

INSTRUCTION MANUAL

for the

***Sanderson
Accu-Fork II***

INVENTRONICS, INC.

130 Middlesex Rd, #14,
Tyngsboro, MA 01879

Toll-free, 1-800-FAST-440
Telephone 978-649-9040

INTRODUCTION

The Sanderson Accu-Fork™ II is the updated version of the original Sanderson Accu-Fork™ (SAF) that was introduced in 1980. The original was the first tunable electronic tuning fork with the accuracy and stability to meet the needs of professional piano tuners and musicians. The Sanderson Accu-Fork II that you have in your hands retains the popular features of the original Accu-Fork:

- ◆ Four notes from A4 through C5.
- ◆ Pleasant oboe-like tone quality.
- ◆ Long battery life.
- ◆ Small size and light weight.

And there are many improvements as well:

- ◆ The CENTS scale is over 2.5” long (40 mm), twice as long as before, making measurements easier and more accurate.
- ◆ The VOLUME control is now independent of the ON-OFF switch so that volume can be set to a constant, comfortable level.
- ◆ The NOTE selection is now made with four pushbuttons instead of a slide switch.
- ◆ Each NOTE button also toggles the unit ON and OFF, for greater convenience in comparing beat rates with and without the Accu-Fork.
- ◆ The Accu-Fork II makes it easy to measure the pitch of a piano, and then to set its initial pitch sharp/flat by just the right amount to cancel out the anticipated drop of a pitch change.

- ◆ Setting pitch and raising pitch to a non-440 value of A is just as easy as tuning to standard pitch when you use the CENTS control as explained in this manual.

The Accu-Fork II with its four notes has an advantage over a single tuning fork in setting a quick aural temperament. After setting four pitch notes to the Accu-Fork II, the rest of the temperament is easy to pull in with thirds and fourths. One simple method is explained in this manual, or you can use your own if you wish.

The original Accu-Fork was very popular among piano tuners for many years, and while it was off the market Inventronics received many requests to have it manufactured again. We are very happy to be able to produce the Sanderson Accu-Fork II, and hope that it meets the needs of our customers even better than the original Accu-Fork.

Dr. A. E. Sanderson
Inventronics, Inc.

SPECIFICATIONS

Notes: Four notes in the octave above middle C, A4, A#4, B4, and C5. Pushbutton ON/OFF controls.

Accuracy: Each note is within ± 0.3 cents and each semitone is within ± 0.2 cent over the range 50° to 90°F.

Stability: No warm-up is required, drift from turn-on is less than 0.1 cents

Tone Quality: Clear oboe-like sound, having all harmonic overtones from 1 through 8.

Volume Control: Continuously adjustable with slide control from pianissimo to forte.

Note Control: Each note has a pushbutton that toggles it ON or OFF. Pushing a different note button will change the pitch to that note.

Cents Control: Slide control with center detent at zero cents, with a range of ± 50 cents. End stops at ± 50 cents are accurate to within ± 1 cent.

Battery: Alkaline 9-volt transistor battery. Battery life about 100 hours. Low battery light.

Size and Weight: 1 x $2\frac{3}{4}$ x $4\frac{1}{2}$ in, (25 x 68 x 115 mm). 6.5 oz. (181 grams).

DESCRIPTION

The controls for the Sanderson Accu-Fork II (SAF) are located on the wide side for convenient operation whether the SAF is placed on the piano or in a shirt pocket. NOTE pushbuttons are also ON/OFF buttons, and toggle the unit between ON and OFF. Pushing the button for a different note will change the pitch to that note.

The CENTS control is the upper slide control, with a centering detent at zero cents. The full range is fifty cents flat or sharp, and the first twenty cents sharp or flat is expanded for better accuracy near standard pitch. The scale marks are at ± 5 , ± 10 . and every 10 cents thereafter up to ± 50 . Although the cents slider appears to go beyond ± 50 cents, the pitch does not.

The VOLUME control is also a slide control, and has its centering detent at a volume that should be correct for tuning a piano. The instrument is calibrated with the VOLUME at the center position.

The LOW BATTERY warning light is next to the volume control. To prevent unnecessary battery drain, the Accu-Fork automatically turns off after approximately one minute.

INSTRUCTIONS

Setting Pitch. Setting an instrument to pitch with the Accu-Fork II is a lot easier than doing so with a tuning fork because the Accu-Fork does not have to be held in one hand and struck to get a tone! In fact both hands are free to tune with, and the Accu-Fork can be turned ON and OFF with a note button without affecting the CENTS or VOLUME control settings.

Standard Pitch. To tune for standard pitch, set the CENTS control to zero cents (the detent), and set the VOLUME control so that the Accu-Fork is as loud as the instrument being tuned. If the instrument is not already in tune you will hear beats between the two sound sources. Tune the instrument until the beats disappear.

Using a Test Note. For greater accuracy, use F2 on the piano as a test note. Play the interval F2-A4 and listen to the beat rate. Then play the interval F2-Accu-Fork "A". When the pitch is right, both beat rates will be the same. If the piano is flat, its beat rate will be the slower of the two, and vice versa. Since the ear can judge the equality between two beat rates more accurately than it can judge a zero-beat unison, this method gives better accuracy. The actual beat rate is irrelevant as long as both intervals

are wide (as they should be), and you are free to retune the test note at will to get a beat rate that is convenient to hear.

Non-standard Pitch. Non-standard pitch can be set easily if you know the cents value for the desired pitch. To figure this out, take the difference between 440 and your pitch, then multiply by four to get the equivalent number of cents. For example, to tune to 442 Hz rather than 440 Hz, take the difference between the two numbers, 2 Hz, and multiply it by four. The result, 8.0 cents, is the equivalent number of cents. Just set the Accu-Fork eight cents sharp and perform the procedure described above for tuning to standard pitch.

Measurements. Since the SAF is tunable, measuring an unknown pitch is very easy. Play the unknown pitch together with the SAF, and adjust the SAF to eliminate beats to the maximum extent possible. Now read the CENTS scale of the SAF to find the cents value of the unknown pitch. For even better accuracy, use a test note to compare the pitches.

To convert a cents reading to equivalent Hz, reverse the above formula. That is, *divide* the cents reading by four and add or subtract this number from 440 Hz. For example, a pitch that measures 12 cents flat, is equivalent is 437 Hz ($440 - 12/4$).

A Quick Aural Temperament. Setting an aural temperament starting from all four notes of the Accu-Fork is much easier than setting one starting from a single note with a tuning fork. Here is a way to set an F3-F4 temperament that is especially easy to learn since no beat rates need to be memorized, they all come from the piano as you tune it. This method also gives you full

control over the octave stretch, while fitting rising thirds within that octave.

1. Set A3, A#3, B3, and C4 beatless to the Accu-Fork. Use test notes F2, F#2, G2 and G#2 for maximum accuracy.

2. Tune F3 against A#3 and F4 against C4 so that these fourths beat equally. Make the F3-F4 octave sound just the way you want it, with up to one-half a beat roll on the wide side of pure.

3. Tune C#4 with three contiguous thirds so that the central A-C# third is midway in beat rate between the beats of the F-A and C#-F thirds. Contiguous thirds will then beat in a 4:5 ratio.

4. Tune G3 until its third against B3 beats halfway between its whole-tone neighbors, F-A and A-C#. Tune D#4 similarly until its third against B3 beats halfway between its whole-tone neighbors, A-C# and C#-F.

5. Tune F#3 so that its third against A#3 beats halfway between its semitone neighbors, F-A and G-B. Tune G#3 similarly so that its third against C is halfway between semitone neighbors G-B and A-C#. Tune D4 similarly so that its third against A# beats halfway between its semitone neighbors A-C# and B-D#. Finally, tune E4 until its third beats halfway between its semitone neighbors B-D# and C#-F.

6. This completes the temperament. Check the fourths to see that they are all about the same beat rate, and check the fifths which should all be very slow if the octave has been stretched slightly as was described in step 2.

This temperament gives perfectly rising thirds since all have been tuned in sequence to put them halfway between a pair of appropriate neighbors. Some polishing may be necessary to improve some wide fourths on some pianos, but the fifths are usually no problem and should lie close to pure. The pitch of A4 may be slightly sharp, a cent or so, when it is tuned up from A3 as a slightly stretched octave, and if this is of concern, check A4 directly against the Accu-Fork after tuning it to make sure it is not too sharp.

Pitch-Raising Pianos. Because all pianos have a very strong tendency to return to the pitch they started from, use the following technique to pitch raise a piano in one pass. If a piano is simply tuned up to standard pitch, it will return to its previous pitch by one-quarter to one-third the amount of the attempted pitch change. To circumvent this problem, go above pitch by the right amount and the piano falls back to the desired pitch.

Calculate the Correction. First measure the current pitch of the piano. For best accuracy, measure the pitch of all four Accu-Fork notes and average them. Take one-third of the measured flatness, set the Accu-Fork sharp by this amount, and tune the piano to the Accu-Fork. After the piano has been completely tuned, you will find that the piano will have dropped from its sharp pitch to 440 Hz, just where you wanted it! It is ready to take a fine tuning immediately.

Caution. Be careful when the piano is more than 50 cents flat, a pitch raise could be dangerous to its health. Proceed with caution as follows: First of all, you can't measure the pitch of A4 directly because it is more than 50 cents flat, which is beyond the cents control. Instead

of measuring A4, find the note that *is* within 50 cents of A4. Subtract 100 cents for every semitone the note played is sharper than A4 to get the true pitch.

Let's use an example to make this clear. On a given piano, the note whose pitch is closest to A4 turns out to be B4, and its pitch measures $A4 + 30$ cents. The piano is actually 170 cents flat ($+30-200$), and therefore A4 should initially be tuned 57 cents sharp ($170/3$). The Accu-Fork would be set to $A\#-43$ cents, which is 57 cents sharp from A4.

Old Pianos. Discretion is advised on old pianos with rusty strings that might not be able to take a full pitch raise. On the first pass it is safer to bring the piano up to pitch and see how this works out. If strings start to break, you can tune the piano below pitch as necessary. If the first pass is successful, you can use the pitch raising procedure on the second pass. The piano will be about one-third as flat as it started, so less overpull will be necessary.

Tuning Pianos to Pipe Organs. The main problem with tuning pianos to pipe organs is the temperature sensitivity of pipe organs. Pianos change very little with temperature, but cold organ pipes go flat, and warm pipes go sharp. The amount is dramatic - the pitch changes 16 cents (4 Hz) for every 10° F change in temperature! If at all possible, measure the pitch of the organ at the normal operating temperature. The air around the pipes should be the same temperature as when the organ and piano are to be played.

If that is not possible, correct for the temperature difference. Measure the pitch of the organ on several pipes and average them. Then multiply the temperature

difference in °F by 1.6 to determine the equivalent cents correction. Tune the piano to a different pitch from the organ by this many cents, flat if the organ is hot, sharp if it is cold. Please note that this correction is *not* necessary for electronic organs.

Optional Note Selection. The standard four notes for the Accu-Fork are A4, A#4, B4 and C5. Other note selections are available on special order, they just need to lie within the span of a single octave. There is an additional charge for this service, call us if you want this information before you order.

Care and Feeding. The Accu-Fork normally requires very little maintenance, battery replacement every 100 hours or so, and a calibration check about once per year.

Replacing the Battery. The Accu-Fork uses a 9-volt battery, either an alkaline or an extra-life battery. To replace the battery, (the battery cover is located on the lower back side of case) press down on the arrow symbol on the battery cover and slide the cover off. Remove the old battery, being careful not to pull on the battery wires. Replace the battery and reinsert it into the battery compartment, locating the wires in such a way that they lie beside the battery and not under it. Center the battery from side-to-side, and slide the battery compartment cover back on.

Calibration. Sanderson Accu-Forks built since 2004 have a crystal reference and don't require an annual calibration adjustment.

Recalibration of Accu-Forks built before 2004.

To recalibrate an older Accu-Fork we recommend using a Sanderson Accu-Tuner™ since other tuning instruments are not as precise. First, remove the battery compartment cover. Look for the small screwdriver adjustment on the board just behind the battery compartment, and find a screwdriver with a 3/32” blade. Set the Accu-Fork to A4, zero cents, set the Accu-Tuner to A6, zero cents (A6 is the fourth harmonic of A4 and will give finer calibration of the SAF). Play the Accu-Fork and turn the adjustment screw to stop the lights. That’s all there is to it, so you can put the Accu-Fork back together again.

If you want to check the accuracy of the other notes on the Accu-Fork, set the Accu-Tuner to the fourth partials of the Accu-Fork notes (A#6, B6, and C7). Play each in turn and stop the lights with the Accu-Tuner cents controls. There is no field adjustment for these three notes, they can be corrected at the factory if any of the notes drift outside of the specifications.

Toll-Free, 1-800-FAST-440

Tel, 978-649-9040

Fax, 978-649-9413

©2009, Inventronics, Inc.,

Tyngsboro, MA 01879.