDIT mode. To delete a stretch point, select it and then press the DELETE key.

In a Custom Style, you can place more than one stretch point on the same note. This would be used to strike a compromise between two intervals—for example, a single octave and a double octave, or a 4:2 and a 2:1 single octave. Up to three stretch points can be placed on a single note.

The Verituner will blend your stretch points into all the notes between stretch points. You can place stretch points on as many different notes as you like. You must have a stretch point assigned to the first note in the scale, A0, and the last note, C8, because these define the endpoints. Also required is a stretch point on notes A3 and A4, because these are used to set the stretch of the Verituner's temperament octave, A3 to A4. The stretch settings for A3 and A4 should be identical.

In most cases you will also want to create at least one additional stretch point in the middle of the bass (between A0 and A3) and in the middle of the treble (between A4 and C8) in order to better control the octave stretch in these sections. You can define as many other stretch points as you want. However,

because the Verituner blends the notes in between your stretch points, having more than 6 or 7 stretch points is probably superfluous.

Saving and Using a Custom Style

Once you are satisfied with your custom style, press the SAVE key. The Custom Style Directory then opens. The new style is saved in the Custom folder. Rename it if you wish. Select it and LOAD it for use in the current tuning, or press EXIT to leave the directory without loading the style. Alternatively, press NEW to create another custom style.

To open a previously saved custom style, select

MENU > Style > Directory

Select the desired custom style in the Custom folder. Press Load. To see which custom style is in use in a tuning file, open the Custom Style Directory; the current style is highlighted.

Chapter 10

Measured Tuning

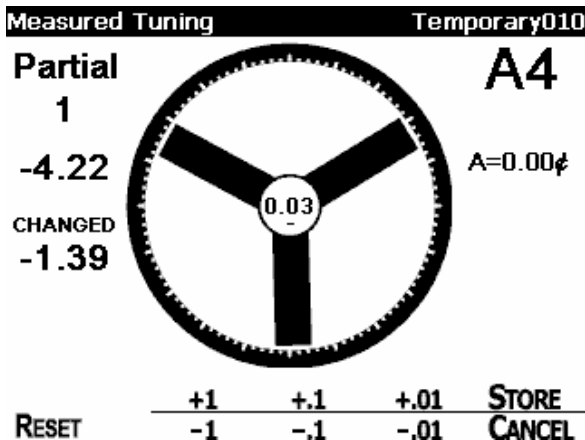
MENU > Function > Measured

The Verituner's Measured Tuning function is used to measure the pitches of an already-tuned piano or other keyboard instrument and store the measurements. Typically the tuning would be done either aurally or, perhaps, with an ETD. An aural tuning could, for example, be measured and stored, and the Measured tuning file could then be used to replicate the tuning at a future time. Measured Tuning is also used to score the Piano Technicians Guild tuning examination, which is covered in Chapter 11.

Unlike the Coarse and Fine Tuning functions, Measured Tuning does not measure inharmonicity and calculate tuning targets. Its primary function is measuring and storing pitches. Since there is no calculated stretch or Styles, Measured Tuning is not intended for tuning a piano *until* it has been tuned and all notes have been measured and stored. Once the measurements have been stored, it can be retuned by loading its Measured Tuning file from the Measured Tuning Directory. Theoretically, an **organ** has no inharmonicity and, therefore, no stretch. Thus, Measured Tuning could be used to tune an organ with a *new* Measured tuning with all offsets at 0.00. Since **harpsichords** typically do have inharmonicity, albeit low, they should be tuned in Fine Tuning.

Unlike standard tunings, in which the target of each note is based on multiple partials, each note in a measured tuning is based on the measurement of a single partial. Each of the 88 notes is preset to a default partial and zero offset. The current partial and offset are displayed at the upper left of the display, e.g., Partial 2 0.00. Press the **PARTIAL** key to change the partial. For example, you might want to change it if the default partial is weak or unstable. Successive key presses cycle through the available partials for the selected note. The default partials are:

A0 – B3	Partial 4
C4 – B4	Partial 2
C5 – C8	Partial 1



All notes in a new, “Normal” Measured tuning are set at 0.00. When a note has been measured and an offset has been determined and stored, the display will indicate this with: **STORED**. If either the partial or the offset is changed from the stored setting, the screen will display **CHANGED** and the partial and/or offset number will blink.

Default Settings

In Measured Tuning, AutoNote is *off* by default. Use the NOTE and OCTAVE keys to select a note. If you prefer, you can turn on AutoNote by pressing the AUTO key. Normal Measured Tunings display the hub number and the offset and CHANGED values (which appear at the left side of the screen) at a precision of one decimal (tenths of a cent). For information on decimal defaults and preferences, see page 74.

Procedure for Measuring and Storing a Tuning

Open a new Measured tuning and select from the options on the setup screen. If you select the Normal file type, you will have the option to rename it and select a folder in which to save it. If you choose Master or Examinee as the file type (for the PTG tuning exam), after naming it, the file will automatically be placed in the Master or Examinee folder.

Before beginning measuring and storing, minimize ambient noise as best you can. Set preferences for the spinner if you wish:

1. At the startup screen, choose:

MENU > Function > Measured > GO

Then, on the Measured startup screen, press NEW. *Or...* if another function, such as Fine Tuning, is open, you can start a new Measured tuning from the menu:

MENU > Function > Measured > GO

- a. In the Measured Tuning Setup screen, select the desired file type. Unless you are measuring a Piano Technicians Guild (PTG) exam tuning, select the **Normal** file type. The RPT Master and Examinee file types are for scoring exam tunings. (See Chapter 11 for that procedure.)
 - b. Set a pitch deviation, if desired.
 - c. Press ACCEPT.
 - d. If you started a Normal measured tuning, the Filename dialog opens. Press ACCEPT to accept the name with no change, *or* press RENAME and name the file.
 - e. Click SAVE. (As with Verituner standard tuning files, no additional save step is needed.)
 - f. MOVE the file to the desired folder; the file then loads.
2. **Strip mute the piano.** If you prefer, mute each individual note as you measure.
 3. **Check the tuning** and make any necessary final adjustments.
 4. **Measure and Store:**
 - a. Use the OCTAVE and NOTE keys to set the note you want to measure.
 - b. Change the partial, if you want. If you do, it will blink in the display, indicating it has been changed. If this tuning is being

measured for scoring the PTG tuning exam, *do not* change any partials.

- c. If necessary, pause until there has been a second or two of musical silence before beginning the next step.
- d. Press the MEASURE key and immediately...
- e. ...play the note at a moderately soft volume. In about a second, the offset that was measured will be displayed— as the *cents offset* number—under the partial number. It blinks to indicate that it has not yet been stored. Note that the commands change after pressing MEASURE:

RESET	+1	+1	+01	STORE
	-1	-1	-01	CANCEL

- f. If necessary, adjust the measurement manually. When the measurement (expressed by the cents offset number) matches the pitch, the spinner will have stopped or slowed as much as possible, and the needle and number in the hub will be as close as possible to zero. If there are pronounced variations in the pitch, from attack through decay, adjust the offset so the spinner is slowest, and the zero target is closest just following the attack.

To adjust the measurement, play the note (with a consistent, moderately soft volume) as you use the cents adjustment keys (+1, -1, etc.) to tweak the offset for the slowest spinner motion you can get. When the offset is changed, it will blink in the display.

If you are **re-measuring a previously stored note**, the difference between the stored offset and the new reading is displayed under the blinking offset:

CHANGED
+1.74

- g. Press the **STORE** key to store the offset and partial. (After storing, the word **STORED** appears below the offset, and the offset and partial stop blinking.) Press **CANCEL** to exit with no change.
5. Repeat step 4 until all notes are measured.

6. Confirm the measured tuning by playing each note in succession while checking that the spinner is virtually stopped for each.
7. To open a new file and measure another tuning, press New in the Measured Tuning directory.

NOTES:

- When playing a note, the difference between the target (the partial and offset) and the pitch being played is displayed in the spinner hub.
- In the Measure mode, a blinking offset number and/or partial indicates a change in the Verituner's offset measurement—a temporary setting until it is stored (by pressing the STORE key). If you move to another note before storing, the offset will be lost. The spinner, needle, and the number in the hub all indicate how close the pitch is *to the offset*—whether temporary or stored. Below the cents offset number, **STORED** or **CHANGED** indicates the current status.
- **RESET** sets the offset to 0.00
- **To re-measure** or tweak a note that already has a stored offset, repeat step 4.
- If you have a single-partial tuning measured by another tuning device, it can be transferred to the Verituner by keying in the partial number and offset for each note. Use these steps in the above procedure:

Step 1 – a-f

Step 4 – a, b, d, f, g

Step 5

Measuring an Interval

To measure the width of an interval in cents, follow this procedure. (An example using a Major 3rd is given in brackets.)

1. Turn AutoNote off, if it is not already off.
2. Set the Verituner to the lower note. [F3]
3. Use the Partial key to set the lower coincident partial. [5]

4. Measure and Store (steps 4 d-g on page 123).
5. Without changing the note setting or the partial number, play the upper note. [A3]
6. Read the width in the spinner hub. (A positive number indicates an expanded interval; a negative number indicates a contracted interval.)

Coincident Partials

Single Octaves	12:6, 10:5, 8:4, 6:3, 4:2, 2:1
Double Octave	4:1
Fifths	6:4, 3:2
Twelfth	3:1
Fourth	4:3
Major Third	5:4
Minor Third	6:5

Measuring a Tuning Fork

With Measured Tuning, the Verituner can be used as a reference to check the accuracy of a tuning fork. (The Verituner’s accuracy is = .01¢.)

1. Go to Measured Tuning and open a new tuning file.
2. Use the NOTE and OCTAVE keys to set the pitch of the fork (e.g., A4).
3. Use the PARTIAL button to select Partial 1, and be sure that the offset reads 0.00.
4. Sound the fork, and hold it close to the Verituner’s microphone (at the left end of the top panel). Hold the fork still.
5. Read the Verituner’s measurement of the pitch deviation (in the spinner hub).

For more on calibration—including how to calibrate a tuning fork—see Robert Scott’s informative article, “Calibration of Pitch References” in the August 2001 *Piano Technicians Journal*.

Chapter 11

Scoring the PTG Tuning Exam

The Verituner 100 can greatly facilitate scoring the Piano Technicians Guild (PTG) “Registered Piano Technician”(RPT) tuning exam. The Verituner is used to measure and store the tunings and score the results. Measured Tuning has been customized to provide this functionality. Each of these tasks—measuring, storing, and scoring—is presented in this chapter in a series of step-by-step procedures that are tailored to the exam. For a general coverage of Measured Tuning, see Chapter 10.

The Master Tuning

Open a New Measured Tuning for the Master Tuning

1. At the standard startup screen, choose:

MENU > Function > Measured > GO

Then, on the Measured startup screen, press NEW.

2. In the Measured Tuning Setup screen, select “RPT Master” for the file type, and leave the pitch at 0.00 cents.
3. Press ACCEPT.
4. In the In the Filename dialog press RENAME and name the file with a positive identification, e.g., Yamaha C7 F5862494 (File names can be up 24 characters and spaces.)
5. Click SAVE. The file is automatically saved in the Master folder and then loaded for use. (As with Verituner standard tuning files, no additional save step is needed.)

Measure and Store the Master Tuning

Before beginning measuring and storing, minimize ambient noise as best you can. Set preferences for the spinner, if you wish:

MENU > Preferences > Spinner

6. Check the tuning and make any necessary final adjustments.

7. Measure and Store:

- a. Use the OCTAVE and NOTE keys to **set the note** you want to measure.

NOTE: Since this tuning is being measured for scoring the PTG exam, *do not change the partial of any note* from the default setting. The partials are pre-set to PTG requirements.

- b. If necessary, **pause** until there has been a second or so of musical silence before beginning the next step.
- c. Press the **MEASURE** key and immediately...
- d. ...**play the note** at a moderately soft volume. In about a second, the offset that was measured will be displayed— as the *cents offset number*—under the partial number. It blinks to indicate that it has not yet been stored. (Values are displayed with one decimal, the precision used in the exam record.) Note that the commands change after pressing MEASURE:

	+1	+1	STORE
RESET	-1	-1	CANCEL

- e. If necessary, **adjust the measurement** manually. When the measurement (expressed by the cents offset number) matches the pitch, the spinner will have stopped or slowed as much as possible, and the needle and number in the hub will be as close as possible to zero. If there are pronounced variations in the pitch, from attack through decay, adjust the offset so the spinner is slowest and the zero target is closest just following the attack.

To adjust the measurement, play the note (with a consistent, moderately soft volume) as you use the cents adjustment keys (+1, -1, etc.) to tweak the offset for the slowest spinner motion you can

get.

Press the **STORE** key to store the offset and partial. (After storing, the word **STORED** appears below the offset, and the offset and partial stop blinking. If you want to exit with no change, Press CANCEL.)

8. Repeat step 7 until all notes are measured.
9. Confirm the measurements by playing each note in succession while checking that the spinner is virtually stopped for each. (If you want, set the first note and then turn on AutoNote for stepwise movement.)

Detuning the Piano

1. Load the Master Tuning.
2. To “detune” the piano prior to the examinee tuning, select:

MENU > Tuning > Detune

The Master tuning is now offset by the PTG-specified amount for each note. (The amount of the offset is displayed at the left side of the spinner.) Simply “tune” the piano to stop the spinner for each note. **NOTE:** The Detune offsets are temporary and *are not saved* in the tuning file!

3. When you are finished detuning the piano, turn off the Verituner. (The file has been automatically saved in the Master folder.)

NOTE: With Veritune’s VTsync software, the master tuning file can be installed in another Verituner, which can be used to score a future examination with this piano.

The Examinee Tuning

Three files will be used for the examinee. Two will be Normal measured tuning files—one for measuring A4 and the other for the stability and unison tests. The third and the most important file will be the Examinee tuning file which

will be used to measure and store the examinee's tuning of C1–B7. This file will be scored against the master tuning.

Before beginning these procedures, minimize ambient noise as best you can. Set preferences for the spinner, if you wish:

MENU > Preferences > Spinner

Open a New Measured Tuning File for Measuring A4

1. Open a new Measured tuning: MENU > Function > Measured
2. In the setup screen, select the file type Normal.
3. Press ACCEPT.
4. In the Rename dialog, press ACCEPT. (This file will be used only once, so there is no need to name it.) The tuning loads automatically.

Measure the Examinee's Tuning of A4

5. Mute A4.
6. Use the OCTAVE and NOTE keys set the Verituner to A4.
7. Press the PARTIAL key seven times to change the partial to **1**. (Ignore the number's blinking.)
8. **Measure A4.**
 - a. If necessary, pause until there has been a second or so of musical silence.
 - b. Press the MEASURE key and immediately...
 - c. ...play A4 at a moderately soft volume. In about a second, the offset will be displayed under the partial number.
 - d. If necessary, adjust the measurement manually. When the measurement matches the pitch, the spinner will have stopped or slowed as much as possible, and the needle and number in the hub will be as close as possible to zero.
If there are pronounced variations in the pitch, from attack

through decay, adjust the measurement so the spinner is slowest, and the zero target is closest just following the attack.

To adjust the measurement, continue to sound the note as you use the cents adjustment keys (+1, −.1, etc.) to tweak the offset for the best measurement you can get.

- e. Read the deviation of A4, which is the *cents offset number* (displayed below the Partial number).

[Measuring the examinee’s tuning of A4 is the only use for this file; it will not be used again. Turn off the Verituner while the examinee tunes C3–B4.]

Open a New Measured Tuning for the Examinee Tuning

9. Choose MENU > Function > Measured
10. In the setup screen, select “RPT Examinee” for the file type.
11. Leave the pitch at 0.00 cents.
12. Press ACCEPT.
13. In the Filename dialog, click RENAME and name the file, e.g., Deb Martinez 8-5-03
14. Click SAVE. The file is automatically saved in the Examinee folder and then loaded. (No additional save step is needed.)

Measure and Store the Examinee’s Tuning of C3–B4

15. Measure and Store:

- a. Use the OCTAVE and NOTE keys to **set the note** you want to measure.

NOTE: Since this tuning is being measured for scoring the PTG exam, *do not change the partial of any note* from the default setting. The partials are pre-set to PTG requirements.

- b. If necessary, **pause** until there has been a second or so of musical silence before beginning the next step.
- c. Press the **MEASURE** key and immediately...
- d. ...**play the note** at a moderately soft volume. In about a second, the offset that was measured will be displayed— as the *cents offset number*—under the partial number. It blinks to indicate that it has not yet been stored. Note that the commands change after pressing MEASURE:

RESET	+1	+1	STORE
	-1	-1	CANCEL

- e. If necessary, **adjust the measurement** manually. When the measurement (expressed by the cents offset number) matches the pitch, the spinner will have stopped or slowed as much as possible, and the needle and number in the hub will be as close as possible to zero. If there are pronounced variations in the pitch, from attack through decay, adjust the offset so the spinner is slowest and the zero target is closest just following the attack.

To adjust the measurement, play the note (with a consistent, moderately soft volume) as you use the cents adjustment keys (+1, −.1, etc.) to tweak the offset for the slowest spinner motion you can get.

- f. Press the **STORE** key to store the offset and partial. (After storing, the word **STORED** appears below the offset, and the offset and partial stop blinking. If you want to exit with no change, Press CANCEL.)

- 16. Repeat step 15 until all notes are measured.
- 17. Confirm the measurements by playing each note in succession while checking that the spinner is virtually stopped for each. (If you want, set the first note and then turn on AutoNote for stepwise movement.)

Score the Examinee's Tuning of C3–B4

18. Open the exam scoring function: MENU > Tuning > Score
19. In the PTG Exam Scoring screen, confirm the master and examinee tuning files are correct. If not, EXIT and load the correct file(s); then, reopen the Score screen (step 18).
20. Use the TEMP key to select the examinee's temperament octave.

NOTE: the **PCN** (Pitch Correction Number) is automatically calculated and displayed according to PTG requirements.

21. Use the **NOTE+** and **NOTE-** keys to move by step to the desired notes. The **Difference**, measured in cents, between the master and examinee tuning for each note is displayed beneath the note name. If the difference is sufficient to result in a point deduction, the number of **Points** deducted is shown. To facilitate the recording of points, press the **NEXT** and **BACK** keys to skip over the notes with a 0 points and see only those with a deduction.

Turn off the tuner while the examinee tunes the remainder of the piano.

Measure and Store the Examinee's Tuning of C1–B7

22. To measure and store C1-B7, follow the same procedure used in steps 15-17. In the midsection (C3-B4), re-measure and re-store any notes that have deviated.

Score the Examinee Tuning of C1–B2 and C5–B7

23. Follow the same procedure given in steps 18-21 to score C3-B4.

Open a New Measured Tuning for Checking Unisons & Stability

24. Open a new Measured tuning: MENU > Function > Measured
 - a. In the setup screen, select the file type Normal
 - b. Press GO.
 - c. In the Rename dialog, press SAVE. (This file will be used only once, so there is no need to name it.)

Score Tuning Stability

25. Before the test blows, measure and store the test note, following steps 15 a-f. (When the spinner is “stopped” the value in the spinner hub is 0.0.)
26. After the test blows, measure the note again, but do not store it. Adjust to stop the spinner. If the pitch has changed, the amount of the change is displayed under CHANGED.

Score the Unisons

27. Measure and store the *center* string of the suspect unison, following steps 15 a-f. (When the spinner “stops,” the value in the spinner hub is 0.0.)
28. Press MEASURE and then play the *left* string and, if necessary, use the cents adjustment keys to stop the spinner (step 15e). The number under CHANGED is the amount of the difference between the left and center strings.
29. Press CANCEL.
30. Press MEASURE and then play the *right* string, and, if necessary, use the cents adjustment keys to stop the spinner (step 15e). The number under CHANGED is the difference between the right and center strings.
31. Press CANCEL.

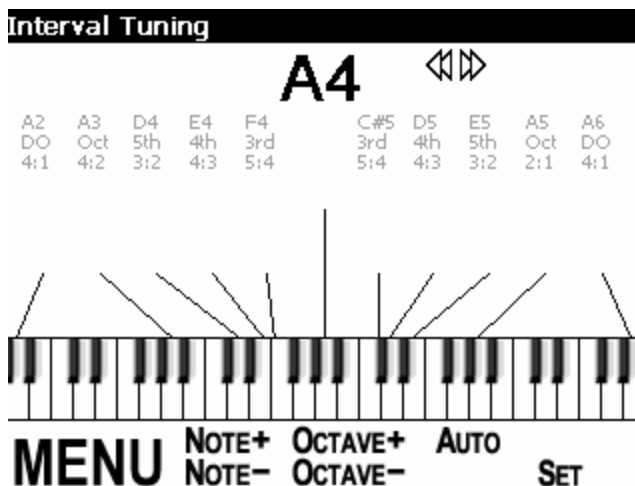
Chapter 12

Interval Tuning

The Verituner's Interval Tuning enables you to tune by interval beat rates. Unlike the other tuning modes, in which the Verituner calculates a target pitch, Interval Tuning calculates and displays the beat rates formed by the note you are tuning against other notes. You tune the note by adjusting its pitch until the desired beat rate is displayed. Although you could tune a piano with the Interval Tuning function, it was primarily designed as a learning aid, and for experimental tuning and research. Since it is not intended for day-to-day tunings, Interval Tunings are not saved.

MENU > Function > Interval

When you play a note in the Interval Tuning function, AutoNote identifies the pitch and displays its name between the various intervals listed at the top. The intervals are dimmed at this point. The keyboard is then repositioned to align the key you are playing with the pitch name.

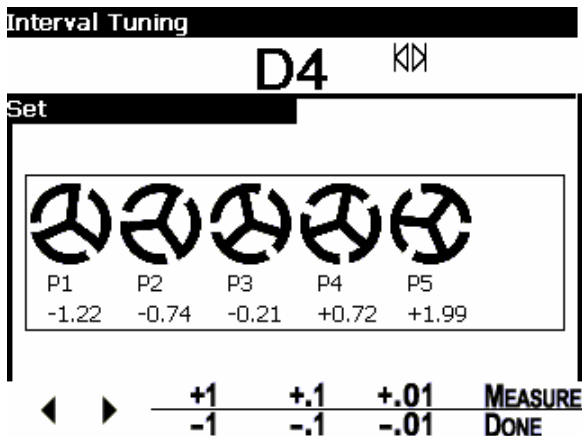


1. **Set the pitch of the starting note.** Start with any note, tuned to any reference, e.g., tune it in Fine Tuning or to a tuning fork. As you tune, the Verituner will identify and display the pitch name of the note. This first note will be “set” as the starting pitch.

Since only one note has been played, there are no intervals, which is why all the intervals on screen are dimmed gray.

2. **Press the SET key** to tell the Verituner what pitch you set. The Set screen then appears.

The Set display has a small ring & spinner for each partial that is used for this note in Interval Tuning. The function of this display is to *set the Verituner to the pitch of the note*—not the other way around, as is the case in the other tuning functions.



3. **Set the Verituner to the note.** While no note is sounding, press the MEASURE key...and then play the note (D4 in this example). If the measurement was successful, all the spinners will slow or stop, indicating that the pitch of each partial matches its target pitch.

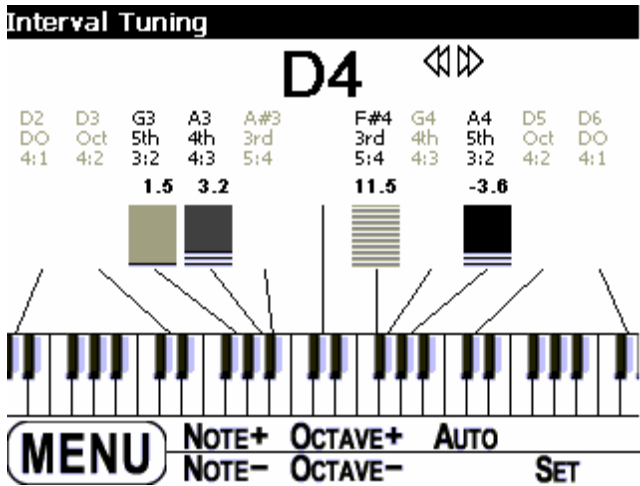
Underneath each spinner is its target pitch expressed in cents. When the spinner is stopped, the pitch it is hearing matches the target pitch. It

works the same as it does in Fine and Measured Tuning, but in these functions, the goal is match the pitch to the target. In Interval Tuning, it is the reverse—you are trying to make the Verituner target match the pitch.

When you press the Measure button, the Verituner attempts to change the targets to match what it is hearing. The goal is to have each spinner stop or slow as much as possible during the sounding of the note. Once this is achieved, the Verituner will know the pitches of the note's partials and will use them to calculate beat rates. If successful, the spinners will stop. If not, you can adjust the targets manually until the spinner stops.

In some cases the measuring function may not be able to find the pitch of each partial. This is indicated by spinners that have not completely stopped. If so, you can adjust partials individually to set the pitch. (See step 4).

- 4. If needed, set the pitch of individual partials.** Use the left and right arrow keys to select (enclose in a box) the partial that needs adjusting. Then, play the note as you press the number keys to adjust the cents, until the spinner stops. Repeat this procedure for each partial that needs it. If all partials are selected (enclosed in a box), the number keys will adjust all partials simultaneously.
- 5. Press the DONE key,** when the pitches are set. This returns you to the Interval Tuning screen.
- 6. Select the interval to check its beat rate.** Now use AutoNote or the NOTE & OCTAVE keys to select another note to form an interval. For example, if we select D4, the keyboard will reposition itself to align the D4 key with the D4 note name, and the interval labeled “A4/5th/3:2” will darken, indicating that the interval is active. As you play D4, a pulsating rectangle will appear above A4, pulsing at the beat rate formed by D4 and A4:



Additionally, the beat rate is displayed above the pulse, expressed as beats per second.

7. **Tune the note to the desired beat rate.** In the example, tune D4 to achieve the desired beat rate against A4. Note that as you tune you are always sounding *one* note, not an interval. The pulsing display and number will change as you tune the note. Once you are satisfied, press the SET key.
8. **Repeat steps 3-7 for each additional note to be tuned.**

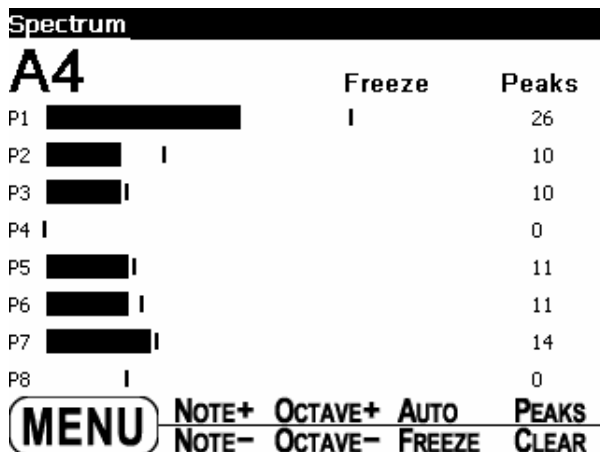
As you continue the procedure of tuning one note from one or more previously set notes, you will set the pitches of more notes, and then many beat rates can be displayed simultaneously. This enables you to see how the beat rates of all surrounding notes are affected by the note you are tuning or by any previously set note(s)

Chapter 13

Spectrum Display

MENU > Function > Spectrum

The Verituner's Spectrum Display shows the harmonic content of a note rather than its pitch. The display is a real time—what you are hearing is graphically represented instantaneously. The graphic representation consists of a set of horizontal bars, one for each partial: P1, P2, P3, etc. Spectrum Display displays the same partials that are measured and used to calculate tuning targets. (See Chapter 5)



These bars represent the relative strength of each partial—the longer the bar, the stronger the partial. Because they are displayed in real time, they dance across the screen as the note sounds and the tone fluctuates. By watching the sustain and decay of the notes, you can see how quickly certain partials decay

in comparison to others. The Spectrum display is useful for voicing, or for otherwise correlating what you hear in a note against its partial content.

NOTE: Ambient noise in the same range as the partials being measured will be included in the display. This should be disregarded since it is not part of the piano tone!

The **NOTE**, **OCTAVE**, and **AUTO** keys have the same functions they have in Fine and Coarse Tuning. The **PEAKS** key is used to toggle Peak Mode on and off. When on, the peak amplitude (volume) of each partial is remembered and displayed along with its real-time value in the column on the right. (See the illustration above.) When the Peaks mode is active, the word Peaks is displayed at the top of the display. The memorized peaks can be reset by pressing the **CLEAR** key. This arms the peaks memory for another note strike.

FREEZE is used to freeze the spectrum display. Press the key while a note is sounding, and the display stops responding and the bars remain frozen right at that point. This allows for a close examination of the readings. The display will remain frozen until the **FREEZE** key is pressed again.

Appendix A

Updating the Verituner's Firmware

The firmware is the Verituner's internal program that controls its operation and provides its various features. From time to time, Veritune may provide updates to the firmware, which include improvements and/or new features. The Verituner 100 enables you to conveniently update its firmware without the need to send it in for service. To perform firmware updates yourself, you will need a Windows PC or Macintosh computer, terminal emulation software, and access to the Internet. As an alternative to needing Internet access, the firmware file can also be obtained on a CD-ROM disk from Veritune, Inc. A computer, etc. is still necessary for installation.

Updating the Verituner's firmware is a safe procedure. An updater file will not be installed unless it is complete and free of errors. This is checked internally by the Verituner. Should something go wrong, the procedure can simply be begun again. Nonetheless, it would be prudent to save the most recent one or two firmware update files on disk. If there were a problem with the most recent update, you can reinstall a previous version. Any version of the firmware can be installed to replace any other version.¹

To see the version of the firmware that is installed, hold down the right arrow key (when it is a MENU key—not functioning as a navigation key) and read the number at the top left of the screen, e.g., 100-7.

¹ See page 4 for how to obtaining a readme document and the latest version of the User Guide, which cover changes and enhancements in the firmware updates.

Updating with a Windows PC

1. The firmware file first has to be on your computer. Follow these steps to download it:
 - a. Go to the Veritune home page <www.veritune.com> and click on “Customer Area.” The Forum screen will open.
 - b. Log on to the Forum. If you don’t have a user name and password, click the Register link and register; then log on.
 - c. At the bottom of the Forum screen, click the “Firmware Updates” link.
 - d. Follow the directions on the “Download Firmware” page.
 - e. When the download is finished, log off the Internet if you are using a dialup connection.
2. Connect the Verituner to your PC's serial port with the supplied serial cable.
3. In Windows, launch the **HyperTerminal** application, which is usually found on the Start menu under

Programs > Accessories > Communications
4. HyperTerminal will display a window titled “Connection Description” and prompt for a connection name. Type the name “verituner” (without quotes) and press OK.
5. HyperTerminal now displays a window titled Connect To. In the last dropdown box, choose one of the following:
 - If your external serial port is configured as COM1, select “Direct to Com1”; or...
 - If your external serial port is configured as COM2, select “Direct to Com2”

If HyperTerminal displays any error messages about not being able to open the COM port, you might want to check whether the port is in use by another program or device, such as a Palm Pilot or other PDA.

6. Next, a window titled COM Properties will be displayed. Change “Bits per second” to 38400 and change Flow Control to None. Click OK.
7. On the Transfer menu,
 - a. Select Send File
 - b. Press the Browse button
 - c. Navigate to the downloaded firmware file, and
 - d. Single click the update file to highlight it.
8. Turn on the Verituner and, then, immediately press and hold down the left arrow key on the tuner until you see two rows of numbers above and corresponding to the eight command keys.
9. Use the command keys to enter your six-digit firmware code assigned to your tuner by Veritune. Six labels (beginning with Port) will then appear, indicating the Verituner is ready to receive the firmware.
10. On the PC, click Send in the dialog to send the file to the Verituner. (Do not use the computer during this process.) Both HyperTerminal and the Verituner display the status of the file transfer. After the file has been received, the Verituner verifies its integrity. If the file is complete and error free, the Verituner screen will indicate that it is “Installing Firmware.”
11. When you see “Installation Complete” on the tuner’s display, power off the Verituner.
12. Disconnect the serial cable from the Verituner, and power on the tuner to confirm that the installation was successful.
13. Quit HyperTerminal. Select yes to disconnect. Select no to save.

The other connections to the adapter and computer can be left in place or disconnected.

Updating with a Macintosh

You will need a serial port at the computer to make the connection to the Verituner. Newer Macintosh computers—those released since and including the first iMac—have USB ports and do not have a serial port. If your model lacks a serial port, you will first need to connect a serial adapter to a USB port on your Macintosh or to a hub connected to the computer. Follow the directions supplied by the manufacturer of the adapter for connecting it and for installing the software driver.

Restart your computer and launch the Apple System Profiler (on the Apple menu). Click the Devices and Volumes tab, and look for the USB-232 Adapter connected to a USB port. If the Profiler recognizes it, you can quit the Profiler. [TROUBLESHOOTING: If the adapter is not recognized and listed by the Profiler: try connecting it first to a USB port on the Mac (the one to which your keyboard is not connected), and then use the Profiler to make sure that it is correctly recognized. You can then connect it to a USB hub, if you have one.]

If your Macintosh has a serial port, you can use the serial cable that connects your printer (or other device) to the serial port. Simply unplug the cable from the printer and plug it into Verituner's serial port (the large round connector). If you are using a USB-serial adapter, connect the large D-shaped plug of the serial cable to the adapter. Connect the smaller, round plug to the Verituner's serial port. Be sure the pins are correctly aligned with the port before pushing in the plugs.

Installing ZTerm on a Mac

ZTerm is a shareware program you will use to transfer the firmware from the computer to the Verituner. It runs on Macintoshes with the Power PC processor. If you are using OS X, it is recommended that you use the OS 9/PPC version of ZTerm in the classic environment. "After using ZTerm for 30 days, you must either register or delete any copies that you have."

1. Connect to the Internet and download the appropriate version of ZTerm at <http://homepage.mac.com/dalverson/zterm/>
2. Launch the ZTerm application.
3. On the Settings menu, select ZModem Options.

4. In the ZModem Options dialog, press the tab key to move the cursor to the Window Limit field, and enter the value 2048. Click OK.
5. On the Dial menu, choose Directory.
6. In the Dial Directory dialog, click the Connection button.
7. In the Connection dialog, change the Service Name from Local to Verituner. Leave the other settings as they are and click OK.
8. Pull down the Dial menu and choose Save Setup.
9. On the File menu, select Quit.
10. To check the setup, relaunch ZTerm. The window should now be named Verituner. On the Settings menu, select ZModem Options and confirm that the Window Limit is set at 2048. Click Cancel, and then Quit ZTerm.

Installing the Firmware on a Mac

1. The firmware file first has to be on your computer. Follow these steps to download it:
 - a. Go to the Veritune home page <www.veritune.com>and click on “Customer Area.” The Forum screen will open.
 - b. Log on to the Forum. If you don’t have a user name and password, click the Register link and register; then log on.
 - c. At the bottom of the Forum screen, click the “Firmware Updates” link.
 - d. Follow the directions on the “Download Firmware” page.
 - e. When the download is finished, log off the Internet if you are using a dialup connection.
2. If it’s not already done, connect the serial adapter to the Macintosh, and connect the Verituner to the adapter.
3. Launch the ZTerm application. An empty window titled Verituner opens.

- 4.** On the File menu, select Send Files, and on the submenu select ZModem.
- 5.** In the Open dialog, find the firmware update file and single click it to highlight it.
- 6.** Turn on the Verituner and, then, immediately press and hold down the left arrow key on the tuner until you see two rows of numbers above and corresponding to the eight command keys.
- 7.** Use the command keys to enter your six-digit firmware code assigned to your tuner by Veritune. Six labels (beginning with Port) will then appear, indicating the Verituner is ready to receive the firmware.
- 8.** On the Macintosh, click Open in the dialog to send the file to the Verituner. (Do not use the computer during this process.) Both ZTerm and the Verituner display the status of the file transfer. After the file has been received, the Verituner verifies its integrity. If the file is complete and error free, the Verituner screen will indicate that it is “Installing Firmware.”
- 9.** When you see “Installation Complete” on the tuner’s display, power off the Verituner.
- 10.** Disconnect the serial cable from the Verituner, and power on the tuner to confirm that the installation was successful.
- 11.** The other connections to the adapter and computer can be left in place or disconnected.
- 12.** Quit ZTerm. When prompted, do not save the current file.

Appendix B

Support

Contacting Veritune

Email	support@veritune.com
Voice	888.VERITUNE (888.837.4886) 773.467.0440
Fax	773.467.0444

User Forum

<http://www.veritune.com/> [click the Forum link under Customer Support]

To register, go to this Web page and click the Register link.

The Latest Version of This User Guide

When the Verituner's firmware is updated, the User Guide is also updated to reflect changes and/or new features. A readme document covering details of the update and a revised Guide are then made available at the Veritune Web site. From the Verituner home page <<http://www.veritune.com/>>, click the Downloads link, and on the Downloads page, click the link for the readme or the latest version of the User Guide. It is in PDF format and opens in Adobe Acrobat Reader.

If you do not have a version of **Adobe Acrobat Reader** that has searching capability, you can download it at

<http://www.adobe.com/products/acrobat/readstep2.html>

In Step 1, check “Include option for searching PDF files and accessibility support.” Once installed, use the binocular icons on the Acrobat toolbar to search the Verituner User Guide. The Guide can also be printed in Acrobat Reader.

Depending on the version of your Web browser, clicking the link of a PDF file will either download the file for viewing on screen, or it will download it and save it on disk. The second option is probably more desirable, since the Guide can be viewed at anytime with out having to go online and download it again.

If by default the file downloads only for viewing, you can opt to save it on disk by doing the following:

- On a **PC**, right click on the link and choose "Save Target As..." from the pop-up menu. At the prompt, select a location to save the file.
- On a **Macintosh**, hold down the control key while you press on the link. On the contextual menu that opens, select "Download Link to Disk." In the dialog that opens, select where you want the file saved.

An alternative method is to hold down the option key while clicking the link. The file will be saved in the download folder that is designated in the browser preferences.

These steps apply to Internet Explorer but probably work similarly with other browsers.

Repair & Shipping

If you feel your Verituner 100 requires repair, first contact Veritune to discuss the problem and arrange to ship the tuner to Veritune. Warranty repairs will be performed at no charge. Repair outside the scope of the warranty is available for a flat labor charge of \$75 plus parts. All repairs include complete testing, calibration and firmware updates.

When packing a tuner for shipment, the unit *must* be surrounded by at least 2 inches of packing material on all sides. The shipping carton should be filled tightly with packing material such that the contents do not move when shaken. All shipments must be insured, as you are responsible for its safe arrival at Veritune, Inc.

Appendix C

Verituner 100 Specifications

Battery Pack: See Appendix D

Screen: LCD, 320x240 resolution, with contrast adjustment and backlight with two levels of brightness
Keys: 12

Circuitry: High-speed Digital Signal Processing (DSP)

Microphone: built-in

External Jacks: power in/charge, mic in, line in, line out, serial port

Standard Pitch: A392 to A466 [−200¢ to +100¢]
Note Range: A0–C88

Accuracy: ± .01 cents

AC Adapter/Charger: Universal AC Input: 100-240V, 50-60Hz;
DC Output: 18VDC, 2.8A, center tip positive, inside tip diameter 2.1mm

An **alternative adapter** that will power the Verituner but not charge the battery is:

Radio Shack part #273-1773, 12V 500mA Power Adapter with Adaptaplug “M” part #273-1716. Set Inside + (plus) and Outside – (minus) by aligning the + on the male plug with the word TIP on the female end of the adapter’s cord.

Appendix D

Replacing the Verituner 100 Battery

The Verituner 100 uses a battery pack with the following specifications: Rechargeable Nickel Metal Hydride (NiMH) battery pack: 10 x 1.2V cell NiMH pack series-configured 4000mAh, 10K thermister, AMP connector #640250-3

After hundreds of charge/discharge cycles, the battery's runtime will begin to decline. This is an indication that you are approaching the time when it will need to be replaced. A replacement battery kit can be purchased from Veritune, Inc. or the battery pack can be obtained elsewhere. Replacement batteries supplied by Veritune, Inc. have been properly broken in before shipment. If you obtain a battery pack from another source, contact Veritune support for guidance on the proper break-in procedure.

Continuous power to the Verituner is not necessary for storage of data; for example, saved tunings, and custom styles and temperaments will not be lost in the process of switching out the old and new batteries. The Verituner uses "flash" memory to store data and does not require a backup battery.

By carefully following the instructions below, you should be able to successfully install a new battery. Be aware, however, that *Veritune, Inc. will not be responsible for any damage to the Verituner 100 that is incurred in the process of installing a battery.* If you do not want to do the installation yourself, consider having someone else do it, or contact Veritune, Inc.

Installation Procedure

For the installation you will need a #1 Phillips screwdriver and 1/4 inch nut driver. You may also need a T8 Torx driver. It is recommended that you read through the instructions before beginning the installation.

1. Place the Verituner face down on a soft cloth (such as a hand towel) to protect the LCD screen.
2. Use the #1 Phillips screwdriver to remove the four outside screws (with the recessed heads) on the back of the tuner. Set the screws aside.

3. Lift off the back, aware as you do that there is a cable connecting the two sections. *Take care that you do not touch the green circuit board and that no metal objects touch any part of the board.*
4. In this step you will disconnect the cable plug from the connector on the circuit board. *It is extremely important that once the plug is off there is no contact whatsoever between the plug and the connector.* Before disconnecting, notice the “catch” on one side of the plug and the connector that secures the connection. As you pull the plug from the connector, *there is no need for you to do anything to release the catch.* Hold the case with the circuit board, and gently rock the plug (in the direction of its narrow ends) as you pull away from the circuit board.
5. When the two sections of the tuner are apart, set aside the front section (with the circuit board).
6. The battery pack is strapped in the case back. Use the 1/4 inch nut driver to remove the four nuts that hold down the straps. Remove the straps and set them and the nuts aside.
7. Note the location of the battery cable in the tuner case. (When you put in the new battery, you will position its cable in the same place.) Now remove the battery.
8. Position the new battery in the case back—with the cable in the same location as the old battery’s cable. Note the guides in the case that help position the battery properly in the center.
9. Replace the two long straps over the long sides of the battery. Next, replace the two short straps.
10. Tighten down the four nuts snugly, but do not over tighten. If the nut does not tighten properly, stand the case on its narrow bottom, and hold the screw head with a T8 Torx driver, to keep it from rotating, while you tighten the nut.
11. **Very Important** The battery cable *must* be connected properly or damage to the tuner will result and it will have to be returned to Veritune, Inc. for repair. Even the briefest incorrect connection will cause damage!

To make this connection correctly, be sure that (1) the **black** wire is positioned nearest the edges of the circuit board and the case, and the red

wire is furthest from the edge—closer to the center of the board than the black wire; and (2) the catch on the plug and on the connector face the same direction.

- 12.** Hold the section with the circuit board and align the plug with the pins. When you are sure the alignment of the plug and connector is correct, gently rock the plug as you push it onto the connector until it is seated.
- 13.** Align the two sections of the case. With the front panel face down, screw the sections together. Again, snug but don't over tighten the screws.

LIMITED WARRANTY

This Verituner™ 100 unit is sold with a ONE YEAR LIMITED WARRANTY. Veritune, Inc. warrants for one year from the day of delivery that the enclosed Verituner unit will be free of defects in workmanship and materials, and that the embedded software shall operate substantially as described in this handbook. As the sole remedy for breach of this warranty, Veritune, Inc. will either repair or replace, at its sole option and expense, any unit having any of the defects described above. This warranty does not extend to any misuse, modification, disassembly or accidental damage of the Verituner unit that is outside the control of Veritune, Inc.

VERITUNE, INC. MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY, NONINFRINGEMENT AND FITNESS FOR A PARTICULAR PURPOSE.

This warranty shall be governed and construed in accordance with the laws of the State of Illinois, and the parties hereby agree to bring any claims arising hereunder before the jurisdiction of any court of the State of Illinois regularly sitting in Cook County, Illinois, or if such claims includes issues subject to the exclusive jurisdiction of the federal district courts, before the United States District Court for the Northern District of Illinois. If any provision of this warranty is declared to be invalid and/or unenforceable, the parties agree to substitute for the invalid and/or unenforceable provision a valid and enforceable provision which approximates the intent and economic effect of the invalid and/or enforceable provisions as closely as possible.

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