



How to use the **peterson** AutoStrobe 490 for Tap Tuning

by

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Supplementary Instructions for Tap Tuning with the Peterson AutoStrobe 490

The Peterson AutoStrobe 490 is a device that measures the frequency of a tone emitted from a sound-producing system (strings, instrument, chime, etc.) and displays the frequency to an accuracy of 1/10th of a cent (percentage of a semitone) on a true stroboscopic screen. In addition to displaying the pitch, the system uses an additional data screen to display the specific note (*A*, *A#*, etc.), as well as the user's chosen settings and parameters.

How it works:

Signals picked up by the Peterson AutoStrobe are converted into voltage, which is used to drive a group of high intensity lamps to flash behind a rapidly revolving disc at exactly the same rate as the frequency at which the tapped plate is vibrating. The disc (Fig. 1) is printed with a unique pattern comprised of several concentric rings, each populated with bars. Each sequentially larger ring has twice as many bars as the adjacent smaller ring.

When the Peterson AutoStrobe 490 detects a signal, it automatically adjusts the motor to one of 12 fixed speeds representing the 12 notes of the scale. Then, depending on the frequency of the

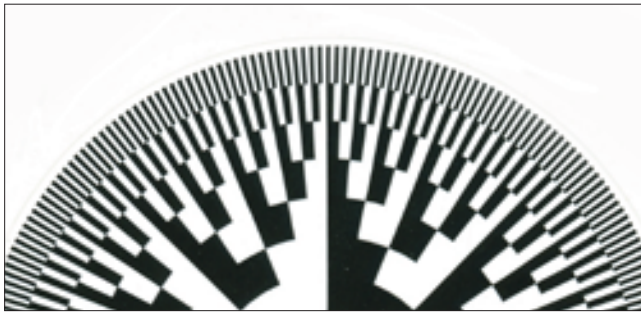


Fig. 1. The disc of the 490 has a unique pattern with seven concentric rings representing the various octaves of the musical spectrum.

signal, the flashing lamps make the images on the spinning disc appear to stop, which, in turn, produces a true stroboscopic image of the signal's pitch, amplitude, and harmonic content. Depending on the signal's "distance" (i.e. sharp or flat) from ideal pitch, the disc's image appears to move

clockwise (indicating sharp), counter-clockwise (indicating flat), or appears to come to a complete stop (indicating an in-tune state). The darkest, most striking image represents the fundamental note, but the Peterson AutoStrobe 490 also displays overtones of a particular note as fainter images. The band that appears most vivid indicates the tuning qualities of that note.

Here's what happens: When an *A440* note is played into the Peterson AutoStrobe 490, it causes the light to flash 440 times per second (Hz) and the disc is made to spin at 55rpm; a speed that is equivalent to the pulse rate of the lowest octave of *A* (first octave *A* is 55Hz). If the light was flashing 55 times second, the first band would appear to be stopped. But since the fourth band on the disc has 440 bars, and the light is flashing 440 times a second, the fourth band appears to stop. (The combination of the strobe flashing at 440Hz and the fourth band of the disc moving its images past the lamp 440 times per second causes the band to appear as if it stopped.) Remember that first octave *A* is *A55* (55Hz or cycles per second), second octave *A* is *A110*, third octave *A* is *A220*, and fourth octave *A* is *A440*.

Why strobe tuners for tap tuning?

Regular digital tuners (those that don't have spinning discs but use either digital [i.e. numerical] readouts or a moving needle/arm) are great for tuning strings and instruments that have sustain. However, for tap tuning, a tuner is needed that will provide instantaneous responses. Here's why:

When a string is excited (Fig. 2), the initial "attack" is followed by several seconds of continued vibrational modes of the string that are the result of the relationship between the energy of the attack and the energy stored in the string (because the string is at tension). And, there is some additional sustain caused by the restoring force. However, when a body or object is tapped – as in tap tuning a violin or mandolin soundboard, or tuning a drum – the attack is abrupt, followed by very little sustain (Fig. 3). In essence, we say that the tapped tone has a fast peak and a fast decay.

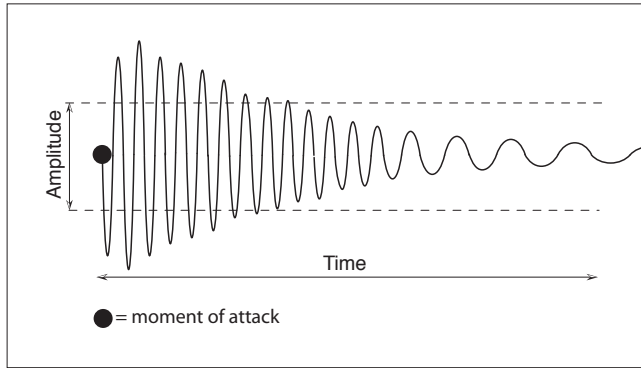


Fig. 2. When a string is picked or plucked, the period of vibrations continues for a long period of time because of the elasticity of the wire, the tension of the string, and the restoring force of the soundboard or membrane to which it is attached.

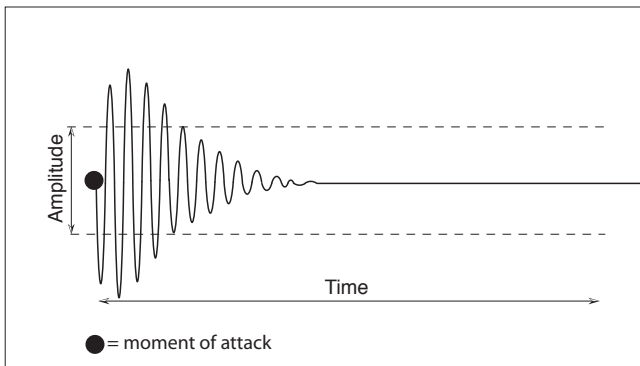


Fig. 3. When a soundboard or backboard is tapped, the vibrational modes decay quickly.

What separates “true mechanical” (spinning-disc) strobe tuners from regular digital tuners used to tune instruments are:

1. Tuners with a regular digital display have to choose between fundamental and overtone signals which, in a complex signal, can be of similar amplitude. The true mechanical strobetuner shows all components of the signal on the disc without having to pick the fundamental or the overtone. When in AUTO mode the Peterson AutoStrobe 490 employs a totally separate note detect circuit to select the note; this method does not compromise the true stroboscopic display. By comparison, LED, needle, or LCD displays only have two settings - on or off, preventing the signal's subtle and complex amplitude characteristics during the attack/decay phase to be revealed. True mechanical strobetuners show amplitude in the form of continually variable brightness.

2. Digital tuners do not operate in real-time. They are designed to take several samples during the

first few seconds of the string's sustain, calculate the data, and report the results to a digital display. However, since there is no significant sustain in tap tuning (Fig. 3), regular digital tuners cannot read and report the information quickly enough for an accurate reading. By the time a regular digital tuner can sample the signal of a tapped tone, the signal of the tap-tuned object has decayed. Regular digital tuners are extremely accurate for showing the pitch and are excellent for tuning strings, but when it comes to tap tuning, digital tuners are not as fast or comprehensive as a true mechanical (spinning wheel) strobe tuner.

For tap tuning, we need a device capable of measuring and reporting the initial attack and displaying this information instantly. This is what a spinning-wheel strobe tuner, like the Peterson AutoStrobe 490, is designed to do and does it very well.

There is a feature of the Peterson AutoStrobe 490 that is very helpful, but one you will disable after the initial phase of the tuning process; this is the Auto Note Selection Mode (“AUTO”). In Auto Note Selection Mode the Peterson AutoStrobe 490 detects the note being sampled and then changes the speed of the wheel accordingly as it begins to flash the impulses of the note behind the disc. While the AUTO mode is effective, the time it takes to get the disc up to the desired speed is a bit too slow for tap tuning purposes. Initially, the AUTO mode is quite handy to find the resonant frequency of the part being adjusted. Once that note is determined, the system should be changed to manual mode (MAN). With the note manually selected, the disc will always be set to the speed for that frequency and be ready for instant response as adjustments are made to the acoustical structure of the instrument (see feature 6, pg. 4).

Enhancing the signal:

No matter how fast the strobetuner is, the fast peak and decay of a tap-tuned signal is still much too short for you to read the results on the tuner. The use of a signal sustainer, like our #825 Compressor, will extend the note for about one to one-and-a-half seconds and provide more time for you to determine what the tap tuned note is.

The set up is rather simple: the microphone plugs into the compressor and the compressor plugs into the Peterson AutoStrobe 490.

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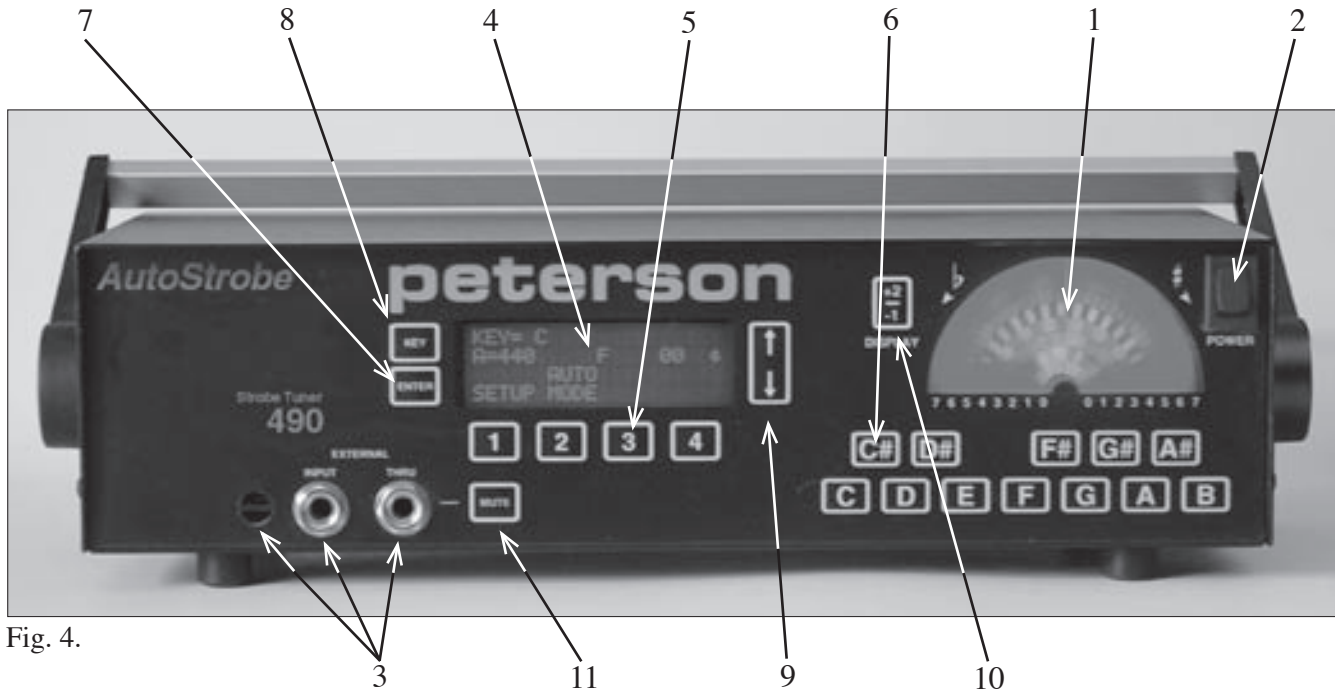


Fig. 4.

Features and functions of the Peterson AutoStrobe 490:

Note:

The numbering sequence below follows the diagram on page 5 in the *Peterson AutoStrobe 490 Strobe Tuner Instruction Manual* (that came with your tuner) in case you wish to cross reference.

1) Frequency window:

This is the 8-octave spinning disc driven by a special motor. The faceplate is marked “0” through “7” to indicate the band on the disc that references each octave. The lower octaves are nearer the center of the disc, the upper octaves are nearer the outer edge of the disc.

2) Power switch:

A rocker switch that is set up for on and down for off.

3) [left] Internal microphone:

This small window to the left of the “INPUT” jack contains a built-in microphone that works quite well for most piano and related applications where the sustain and clarity of the note are significant. However, because you are searching for delicate tonal qualities, we recommend using our #826 Tap Tune microphone (which has been enhanced for tap tuning) or some other dynamic microphone.

3) [middle] “INPUT”

This port accepts a standard male phono jack port to accommodate the phono plug on our #826 Tap Tune microphone, or the phono plug of some other dynamic microphone.

3) [right] “THRU”

This microphone connection is handy if you have a need to use the Peterson AutoStrobe 490 in an environment where you want to pass the microphone’s signal through the unit and to an amplifier or recorder (such as if the system were being used in a musical performance). If a microphone jack is in the THRU port, pressing the MUTE [11] button will disconnect the THRU signal so that an instrument can be tuned without the tuning being heard in the amplifier or recorder. Pressing the MUTE button a second time will reconnect the THRU signal.

4) LCD menu screen

This digital display shows information about the note being tuned along with information about any of the selections made by the functions buttons.

5) Function buttons

The four function buttons (numbered “1” through “4”) are used to control various menu items that are displayed in the LCD menu screen. In the

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Fig. 5. The four FUNCTION keys, 1 thru 4 control the settings that appear directly above them in the LCD menu screen.

various menus displayed, the function button can have a different purpose based on which menu is displayed directly above the corresponding function button.

6) Manual note-selection buttons

The 12 manual note-selection buttons force the tuner to measure only the note selected and to disengage the tuner from the auto-search (AUTO) mode. For example, if the *A#* button is pressed, the tuner's disc will only show notes that are *A#* (from *A#* -50 cents to *A#* +50 cents) and not be sensitive to other notes.

Note:

Manually setting a desired note is an important feature for tap tuning because it disables the auto search mode and sets the disc to spin at the desired frequency that makes the tuner instantly sensitive to values in the selected note. For example, if you manually set the system to *G* and tap a *G* tone bar, the tuner is ready to instantly report the *G* values.

7) "ENTER"

The ENTER button is pressed to acknowledge and accept a setting or change that is displayed in the LCD menu screen.

8) "KEY"

The KEY button enables the Peterson AutoStrobe 490 to reference other notes in the scale of the same key that the musical instrument is tuned to. Pressing the KEY button steps through the pre-set keys of *C*, *Bb*, *F*, and *Eb*. (This function is not used in the tap tuning process. For more information on the use of this function, refer to the Peterson AutoStrobe 490 manual)

9) UP and DOWN arrows

The UP (arrow up) and DOWN (arrow down) buttons have two functions:

1) In the SETUP modes, used to increase or decrease a setting on the LCD screen as required by various menu items.

2) In the tuning mode, used to adjust the "offset" or speed of the disc (relative to the frequency) and for determining precisely how sharp or flat a note is. Each time the up or down arrow is pressed, it advances or retards the offset by .1 cents. Pressing both the UP and DOWN arrow keys at the same time resets the deviation to 0. Example: If you were to tap a note and it was slightly sharp, the disc's image would appear to rotate slowly in a clockwise direction (indicating that the note was sharp). To determine how sharp a note is, you can press the UP arrow key until the disc's image appears stationary. The numbers in the LCD screen immediately to the left of the UP and DOWN arrow keys display the number of cents that the note is sharp or flat.

10) "+2" and "-1"

These buttons are used to expand the range of the notes displayed on the disc. While the disc has 8 bands, numbered 0 to 7 on the face panel of the Peterson AutoStrobe 490, there are times when you might seek a greater range. By using the +2 and -1 buttons, the Peterson AutoStrobe 490 is capable of providing a measurable range of 11 octaves. (This function is not necessary for tap tuning.)

11) "MUTE"

The MUTE button is used to disconnect the pass-through signal from the THRU female microphone port. Pressing MUTE will disconnect the THRU port [3] and pressing MUTE a second time will connect the THRU port. If the Peterson AutoStrobe 490 were to be used as a tuner during live performances or recordings, pressing the MUTE button would enable tuning of the instrument without the signal being sent to the amplifier or recorder. (See "3" on page 3.)

SET UP SCREENS:

Note: The Peterson AutoStrobe 490 manual describes a multitude of functions that are controllable in the LCD menu screen. This *Tap Tuning Set Up Manual* references only those functions that are necessary for tap tuning.

Supplementary Instructions for Tap Tuning

Automatic or manual note selection modes:

The Peterson AutoStrobe 490 can display information in either automatic (AUTO) or manual (MAN) note selection modes.

Automatic mode (AUTO):

In the AUTO mode, once the Peterson AutoStrobe 490 detects a signal, it:

- 1) Deciphers the fundamental frequency of the pitch played.
- 2) Changes the speed of the disc's motor to spin the disc at the corresponding cycles per second.
- 3) Instantly flashes the strobe light in relation to the frequency of the pitch being heard.
- 4) Displays the pitch of the discovered note on the LCD Menu Screen.
- 5) Enables viewing of the image on the disc of the Peterson AutoStrobe 490 after the disc motor arrives at the correct speed. The band closest to the center of the disc that appears as a readily discernable and stable pattern – whether it is rotating slowly clockwise or slowly counterclockwise – is the resonant frequency of the note being displayed.

Manual mode (MAN):

In the MAN mode, the pitch desired can be pre-set using one of the 12 note keys: C, C#, D, D#, E, F, F#, G, G#, A, A#, B. When in manual (MAN) mode the Peterson AutoStrobe 490:

- 1) Adjusts the speed of the disc's motor to spin at the corresponding cycles per second and readies it for instant response.
- 2) Instantly flashes the strobe light in relation to the frequency of the pitch being detected.
- 3) Enables instant viewing of the image on the disc of the Peterson AutoStrobe 490. The band closest to the center of the disc that appears as a readily discernable and stable pattern – whether it is rotating slowly clockwise or slowly counterclockwise – is the resonant frequency of that note.

Note: To enter the MAN (manual) mode, press the “2” function button. The system will change to manual mode and the disc will spin at the

speed for the note last recognized by the Peterson AutoStrobe 490. The words “AUTO MODE” (directly above the “2” button) will change to “MAN MODE.”

Increments sharp and flat:

There are 100 steps or “cents” between each note (0.5 & 0.1 cent steps are also selectable). Each display of the wheel indicates a range of cents from 0 to -50 and 0 to +50 (with 0 in the middle). When the disc's image appears to be standing still, the string or part being tuned is in perfect pitch.

Menu adjustments:

There are only a few settings that specifically relate to tap tuning, and these are accessible through the SETUP mode. To enter SETUP, turn power on, press the “1” key; the LCD screen will refresh and say “SET UP MENU. PLEASE SELECT MODE.”

• OPTN (option, function key “1”) will step through the menu selections. Each subsequent menu is advanced by pressing the NEXT (function key “1”) key. The four sequences of menus are:

RECALIBRATE TUNER? This menu allows you to set the tuner to some other tuning standard besides A=440. If you wish to use A431 (of which C=256 is part), you can use the DOWN (function key “3”) or UP (function key “4”) to change the frequency for A. (Pressing the RUN key returns to the normal tuning mode.)

KEY SETTING. This menu displays the current key that the system is set to. To change the key (not typically used for tap tuning. For more information on these settings, please refer to the Peterson 490 instruction manual.)

AUTO-NOTE SETTING. This menu allows turning ON or OFF the AUTO NOTE selection mode. Set it to ON.

STORE VALUES IN SYSTEM MEMORY? This menu allows you to store the setting you just made into the system's memory. The new values are retained and appear automatically when the tuner is next switched on.

• FILE (function key “2”) will take you to the TEMPERAMENT MENU (not typically used for tap tuning. For more information on these settings, please refer to the Peterson 490 instruction manual.)

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- RUN (function key “3”) will enable you to exit from the SETUP menu and return the system to the normal run mode.
- DIAG (diagnostics, function key “4”) will run a series of diagnostics. (For more information on these tests, please refer to the Peterson 490 instruction manual.)

Finding the right note:

Tapped tones of instrument parts include the overtone series (the partials), along with the fundamental so there is a possibility that the Peterson AutoStrobe 490 could indicate an almost-still wheel that is actually a measurement of a strong partial rather than that of the fundamental. Typically, this is due to how and where the part is tapped and not a defect of the Peterson AutoStrobe 490. To ensure that you are reading the fundamental, it is important to tap several times in different places on the part being measured and look for the most vivid image on the wheel as well as the lowest note achieved. It is also important to note that tapping in the center of the soundboard or backboard tends to produce a stronger fundamental which, in turn, produces a more vivid image in the tuner's disc display.

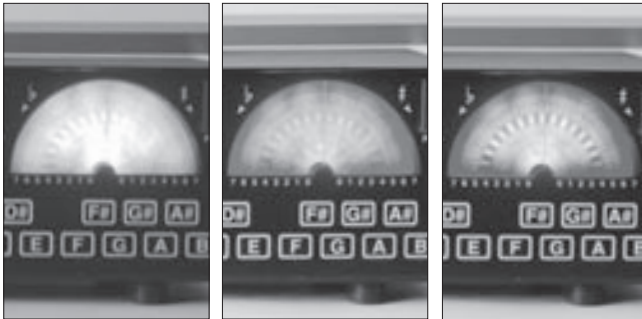


Fig. 6. Partial and noise are displayed along with the fundamental. These samples show three qualities of the disc display analyzed by the tuner: questionable (left), possible (center), absolute (right).

Each time a soundboard or backboard is excited, it will evoke the partials as well as the fundamental, and these partials are also displayed on the disc at various intensities (according to the signal's strength and clarity). The discs in Fig. 6 show examples of a questionable target, a possible target, and an absolute target.

Accessories:

We carry a full line of Tap Tuning tools and accessories to help you with your tuning processes, available on-line at www.siminoff.net



Fig. 7. Tap Tune Hammer, #820. Double-felted tapping face, ball handle to enable rotating hammer forward to each force for every tap.



Fig. 8. Compressor, #825, to expand the sustain of tapped notes. Microphone plugs into compressor, compressor plugs into strobetuner.



Fig. 9. Tap Tune microphone #826, dynamic microphone modified to be more directional, with slide-in base and mounting screw.

For information or service for your Peterson 490 Strobetuner, contact:

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