

## ADJUSTING THE TUNING OF THE PIANO

In Western music, the dominant tuning system has been the 12 tone **Equal Temperament (ET)** system. In this system all the notes within an octave are divided into 12 equal distances. Unfortunately ET is a tuning system that does not correctly represent what really happens at a micro pitch level when an orchestra, jazz or vocal ensemble plays. Unfortunately, a piano cannot adjust for temperament (smooth sounding chords) as an ensemble easily can.

The historical advantage of ET has been that the misrepresentation pure harmony is evenly distributed among the 12 notes of an octave so that the level of the error is equal in all 12 keys. This allows for modulation in any key with an equal amount of roughness relative to the pure sounding harmonies that ensembles can achieve. The solution to this tuning problem is to use **just intonation**. In this system, one can set the tuning to the key of C **just intonation**, then as long as one plays in the key of C, the listener is able to hear the smooth sounding harmonies of ensemble playing from a piano. The challenge for a keyboard player arises when an ensemble changes key, because the tuning of each pitch also changes to reflect the new key. The practical problem for keyboard players is that they cannot change the tuning of their instrument unless software allows this feature. Unfortunately, most software is not real-time friendly. To add to the difficulties, often ensembles will think vertically and the tuning is in reality a floating just intonation system where each chord is referenced to itself and not referenced to a particular key. This system gives the maximum harmonic smoothness for each chord regardless of the key. For a keyboard player to follow this, the **just intonation** key has to be changed before every chord (the key would be the root of each chord) so a C maj 7th chord would require a C **just intonation** tuning but if the next chord is F# min7 then the tuning has to be changed to F# **just intonation** before the notes of this chord are played.

There is now a solution to this variable tuning that keyboardist can use. It is embedded in the Blüthner Digital Model One. The system enables a keyboardist to adjust the tuning in real time. The floating just intonation system however is more realistically achievable if one uses a sequencer. In the BDMO the tuning can be changed in two ways. Both approaches can be recorded into a sequencer and also edited after the original performance. There are two approaches both require the user to press the tuning button - outlined in a red rectangle on the upper screen shot below. The lower screen shot shows that the tuning is active because the same button colour has changed to a grey tint.



To activate the tuning feature press the BypassTuning button - when it turns grey the feature is activated.



## VARIABLE TUNING APPROACH ONE

The first approach: use the lowest midi notes (below A0) in order to adjust to the tuning key. Even though these notes do not trigger a sound the **BDMO** converts to the just intonation key to the note played in this range. In this example we will use an Oxygen V2 keyboard. First set the octave range to -4 now all the notes from the lowest C to the upper G will trigger a change in tuning scale. The only exception occurs when G#0 is played - it converts the keyboard back into **equal temperament**. The advantage of this is that you can quickly switch to any **just intonation** key, then switch back into equal temperament by triggering G#0. Because the sequencer can record these notes, this is all programmable. In a real time performance, a keyboardist can have 2 keyboards one a small Oxygen 2 octave keyboard for adjusting the tuning and a regular sized one for playing.



In this range C-1 to G0 you can select the just intonation key by triggering (and recording) one of these notes. To change the just intonation key simply trigger the desired note. To switch back into equal temperament simple play the G#0 note (has a red rectangle around it).

A0

When Octave set to 04 this A note is the lowest note of the piano midi pitch is 21



When you change to the 12 just intonation keys or equal temperament the tuning information box (outlined in red in the screen shot above) informs you of the key the BDMO is in.

## VARIABLE TUNING APPROACH TWO

The second approach requires that you program a knob or slider on the keyboard to send midi CC#16 data. When the slider value is moved slightly (CC#16) value has to be greater than 10 the notes from middle C (C4 up to C5) are muted. The keyboard player then selects the note they want the tuning key to be in then slides the knob/slider back to the zero position (less than 10). The muted octave becomes active but the tuning has changed. When the CC16 value is greater than 9 and you select C5 the keyboard switches back into Equal temperament.

In this example knob C5 is programmed to output midi CC#16 data.

