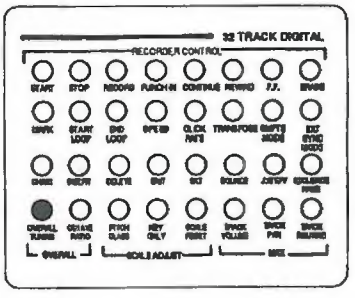
Live performance features

MR-06-0188

Special keyboard tuning

The Synclavier keyboard uses the equal tempered scale with the fourth A on the keyboard assigned the standard frequency of 440.0 hertz. You can change this standard tuning to a number of customized tunings.



overall tuning panel 2

Overall tuning

Whenever you load the Synclavier operating system, the keyboard is tuned in equal temperament with a reference pitch of A-440. You can change the tuning to play along with analog or acoustic instruments that may be tuned above or below A-440.

1. Press the **overall tuning** button.

   The **overall tuning** button lights, and the display window shows

   [number] HERTZ

2. Use the control knob to select a new frequency for the tuning base, A3 (middle A). Any frequency between 00.0 and 1760 hertz can be dialed in, in 0.1 hertz increments.

   When you press A3, the note sounds at the selected frequency.

You can also step the tuning in octaves through the cycle

110.0 220.0 440.0 880.0 1760.0 Hz

- Press **overall tuning** repeatedly.

The new tuning remains in computer memory until you change it or turn off the system. It affects all notes you play in real time and any sequences you recall from a sequence file and play back.

Changes in overall tuning are not saved with sequences or timbres.

Changing the octave ratio

The octave ratio determines the relationship between the keyboard octave and the actual tonal octave. With the standard octave ratio of 1.000, every keyboard octave produces the perfect tonal octave, or a doubling in frequency. By changing this ratio, you can expand or contract the frequency range defined by the keyboard octave. The interval between any two adjacent keys as well as the overall range of the keyboard is affected.

The pivot pitch around which the range expands or contracts is A3 (middle A, 440.0 hertz). The pitch of A3 does not change when you change the octave ratio. All other pitches change relative to A3.

To change the octave ratio:

1. Press the **octave ratio** button.

   The button lights, and the display window shows

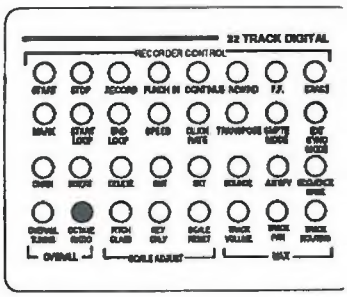
   [number] OCT RATIO

2. Use the control knob to select a new ratio between .000 and 4.000.

   If you play two notes, you can hear the relationship between the notes changing as the octave ratio changes.

To return the setting to 1.000:

- Press octave ratio again.



octave ratio panel 2

Special keyboard tuning (con't)

Useful octave ratio settings

If you dial a ratio of 4.000, an octave played on the keyboard sounds a four-octave interval. The interval between any two adjacent keys is four semitones (a major third). Playing a chromatic scale on the keyboard results in an arpeggiated augmented triad.

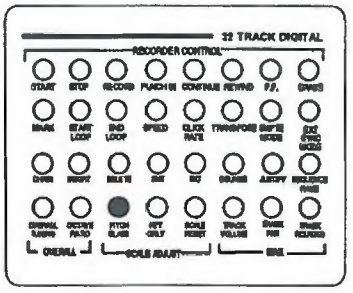
If you dial a ratio of 3.000, an octave played on the keyboard sounds a three-octave interval. The interval between any two adjacent keys is four semitones (a minor third). Playing a chromatic scale on the keyboard results in an arpeggiated diminished seventh chord.

Microtonal scales can be established by dialing octave ratios of less than 1.000. With an octave ratio of 0.000, every key on the keyboard produces the same pitch: A-440.

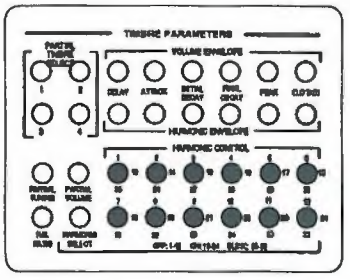
Whenever you store a Memory Recorder sequence, the current octave ratio is also stored. Additionally, you can save the adjusted ratio as a sequence, even if there are no actual notes played in the sequence. The adjusted ratio remains in computer memory until you change the ratio, recall a sequence or turn off the system.

adjacent key interval	setting
Quarter-tone	.500
Microtones	.001 to .999
Semitone	1.000
Whole-tone	2.000
Minor third	3.000
Major third	4.000

Special keyboard tuning (con't)



pitch class
panel 2



harmonic control buttons
panel 1

Pitch class: establishing special scales

Each of the twelve keys of the chromatic scale can be assigned any frequency between 261.6 and 523.0. Changes made to a specific note's tuning are made in every octave on the keyboard; the frequencies of the other eleven notes of the chromatic scale remain unchanged.

1. Press the **pitch class** button to assign the pitch control function to the **harmonic control** buttons.

   Each **harmonic control** button can now be used to adjust a different note of the chromatic scale.

2. Press **harmonic control button 1.**

   The button lights, and the display window shows

   [number] HERTZ C

3. Use the control knob to select a frequency between 261.6 and 523.0. The new frequency affects all the Cs on the keyboard.

4. Press **harmonic control button 2** and turn the control knob to change the pitch of C# above middle C.

5. Continue in the same manner with the other buttons under **harmonic control.**

Equal-temperament frequencies for the octave beginning on middle C

key	frequency
C	261.6
C#	277.1
D	293.7
D#	311.1
E	329.5
F	349.3
F#	370.1
G	391.9
G#	415.5
A	440.0
A#	466.1
B	493.9
C	523.0

Special keyboard tuning (con't)

Storing special scales

Whenever you store a memory recorder sequence, the current scale is also stored. You can also save the adjusted scale as a sequence, even if there are no actual notes played in the sequence. The adjusted tunings remain in computer memory until you turn off the system, change the tunings or recall a sequence.

Restoring tempered tuning

To restore tempered tuning of any individual note:

- Press twice the numbered button under **harmonic control** that corresponds to the note.

  All notes of that name are readjusted.

To restore the entire keyboard to tempered tuning:

- Press **scale reset** twice.

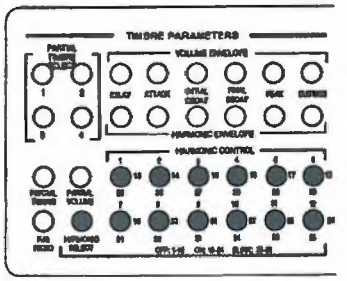
  This also changes the pitch wheel range setting.

To reset the pitch wheel range to its original setting:

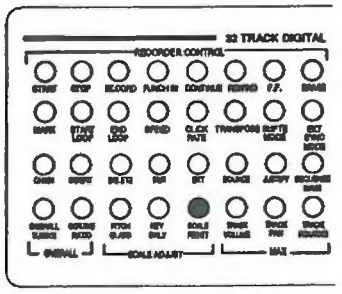
- Press **scale reset** repeatedly until the correct value returns. (For more information on pitch bending, see the section "Real-time effects.")

To restore the harmonic coefficient function to the **harmonic control** buttons:

- Press **harmonic select.**



harmonic select, harmonic control panel 1



scale reset panel 2

Special keyboard tuning (con't)

Special tunings

There are many systems of tuning and temperament which can be precisely created on the Synclavier.* Following are several keyboard tunings that musicians may be interested in creating for compositional, performance or educational purposes.

- **Pythagorean tuning** is the theoretical scale derived from the frequency ratios of the unison, the octave, the fifth and the fourth. By mathematically manipulating these ratios (1:1, 2:1, 3:2 and 4:3), a seven-tone scale results with whole tone interval ratios of 9:8 and semitone ratios of 256:243. The Pythagorean third, with a ratio of 81:64 to the fundamental, is considerably sharper than the equal-tempered third.

- In **just tuning**, a system of tuning popular in the Renaissance, the intervals of the scale are derived from the 3:2 ratio of the fifth and the 5:4 ratio of the third. Just tuning has the advantage of having acoustically perfect tonic, subdominant and dominant triads in the key for which it is tuned. That is, in key of C just tuning, the C, F and G chords have the ratio 4:5:6 and thus are more euphonious than the same chords in tempered tuning.

- The **overtone scale**, popular with some composers today, is derived from the first 16 harmonics of any given fundamental frequency, harmonics which define the pitches of notes equivalent to the fundamental and seven other tones. If each pitch is placed within the same octave by dividing its frequency, the result is an eight-tone scale.

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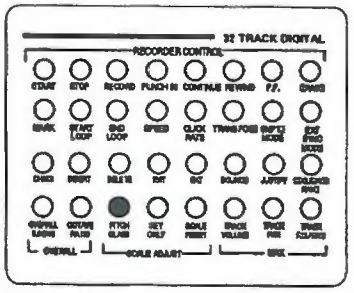
* For more on this subject, see J.M. Barbour, Tuning and Temperament, (Michigan State College Press, East Lansing, 1953).

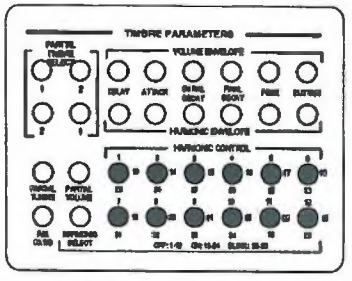
Settings for four diatonic scales with a base of middle C

note	equal tempered	pythagorean	just	overtone
C	261.6	261.6	261.6	261.6
D	293.7	294.3	294.3	294.3
E	329.5	331.1	328.1	328.1
F	349.3	348.8	348.8	359.6
G	391.9	392.4	392.4	392.4
A	440.0	441.5	435.9	425.1
Bb	(overtone scale only)			457.8
B	493.9	496.6	490.6	490.4

Special keyboard tuning (con't)



pitch class panel 2



harmonic control buttons panel 1

Special equal-tempered tunings

There may be times when you want to create a special tuning that uses only pitches of the equal-tempered scale. You can change the pitch of any note to any other equal-tempered pitch in the following way:

1. Press the **pitch class** button.

   The button lights and the **harmonic control** buttons control the pitches of the twelve scale tones.

2. Press and hold the appropriate **harmonic control** button.

3. Play a note on the keyboard.

   The pitch of the key corresponding to the pressed **harmonic control** button is changed to the pitch of the pressed key.

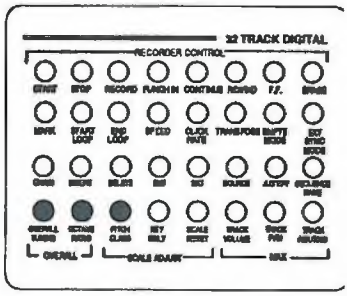
This method of retuning the keyboard can be used to quickly change tunings to perform, for example, chordal glissandos or whole tone scales.

Combining keyboard tuning functions

The three keyboard tuning functions, overall tuning, octave ratio and pitch class, can be combined.

If you select a new scale using the **pitch class** and **harmonic control** buttons and then establish a different octave ratio, the frequencies of the notes, of course, change as the intervals are contracted or expanded. The numbers in the display window that represent the frequencies of these notes, however, remain at their selected settings.

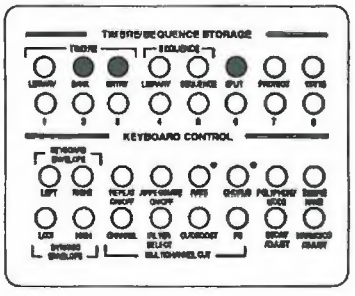
You can also use the **overall tuning** button to adjust the overall pitch of a keyboard that has been redefined by the octave ratio and pitch class functions. The entire keyboard of frequencies, with any established overall range or scale relationships, can be tuned up or down in .1 hertz increments. Again, the numbers displayed for each note remain at the selected settings.



overall tuning, octave ratio, pitch class panel 2

The split keyboard

The Synclavier keyboard can be split into upper and lower sections with a different timbre active on each section. This makes it possible to perform in real time with different timbres for left and right portions of the keyboard.



bank, entry, split panel 4

Establishing upper and lower timbres

When you define a split keyboard setting, the split point is the bottom note of the right timbre. You can use the default split point of C3 (middle C) or change the split point to any other note on the keyboard.

To place a timbre from a timbre bank on the right portion of the keyboard:

1. Press the **split** button once.

   The **split** button lights and the track select buttons begin blinking.

2. Recall a timbre from a timbre bank by pressing **bank**, then the number of the timbre bank that contains the desired timbre, then **entry**, then the number of the desired timbre.

   All notes to the right of B2 sound the selected timbre.

To place a timbre from a timbre bank on the left portion of the keyboard:

1. Press the **split** button twice.

   The **split** button and the **track select** buttons begin blinking.

2. Recall a timbre from a timbre bank in the usual way.

   All notes to the left of C3 sound the selected timbre.

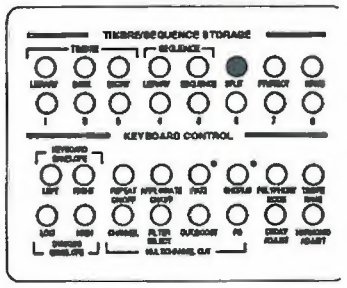
Placing a track timbre in a keyboard split

You can also recall a timbre from a track recorded in the Memory Recorder.

1. Press **split** once or twice, depending on whether you want the timbre on the right or left.

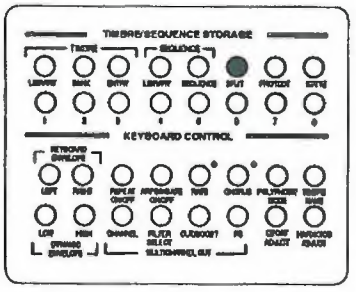
2. Press the **track select** button of the track containing the desired timbre.

   The selected portion of the keyboard sounds the selected timbre.



split
panel 4

The split keyboard (con't)



split panel 4

Changing the split point

You can set the split point to any key on the keyboard before or after you split the keyboard.

To set the split point before you split the keyboard:

1. Press the **split** button once or twice.
2. Select a split point by pressing a key on the keyboard.
3. Recall a timbre.

To change the split point after you have split the keyboard:

1. Press the **split** button once or twice.
2. Select a split point by pressing a key on the keyboard.
3. Press the **split** button until it goes out, or press the **stop** button.

   The split point is now in the selected position.

Modifying, recording and storing with the split keyboard

The split keyboard can be used in real time only. This is because two different timbres cannot be stored on the same track in the Memory Recorder. If you record a sequence with a split keyboard, the Synclavier records only the right timbre of the split.