MSSIAH
MIDI SID SOFTWARE

Sequencer

The MSSIAH Sequencer is a powerful music application that combines making music on the C64 with MIDI requirements in the 2000s.
Whether you want to sequence tunes that play on your favorite 80s computer or make your boxy old friend a multi-timbral / polyphonic MIDI synthesizer, this is the application you have been looking for.

As a SID music composing tool the MSSIAH Sequencer breaks the barrier between old computers and modern producers.
Back in the day music applications were quite Spartan, not the least C64 software which focused on optimized playback routines chasing CPU performance. The user interface was less prioritized resulting in tedious note edits requiring lots of patience and steep learning curves. That is something people could tolerate in the early days of sequencers but hardly anymore…
By contrast, MSSIAH Sequencer targets musicians. The elements you recognize from your studio sequencers are all there: mouse control, windows, sequence blocks, arrangement workspace and a grid editor. MSSIAH Sequencer effectively mimics industry standard software so that most users are up and running within 15 minutes. Making SID music becomes just as easy as producing music on your Mac/PC machine!

But it doesn't stop there.
If you're not looking for a Commodore 64 sequencer to make nifty SID music you can always switch the MSSIAH Sequencer[1] to MIDI mode and it turns into a MIDI synthesizer awaiting your input. It can operate in full six-channel monophonic multi-timbral mode or as a six voice polyphonic synth[2]. Alternatively you can mix these modes and get a 3 part multi-timbral AND three voice polyphonic synth using one SID for each purpose.
For real versatile playing the poly modes can use your played notes as the input for wave-table sounds. That means playing classic broken chords live!

Recognizing notes and velocity, control change messages, program changes and even full range pitch wheels will make the MSSIAH Sequencer a trustworthy member of your MIDI setup. Never before has hooking up the Commodore 64 to MIDI been so easy and cost effective (and, not to forget, such great fun!).
Whether you use it as a stand-alone application for SID music or full MIDI only we are sure this program will bring lots of useful backup to your tracks when you need that something extra!

To fully enjoy MSSIAH Sequencer we recommend that you take the time to read this whole manual through.

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1 = Though named *Sequencer* this program does not function as a sequencer in MIDI mode.
2 = Six tracks/voices with SID2SID installed. If not, only three tracks/voices.

Using the MSSIAH Sequencer

Starting Up

To start the Sequencer, select *Sequencer* in the startup menu and press return.
The program loads from the cartridge and starts up within 8 seconds.

Note:

The user is strongly advised to carefully read the instructions on how to properly handle the cartridge in the booklet *MSSIAH - Getting Started* available for download on our site at http://www.mssiah.com.

The Basics

The Sequencer consists of a main screen (the *Arrange window*) and a set of separate windows with each editor module.
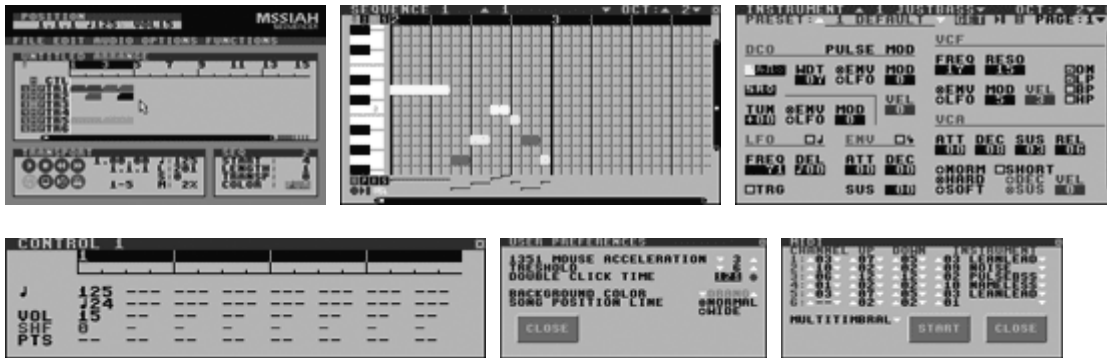
The arrange window is where you put together and manage the building blocks in your current creation. These blocks are called *sequences* and each one holds up to eight measures of note data. The sequences are played within the arrange window's workspace in any of six tracks. Each track is locked to a SID oscillator, 1-3 for SID #1 and 4-6 for SID #2 (if installed). On top of the six note tracks is a control track for tempo, shuffle and volume data changes.

Notes are inserted, removed and edited with the *Grid editor* using standard piano roll design. It opens up when double clicking a sequence.
The 32 available instruments are created with the *Instrument Editor*.

All controls are accessed with the mouse pointing and clicking each object. Values are altered by clicking at the parameters and moving the mouse up or down. That turns the mouse pointer into a vertical bar indicating value change mode.

The menu at the top of the screen opens up when you click it once. Click on a menu item to execute a function or activate an option. Click anywhere outside the menu to close it.

Note:

Being larger than the C64's internal memory, the application needs to access the cartridge ROM when loading new window modules. Whenever this happens the computer halts for a split second. Be aware that this short delay is enough to lose the MIDI clock if synced externally! Good thing is that subsequent calls to open the same window do not initiate ROM loads if it's already present in the computer's memory.

This constant flow of data between the cartridge and computer requires a flawless expansion port connection to ensure an error-free execution of the application. Same goes for MIDI synchronization and various other types of communication.

NTSC

Since the old Commodore computers were directly hooked up to TV sets and TV standards around the world differ (NTSC vs. PAL), so do C64s in different markets.
A computer built to run on the NTSC TV system has somewhat higher clock speed and less screen resolution outside the visible screen.

Running programs that are written for PAL machines on NTSC computers can make things go a bit faster than they were intended to. As for music it does not only play faster but also in a slightly higher pitch. Some programs do not even work at all.
The MSSIAH software is adapted for both PAL and NTSC standards however you must switch mode manually.
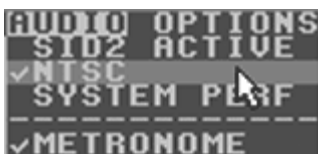
Open up the *AUDIO* menu and check the *NTSC* option.
When active, the Sequencer application adjusts its internal timers as well as the frequency scale.
If you are running a C64 built for the PAL system, leave the *NTSC* option unchecked.

Note:

When opening project files or the demo arrangement, don't forget that the NTSC setting affects how the song is being played back. This is due to your own computer, it does not make any difference on what type of machine the song was initially composed. NTSC setting is not saved in the project file.
Make it a practice to always check the NTSC option when starting up the Sequencer.

User Input Controls

MSSIAH Sequencer is compatible with a number of user control devices inserted into Controller port #2. Select the control device in the *OPTIONS* menu.

This must be made manually at startup. The Commodore 64 cannot auto-detect what is connected to the port (*plug n' play* was invented much later, remember?).

Joystick

Joystick is the default control at startup. It gets activated when no other control option is selected.

1351 mouse

This is the option that selects C-1351 mouse. This mode gives you full control of the Sequencer including right mouse button to access the toolbox and the mouse wheel too.

This is the preferred choice when operating the Sequencer. You can use a modern USB mouse if you aquire a Savyour device in our online store.

Note:

Tips! Press and hold the **Commodore Key** (**C=**) while starting up the MSSIAH Sequencer to automatically activate 1351 mode.

Amiga Mouse

Select this option if you use an Amiga mouse.

Atari Mouse

Select this option if you use an Atari ST mouse.

Right Mouse Button

Unmodified C64s cannot read the right button of an Amiga or Atari mouse. The signal would have to be converted for the A/D converter inside the C64. Our Savyour device converts these signals in Amiga/Atari mouse mode so MSSIAH Sequencer will respond to it. If you however use a real standard unmodified Amiga/Atari mouse you need to use the **F5** key to open the toolbox.

Under the hood MSSIAH Sequencer treats values above 128 ($80 hex) on the POT-X pin of controller port #2 as an activated mouse button. Any value below 128 denotes a released button.

Note:

Be aware that an unmodified Amiga/Atari mouse will let the computer think that the right mouse button is constantly depressed. This leads to a constant trigger to open the toolbox if *Right Mouse Button* menu item is selected in the *OPTIONS* menu.

Therefore, do not select *Right Mouse Button* if using a real unmodified Amiga or Atari mouse.

Acceleration

The accelerate option works with both joysticks and 1351 mice.
Joystick acceleration increases the speed of the mouse pointer gradually.
1351 acceleration is more like a modern PC mouse acceleration; it speeds up the pointer the faster you move the mouse. It's great for saving time but also relieves stress on your wrists.

Trimming Mouse Controls

In the Sequencer's user preferences you will find a couple of parameters to fine tune the 1351 mouse acceleration.

Double-Click Time

In the *User Preferences* window there is also a parameter that controls the double-click speed for the left mouse button. If you find that the MSSIAH Sequencer is too slow or too fast with the double-click sensitivity you can tweak the setting in here.
Double-click the red circle to try out the new setting. It toggles between white and red color when it detects a double-click.

Changing Background Color

While we're at it, the Sequencer has a setting for background color in case the orange default color doesn't match your taste.
You find the setting in the *User Preferences* window just below double-click time.
Background color is not saved onto disk.

Keyboard Control

If you start up the Sequencer with any other device than joystick or accidentally select the wrong device you can always reach for the panic keyboard control.
By pressing the **CTRL** key, keyboard control is activated and the mouse pointer is controlled with the **CRSR** and **RIGHT SHIFT** keys.
F3 key replaces left mouse button and **F5** key is the right button.

A Word of Advice

It is our recommendation to use MSSIAH Sequencer together with a USB mouse running through our Savyour device in 1351 mode. Not only does it give you a closer and more PC-like response, it is also free from C64 keyboard conflicts:
Because of the internal design of the C64's keyboard and joystick inputs, data signals on the controller ports sometimes interfere with the keyboard. In practice that means Amiga and Atari mouse operation could seriously block different keys on the keyboard. One example when this C64 quirk may become a problem is in the Instrument Editor. Here you have the C64's keyboard available to play notes and try out the sound you are editing. Depending on the current position of the Amiga/Atari mouse the sound might not play at all when you hit that key due to the conflict between the struck key and the input data from the Amiga/Atari-mouse. The same goes for certain hot keys in the application. Joystick mode has got the same problems but to a much lesser extent.

Arrange Window

Overview

The Arrange window is the main window in MSSIAH Sequencer. It contains the sequence workspace window (from now on referred to as the *workspace*), a transport window and a property window that displays basic properties of selected items.

The workspace is where you create and arrange sequences.
Each block represents one sequence and can be moved around freely.
Different tools are used to create and work with the sequence objects.
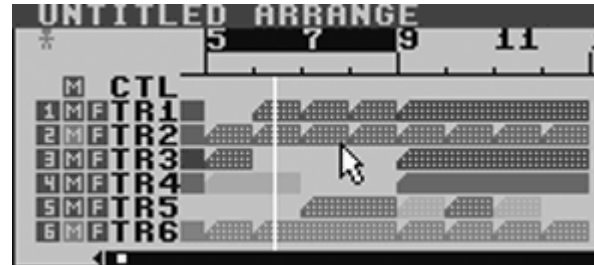
The workspace is 256 measures long. Such a vast area to lay out objects (aka *sequences* and *aliases*) not only makes it possible for a quite lengthy song, it is also a great place to throw out different ideas when working on another project. That's often the time when new ideas keep popping into your head so take advantage of that! Use the empty workspace area to test different variations and angles on your beats, phrases, bridges, verses and choruses.

The Toolbox

Editing objects in the MSSIAH Sequencer is done with a set of tools in the Toolbox.
To access the toolbox:

- Press the right mouse button (or **F5** key) within the workspace area. The toolbox stays open until the right button is released.
- Select the tool you want.
- Close the toolbox by releasing the right mouse button.
- The mouse pointer now takes the shape of the tool you selected and is ready to be used.

	Arrow	No tool selected. Picks and selects objects
	Pencil tool	adds objects
	Eraser tool	removes objects
	Glue tool	merges objects together
	Scissors tool	cuts objects in two

The toolbox is a function you will use frequently when working with the Sequencer.

Sequences

A sequence is an object within the arrange window holding the note information. Sequence objects can be moved, merged ("glued") and copied into alias sequences.

Creating Sequences

Clicking the left mouse button anywhere on the workspace with the pencil tool creates a new sequence. Default length is one measure but can be extended up to eight measures by merging two objects with the glue tool.

To keep track of each sequence they are assigned a unique number from 1 to 255 automatically on creation (limited memory prevents the use of full names).

Further identification is possible by the use of individual colors. When created, the sequence first inherits the predefined track color but you can change it afterwards.

With a graphic layout, identifying single objects becomes so easy that you probably will keep track of your sequences visually instead of going for the number identifier. Users of modern MAC/PC sequencer software can testify to that.

MSSIAH Sequencer can store up to 255 sequences with a length of one measure. Every time you *glue sequences* together (more on that later) the limit is reduced.

To monitor remaining memory there is a memory meter in the transport window showing the percentage of used up memory. It can be toggled to show either memory consumption or system performance by checking the *SYSTEM PERF* option in the *AUDIO* menu.

Add a New Sequence

- Select the Pencil tool.
- Left click the spot on the workspace where to place the new sequence.
- If the spot is empty, the sequence is created and placed on the workspace. The mouse pointer then switches to a hand allowing you to move the new sequence anywhere you like.
- If there is already an object in that position it is selected instead. MSSIAH Sequencer does not handle overlaps.

If the sequence memory of the MSSIAH Sequencer runs out of available storage space you will be notified this when trying to insert a new sequence:

That means no more sequences can be created. Memory is full.
You will have to clean up by removing (non-alias) sequences you're not using.

Delete a Sequence

Sequences are deleted with the Eraser tool.

- Select the Eraser tool.
- Left click the object you wish to delete.
- Object is deleted.
  If you try to erase a main sequence with one or more *alias* objects every alias will also be erased. You are first asked to confirm this action. Alias sequences are explained later in this chapter.

Note:

Tips! There is no 'undo' function in the MSSIAH Sequencer! To prevent accidental removal of objects there is an option that always confirms deletions in the program. The default mode of this option is On.
You access the confirm deletes option in the *EDIT* menu.

```
MSSIAH                                    ⊠

    X            ARE YOU SURE?


           CANCEL            OK
```

If you find this option annoying or just want to disable it temporarily, uncheck the *Confirm Deletes* option in the *EDIT* menu.

You can also use the **INST DEL** key to delete the currently selected object.

Several sequences can be deleted at the same time by using *selections* covered later in this chapter.

Glue Sequences / Increase Sequence Length

Two sequence objects can be glued together to form a longer sequence.

- Select the Glue tool.
- Left-click the first sequence to join.
- Hold **LEFT SHIFT** key and left click the second one.
- The objects are glued together.
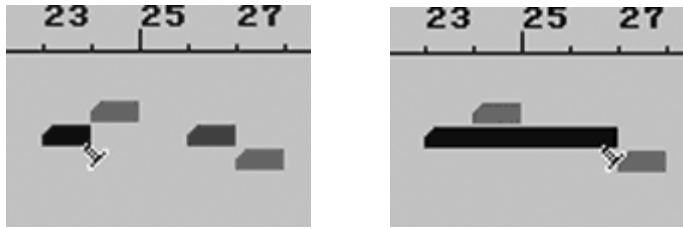
If the two sequences are several measures apart, the gap between them are filled automatically. Merged sequences can be further glued to other objects as long as the maximum length does not exceed eight measures.
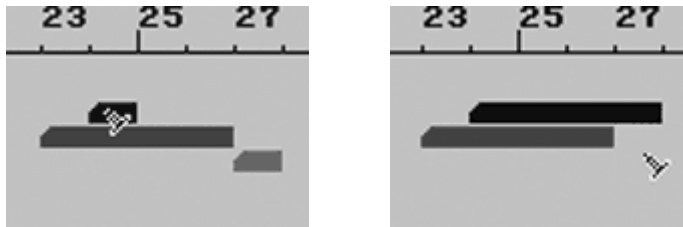
The sequences do not have to be on the same track as long as there is empty space between the two objects. This is taken care of automatically by the MSSIAH Sequencer.

The glue operation can fail for three reasons:
▪ One or two objects are blocking the way. Unlike modern PC/Mac sequencers MSSIAH Sequencer does not allow objects to overlap.
▪ Two objects joined together would form a larger sequence than eight measures.
▪ Memory is full.

Split Sequences

Glued sequences can be split up by the Scissors tool.

• Select the Scissors tool.
• Left click the position where you want to split the object.
• The result is two sequences with individual number identifiers sharing colors and transpose settings.
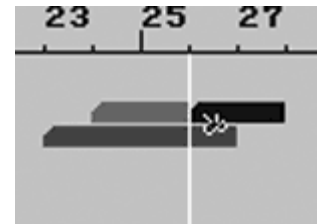
The two split objects do not consume any more memory than if merged together.

Changing Sequence Color

Every sequence is assigned its own color for easier recognition. Default color is inherited from the track in which it is created. To change sequence color manually:

• Left-click the sequence with either Arrow or Pencil tool to select it.
• Left-click the value in the property window. Drag mouse up and down to select a new color.
• An *alias sequence* has the same color as its main object. Changing one will also change the others.

Transpose Sequence

A sequence can be played back with all its notes transposed up or down by 12 semi-notes.

- Select the sequence you wish to transpose.
- Alter the transpose value in the property window.

Cycle Region

MSSIAH Sequencer has a loop function that repeats parts of any length in your song.

- Define the cycle region by marking the selected measures in the upper part of the bar ruler.
- Merge longer regions by holding **LEFT SHIFT** key when clicking on the new start or end measure.

If not already in Cycle mode, MSSIAH Sequencer activates it as you click the bar ruler area.

Cycle mode means that the *Song Position Line* jumps back to the start position once it has travelled past the end when playing. That creates an eternal loop.

Cycle mode is toggled with the Cycle button in the *Transport Window*. More on that later.

The Song Position Line (SPL)

The Song Position Line (SPL from here) is the white vertical line that marks the current song position in the arrange window and grid editor.

You can set the SPL position by clicking anywhere in the area below the bar ruler.
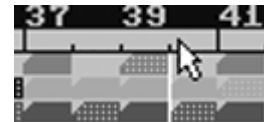
The SPL is also controllable via the **£** key to forward one measure and **CLR HOME** key to move back one measure.

Note:

Tips! The SPL can be made a little wider to make it more visible if your screen is small.
Open the *User Preferences window* with the *OPTIONS* menu and make your selection for the Song Position Line.

Catch Mode

The stick man in the upper left corner of the Arrange window indicates whether Catch
mode ("follow song") is on or off. Catch mode automatically moves the workspace to
where the SPL is if it runs outside of screen boundaries. If you start scrolling the window, catch
mode is automatically switched off.

Transport Window

```
TRANSPORT
         1.00.03 J:125
         4.3.4   L:201
                 S:0
    1-5          M:  1%
```
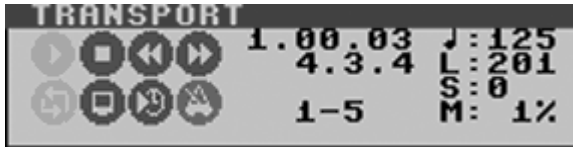
The Transport window includes the controls and parameters that concerns song playing.

▶	**Play**	plays from the current SPL position or cycle start if cycle mode is activated.
■	**Stop**	stops playing. Press twice to place SPL at the beginning of the song.
◀◀	**Rewind**	moves SPL one step back. Keep depressed to repeat rewinding.
▶▶	**Forward**	moves SPL one step forward. Keep depressed to repeat forwarding.
↻	**Cycle mode**	toggles cycle mode. You can reach this option in the *OPTIONS* menu also or simply press the **C** key.
▣	**Blank screen**	activates screen to go blank in the arrange window when playing. Screen becomes visible again when playing is stopped. This will reduce the noise from the audio output significantly thus improving audio quality. Alternatively press the **K** key to toggle blank screen.
⏲	**External Sync**	activates synchronization with MIDI clock. This option is also accessed via the *OPTIONS* menu or the **Y** key.
🔔	**Metronome**	activates the metronome in Grid Editor recording mode. The metronome can also be activated in the *AUDIO* menu together with the click note.

Current Position

The transport window displays the current song position in measures, beats and sixteenth
notes.

The Position Window

In the top left corner of the screen is the Position Window. Since it is located outside the working area of the Sequencer application it stays open at all times though you cannot reach it or edit the values directly.

The position window is a quick display of your song's current position, the current tempo and volume. The green arrow indicates that cycle mode is activated.
This window is a great help when working with any of the editors not being able to see the transport window.

Tempo

When running the MSSIAH Sequencer on internal clock, 14 fixed tempo settings are available. The current tempo is displayed in either black or gray color where black colors refer to classic C64 tempo settings.
When Sequencer is running as MIDI slave, the tempo displays *MID* and follows your MIDI master device instead.

Shuffle

The Sequencer has seven shuffle steps, "swing", adding groove to the song.

Song Length

Here you set the maximum song length of the current project. When the SPL reaches this end point it stops playing. Bar ruler turns gray passed the song's end position.

Memory/System Performance

The lower right numbers in the Transport window is the Memory Meter / System Performance Meter.
The memory meter (default) shows how much memory is used up by the sequence objects whereas the system performance meter shows current CPU load for the audio engine. Peak value holds for a short time. The mode is toggled in the *AUDIO* menu.

Tracks

The left side of the arrange window shows track numbers, mute buttons and filter indicators.
The *track number* turns to a velocity level meter during playback.
The *mute button* allows you to mute the output from the selected track.
The *filter indicator* lights up when the filter is turned on for the track.
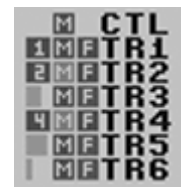
Naming a Track

You can set a name for each audio track:
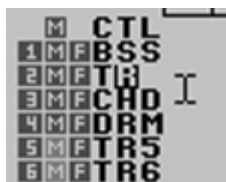
- Double click the old track name.
- Mouse pointer turns into a cursor.
- Enter a new name, use **CRSR** keys to go back/forward.

- Press **Enter** key when done.

Name length is limited to three characters. Use short names like "bss" for bass, "drm" for drums, etc.

Zooming

The arrange window workspace has three levels of zooming.
The zoom level controls are located at the lower right corner of the window.

- Use left part of the zoom control to zoom out.
- Use right part of the zoom control to zoom in.

Alternatively:

- Use + key to zoom in.
- Use – key to zoom out
  (Commodore 128 numeric keypad is supported).

Scrolling

You can scroll the workspace forward and backwards with the horizontal scroll bar.
Either click the left or right arrow buttons or grab the scroll box inside the bar and drag it to the wanted position.

If you are using a USB mouse with Savyour, MSSIAH Sequencer supports the mouse wheel so that you can use it for scrolling too.

When moving objects or marking up a long cycle region that spans over more than one page the workspace window scrolls its content automatically.

Key Control

The MSSIAH Sequencer offers a few hotkeys to access some of the most used functions in the program. The hotkeys were kept to a minimum because of the Commodore 64's user control/ keyboard conflicts.

SPACE	Play/Stop (alternatively)
RETURN	Play
+ / -	Zoom in/out
INST DEL	Delete selected sequence
C	Cycle on/off
K	Blank screen on / off
Y	MIDI sync on / off
£	SPL forward one measure
CLR HOME	SPL rewind one measure
	- Hot-keys for dialog boxes -
RETURN	Dialog OK
RUN/STOP	Dialog CANCEL
	- Commodore C128 numeric keyboard -
ENTER	Start
0	Stop
*	Record (grid editor)
+	Zoom in
-	Zoom out

Copy/Move sequences

To move a sequence:

- Left click the sequence with either arrow or pencil tool. Keep the left mouse button depressed.
- With the mouse pointer shaped like a hand, drag the object to the new position.
- Release the left mouse button and the object slides into the new position if it's empty and there is enough room.

You cannot move or copy control sequences outside the control track or normal sequences into the control track.

Copying is the same procedure except keep the **Commodore** (**C=**) key depressed. When releasing the left mouse button you end up with a new object. It is not really a new sequence copy but a so called *Alias* sequence.

Alias Sequences

An alias sequence is not a real object but merely a reference to a main sequence. It therefore contains no data and does not consume any memory. Whenever a main object's data is changed it also affects the alias.

You can identify an alias object by its check pattern. Main objects are filled.

Aliases are great to free up memory when working with repeated sequences but they also save a lot of work for you. Instead of altering notes in each and every sequence you focus on one object only and all the aliases are affected at once. A must have when working with drum sequences.

Creating an Alias Sequence

Aliases sequences are automatically created when copying a sequence.
(Transforming an alias back to a main object is explained later)

Cutting and Gluing Alias Sequences

Gluing alias sequences is possible as long as both objects share the same main sequence. As aliases are just reference objects the length cannot exceed the length of the main sequence. If the main object is split afterwards, the aliases are automatically split also.
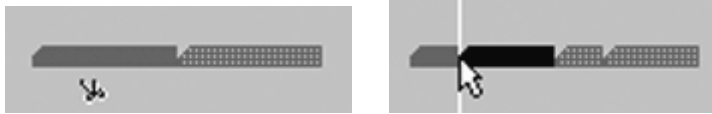
You can split an alias manually. However, when playing an alias sequence it will always start playing from the beginning of the main object.

Changing Colors and Transposing Aliases

An alias sequence color is always the same as its main object. When you change it in the property window it also affects the main sequence as well as all other aliases.

Transposing is unique for every single object so every alias can have its own transpose setting just like regular sequences.

Finding the Original Object

To quickly find the original object of an alias there is a handy function provided in the *Transform Functions*. See the *Select Original* function explained in the *Transform* chapter for more information.

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Editing an Alias Sequence.

Since alias sequences are reference objects, editing means altering the data of the main sequence. However, when double-clicking the alias to open up the grid editor you have three options:

```
MSSIAH                                    ⊠
         THIS IS AN ALIAS WITHOUT DATA.
    !    DO YOU WANT
         TO MAKE AND EDIT A REAL COPY OR
         TO EDIT THE ORIGINAL?

      CANCEL      REAL COPY      ORIGINAL
```

CANCEL
Cancel the operation. Do not open grid editor.

REAL COPY
You create a completely new copy of the alias so your edits take place in a brand new sequence.

ORIGINAL
You edit the alias affecting the main sequence directly. The alias position in the arrangement is kept as the reference point for the grid editor.

The **REAL COPY** option is a great way of making real copies of alias sequences.
The **ORIGINAL** option is great when you have repeated sequences e.g., drum beats, and want to edit any object but affecting all the other objects too.
It's important to learn the difference to not confuse one option with the other.

Deleting an Alias

Deleting aliases are done the same way as deleting main sequences.
However, if you try to delete a main object that has underlying aliases all of those will be deleted too. They are not allowed to exist freely without a parent object.

```
MSSIAH                                    ⊠
         ONE OR MORE ALIASES ARE MADE
    !    FROM OBJECTS TO BE CLEARED!
         DO YOU STILL WANT TO CLEAR
         THESE?

         DON'T CLEAR      CLEAR
```

You are given a choice on how to proceed before anything is deleted.

Selections

A selection is a consecutive block of sequences that are about to be moved, copied, deleted or transformed in one of several ways. The limited memory prevents buffering of sequence selections so they only exist on creation and processing is done immediately thereafter. Sequence selections have a maximum range of 64 measures. All seven tracks may be included although control objects and ordinary note sequences cannot co-exist on the same track.

How To Make a Selection

- Press and hold the **LEFT SHIFT** key.
- Press left mouse button and draw the mouse   on
  the workspace to select an area.
  The area is marked out with brackets.
- Release **LEFT SHIFT** key still holding left
  mouse button depressed to make the selection
  active. You can tell this by the mouse pointer changing to a hand icon.
  The selection is now ready to be moved, copied or transformed.
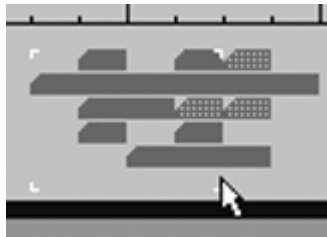
Not all sequences may be included in your selection. Only full objects within the marked up area is considered valid.
The left image illustrates this:
The longest sequence, second from the top, is not included nor the one in the bottom as they are sticking out of the white brackets.

Move/Copy Selections

Move

- Press and hold the **LEFT SHIFT** key
- Press and hold left mouse button and mark up the area using arrow or pencil tool.
- Release the **LEFT SHIFT** key still holding down the left mouse button.
  As the mouse icon turns into a hand you are free to move your selection anywhere on the workspace.
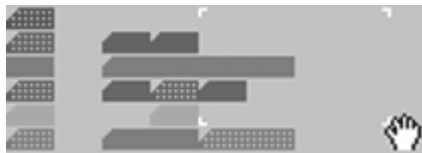
- When the selection is in place release the left mouse button and the objects are moved. If there are objects blocking the way the move is canceled. Empty spots in your selection are considered transparent.
- After the selected sequences are moved (or operation is aborted) the selection seizes to exist. You will need to define a new selection for every new action.

Copy

- Press and hold the **LEFT SHIFT** key
- Press and hold left mouse button and mark up the area using arrow or pencil tool
- Release the **LEFT SHIFT** key and move your selection.
- Before you release the left mouse button to drop the selection, press and hold **COMMODORE (C=)** key.
  The selection is now copied as alias sequences into the new position.
  Just like moving objects copying is not executed if there are blocking objects.
  Empty space in your selection is considered transparent.

Note:

If you have a large selection that spans over several pages it's a good idea to start marking it up in the opposite side of the moving direction.
That way you will see what's ahead in the arrangement when dragging the selection.

Delete Selections

Instead of deleting a large amount of sequences with the eraser tool there is a convenient way of doing this with the help of a selection.
First you need to tell the MSSIAH Sequencer that you want to treat the selections as deletions.

- Check the *Delete Selections* option in the *EDIT* menu.
- Press and hold the **LEFT SHIFT** key.
- Press and hold the left mouse button and mark up the area containing the sequences you wish to delete just like when copying and moving.
- Release left mouse button to start deleting.
- Make sure to uncheck the *Delete Selections* option when you are finished unless you plan to use it repeatedly on multiple selections.

As a matter of safety, *-- remember there is no undo-function --* you are asked to confirm this action regardless of the current state of the *Confirm Actions* option in the *EDIT* menu.

Be aware that if you have alias sequences outside the selection that belong to main objects within the selection they will be removed too without any confirmation.

Note:

Caution! Make sure to uncheck the *Delete Selections* option after you're done unless you really plan to use it repeatedly on multiple selections.

Transform Selections

Just like deleting there is a way to perform a set of actions on a large selection of objects.

- Select *Transform Options* in the *FUNCTIONS* menu, select action and set parameters (explained later in a separate chapter).
- Press and hold the **LEFT SHIFT** key.
- Press and hold the left mouse button and mark up the selection of sequences whose notes you wish to transform.
- Release either the **LEFT SHIFT** key or the left mouse button to start transforming.

If you have checked the *Confirm Actions* option in the *EDIT* menu you will first be asked to confirm the action. If not, actions will be taken without your confirmation.
Aliases are not affected.

If both *Delete Selections* AND *Transform Selections* options are checked in the *EDIT* menu, Transform has priority when making a selection.

Note:

Caution! Make sure to uncheck the *Transform Selections* option after you're done unless you really plan to use it repeatedly on multiple selections.

New (Initialize Project)

By selecting *New* in the *FILE* menu you can initialize memory to start a new project.
You will be asked to confirm the action since this function completely wipes out your current project, even the instruments. Unsaved work is lost.

Naming the Project

The project's name is displayed in the title of the arrange window.
Default name is *Untitled* until you save the project. Then the filename is automatically used as project name and will be seen in the arrange window title.
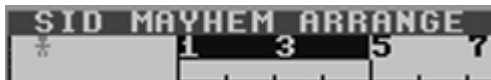
Editing Sequences

Grid Editor

Note sequences are edited in the grid editor window.
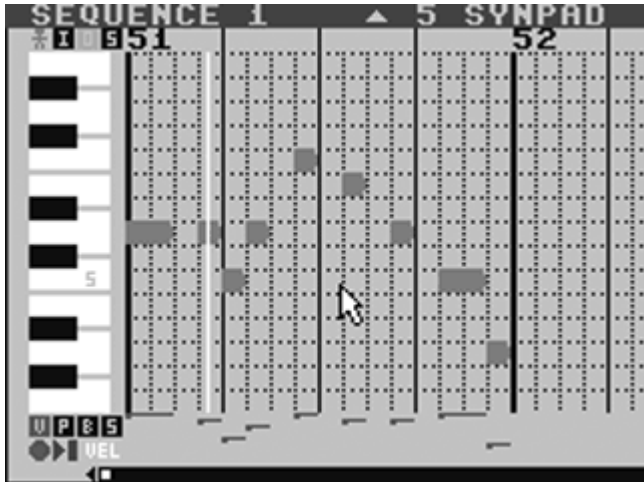
Grid editors are often called piano roll editors referring to the old player pianos. It's the same principle except the holes of the piano roll is made up by note blocks on the screen. If one would imagine the 'roll' moving left then the vertical positioning of the block would represent the pitch whereas its length and horizontal position would correspond to the note's length and timing.

Grid editors are great to get a quick visual overview of a musical phrase. They are also superior to other editors when altering note lengths.
Chord editing becomes a really easy task too of course the MSSIAH Sequencer being a monophonic editor does not handle multiple notes playing in unison.

Underneath the grid is an additional editor to alter note info such as velocity and program changes. The data is positioned right under its parent notes.

Open For Edit

The grid editor window opens whenever you double click a note sequence.
Alias sequences however, being merely reference pointers to main sequences, cannot be edited directly. When double-clicking an alias you need to decide how to handle it:

CANCEL
Cancel the operation, do not edit.

REAL COPY
Make a real sequence object out of this alias sequence and open it with the grid editor.

ORIGINAL
Open the grid editor at the selected sequence's position and edit the data. In this case the data belongs to the main sequence i.e., the original sequence is being edited.

-So, which one do I choose?
If you want to edit specific notes on a specific position in the song you need to convert the alias to a real sequence.
If you on the other hand want to edit a whole loop of alias objects where they all are children of the same main sequence, choosing to edit the original is a better idea since your edits will affect the whole loop.

A great example of this is when making a drum track. Let's say you have a simple four measure drum loop (track 3 in the right image).
The first sequence is repeated four times.
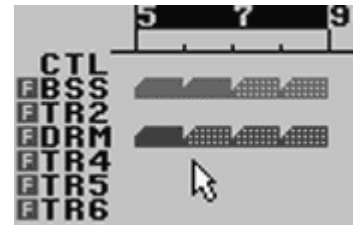
Now assume you want to add an extra snare drum strike in between beat 2 and 4 for the whole drum beat.
In this case you could either go for the main sequence and add the extra notes for the snare drum or go for an alias sequence and select to edit the ORIGINAL.
If you have lots of aliases it's probably easier to double-click the closest object instead of looking for the main sequence. Either way will do the job.
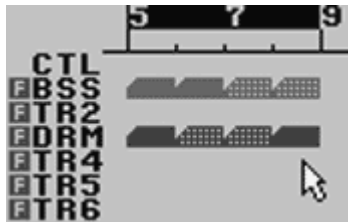
Let's say you also want to make a variation in the last measure before the loop starts over.
Now is the time to make a REAL COPY to distinguish the last sequence from the rest. As you select the real copy option the alias becomes a new sequence and any changes will not affect or be affected by the other sequences.
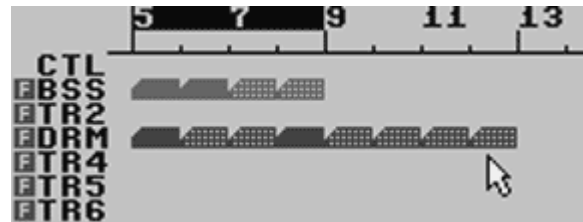
When you continue copying your drum beat, the first three objects and the last one are different sequences.

Controlling

Just like the rest of the Sequencer, the grid editor is fully mouse controlled.
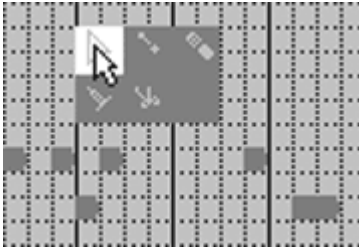
Notes are inserted, moved, copied and deleted with the same tools in the toolbox.

The grid editor window scrolls vertically to reach all the eight octaves and horizontally if the sequence length exceeds the two measures of screen space. If you open up a sequence that is only 1 or 2 measures long you cannot scroll the window horizontally.

Use the scroll bars to scroll the window. You can use the mouse wheel to scroll the vertical position also.

Insert a Note

To insert a note:

- Select the pencil tool.
- Select an instrument for the note.

- Point at a free position to place the note and click the left mouse button.
- The note is inserted with the chosen instrument. The length is one sixteenth note unless default note length has changed by extending or gluing.

Monophonic Editor
The MSSIAH grid editor is monophonic. It means that unlike other grid editors it cannot overlap notes since only one note is allowed to play at a time. When inserting or moving notes onto others there are two ways to handle it:

- Overwrite whatever is there. Long notes are interrupted by the new ones.
- Prevent overwrites completely. Inserting and moving notes onto existing ones become impossible.

You find the settings for the overwrite mode in the *EDIT* menu. Checking or unchecking the *Overwrite Notes* option toggles the overwrite mode. Default is to overwrite notes so if you want to protect a certain sequence when editing make sure to uncheck this option.

Try out the different modes yourself so that you really understand the difference.

Erase a Note

- Select the eraser tool.
- Click on the note you wish to remove.

There are two alternative ways to erase notes:
- Press the **INST DEL** key and the selected note(s) is deleted.
- With the pencil tool, double click the note to be erased.

Split Notes

Splitting notes works in the same way as cutting sequences with the scissors tool.

- Select the scissors tool.
- Click on the note where you want to cut it.

The result is two new objects sharing the same velocity and program change values.

Glue Notes

To glue two notes together:

- Select the glue tool.
- Select one of the notes to tie.
- Hold **LEFT SHIFT** key and click on the other note.

Notes are tied if they are on the same key and no notes are blocking the way in between.

Extend Notes
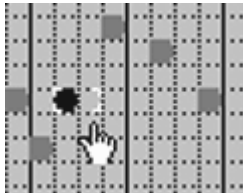
 Instead of adding two notes and gluing there is a better way to alter note lengths. When clicking on the rightmost part of a note block the mouse pointer turns into a finger and you can set a new length by moving the mouse left and right. It works on selections also.

Changing the length of a note makes it the new default length.

Move / Copy Notes

To move notes:

- Select either arrow or pencil tool.
- Left-click the note to move and keep the mouse button depressed.
- Drag the note to a new place.
- Release the left mouse button.

Copying is the same procedure except press and hold the **COMMODORE** (**C=**) key during the whole operation. Unlike the arrange window workspace, notes do not have alias objects.

Depending on the current state of the overwrite option notes are kept or overwritten when moving/copying a note or whole selections of notes.

Selections

As opposed to the arrange window the grid editor offers an in-memory selection feature. That means you can select any notes you like to include in the selection and they stay selected until you close the grid editor window.
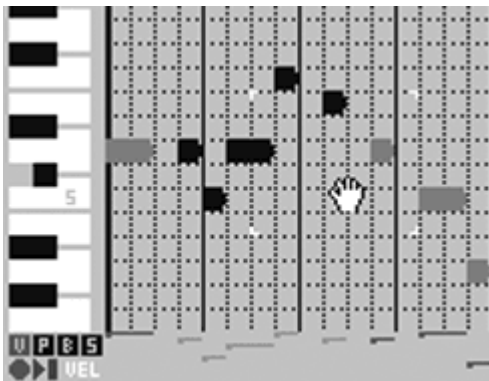
Move and copy, extend and eraser tool all operate on selections.
That means if you have more than one note selected while for example deleting, all of those notes will be erased.

There are several ways to include notes in a selection:

- Left-click a note.
- Drag the mouse over an area of notes you wish to include
- Click on a key on the left piano keyboard to select all notes on the same key.
- Use the *Select All* function in the *EDIT* menu, alternatively press **Commodore** (**C=**) key together with the **A** key. That will select all notes in the open sequence.

Holding the **LEFT SHIFT** key includes the note to an already defined selection. If you don't, all the previous selected notes are deselected.
Left-clicking a note multiple times holding the **LEFT SHIFT** key toggles its selection.
Selected notes are displayed in black color.

Move / Copy Selection
To move a selection:

- Left-click any of the selected notes.
- Drag the selection to a new position.

To copy the selection

- Same as moving but press and hold the **COMMODORE** (**C=**) key during the whole operation.

The overwrite option applies to moving and copying both single notes and selections.

Note:

If you have unchecked the *Overwrite Notes* option in the *EDIT* menu you could end up losing or corrupting the whole selection if moving it onto an already occupied area in the grid editor.

Note Controls

Note controls are assigned values set individually for each note or in between them.
They appear in the space just below the grid editor.

The four types of controls are:

V   Velocity
P   Program Change (Instrument)
B   Pitch Bend
S   Slide

Editing is done one at a time which means you have to choose the active control.
You do this by clicking any of the four buttons in the lower left corner of the window.
The active control type is displayed in plain abbreviated text right under the buttons.

Velocity

Every note has a velocity value. It modulates any of three parameters in the instrument editor (more on that in a separate chapter).
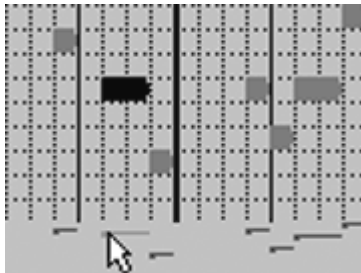
To alter the velocity value, grab the vertical bar representing the value and drag it up or down.
You don't have to be dead-on, clicking in the neighboring area will do.

Program Change

PRG   Program change sets the instrument for the current note.
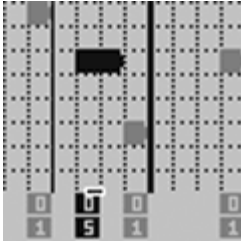
If you click on the program change value the mouse pointer turns into a vertical bar and you can move the mouse up and down to alter the value. You cannot manually insert program changes in between notes. They are automatically inserted with the new note when using the pencil tool.

Pitch Bend

BEND   Pitch bends have never been easier to insert in a C64 application:
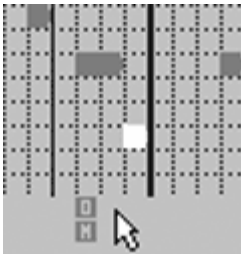
- Find the position where you want the pitch bend to start.
- Click on it in the note control editor.

     -That's it!

The next following note turns white indicating that it's the destination for the bend.

The only limit is that the longest distance between the pitch bend and the next upcoming note must not exceed 16 steps.

The program itself sees to it that it isn't. If you move the white note farther away from the bend point than 16 steps the bend automatically disappears.

If you try to insert a pitch bend where there are no destination notes available within 16 steps, no bend is inserted.
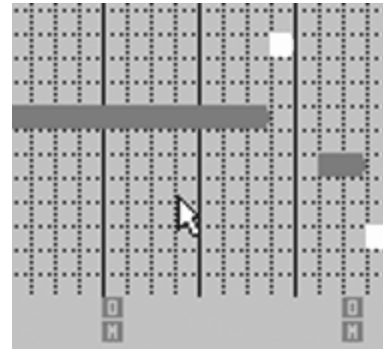
Slide

SLIDE   Slide is similar to the one found in MSSIAH Mono Synthesizer and Bassline.

Click the note where you want the slide to start to activate it. It's displayed in white color just like pitch bend notes. A note slide starts instantly when the note is up for playing.

Playing

To start playing in the grid editor use the same keys as in the arrange window. You can also use the play/stop button in the lower left corner of the window. Press it once to start playing and once again to stop. While playing the button gets a lighter blue color.

Cycle

The grid editor offers a higher cycle resolution than the arrange window.
Start and end points can start on any sixteenth note. This makes it perfect for looped edits.
The cycle region goes back to full measure resolution when you close the grid editor but the start and end points are kept until you open it the next time.
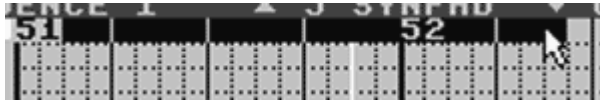
To create a cycle:

- Mark out the cycle region in the upper part of the bar ruler.
- Press **LEFT SHIFT** key to join an already defined region.

SPL

You can set the SPL by clicking in the lower part of the bar ruler.
Alternatively use the **£** key to step forward and the **CLR HOME** key to step backwards.

Catch

When catch mode is activated the screen is automatically updated to follow the SPL. This occurs as long as the SPL is inside the position boundaries of the current sequence.
If you start scrolling the grid editor window horizontally, catch mode is automatically switched off.

Solo

The solo function mutes all tracks except the one for the current sequence.
That way you listen to it in solo. Very convenient when editing.

Output (Echo Notes)

When output is activated notes that are selected, inserted or moved are echoed in the same track. The same thing goes for clicking the piano keys on the left side of the screen.
If the sequence is transposed so are the echoed notes.

Colors

The grid editor uses several colors to display notes.
Lower velocity makes the note appear in darker colors whereas a higher velocity results in a light color. Selected notes are displayed in black color and destination-notes for a slide or pitch bend appear in white.

Alternative Editing

Instead of using the mouse to insert notes you can use a step input for some fast composing.

Step Input Keyboard

The input mode is activated with the **I**-button in the upper left corner of the window.

- With the Sequencer not playing, press the **I**-button to turn step input mode on.
- Set the SPL at the position you wish to start.
- Set instrument and octave in the window title bar.
- Play the notes you want to insert on the C64 keyboard.
- Use SPL buttons (**£** and **CLR/HOME**) to step forward to create pauses or backwards to go back.

When you're done, turn off the input mode to not accidentally overwrite any notes.
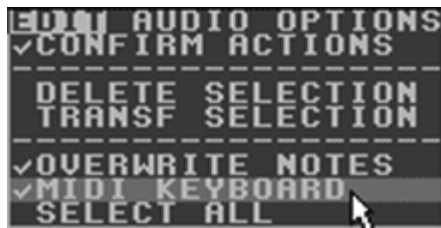
If you wish to use an external MIDI keyboard check the *MIDI keyboard* option in the *EDIT* menu.

MSSIAH Sequencer now inputs notes from the first track's MIDI channel. Note input on the keyboard is limited to three octaves ranging from C_2 to F_4 but using the grid editor's octave setting you can further transpose the incoming notes.

Recording

It's also possible to record sequences into the grid editor in real time.

- Press the record button in the lower left corner of the window to start recording. If the Sequencer is already playing, recording starts instantly.
  If not, SPL starts from cycle start. If cycle mode is turned off it starts two measures ahead of the open sequence.
- Provided that the SPL is within the current sequence's boundaries and the grid editor window is open, all key strokes on either C64 keyboard or the MIDI keyboard (if active) is recorded into the sequence.
- Recording mode is turned off either by stopping the sequencer, exiting the grid editor or deactivating recording mode by clicking the record button once again.
- C128 users can use the numeric pad ***** key to start recording.
- MIDI synchronization works with MIDI keyboard active so you can record the sequence playing back other MIDI parts on your master sequencer too.

Metronome

There is a built in metronome to guide you playing when recording.
The metronome works on SID 6581 revisions only.
8580 cannot handle the technique used to produce the click (actually it can but not in this context).

To activate the metronome and select any of the five metronome key notes check the options in the *AUDIO* menu.

You can use the metronome button in the transport window to toggle the metronome too.

Metronome is turned on by default at start up.

Transform Functions

Transform functions affect notes directly. These are covered in a separate chapter.

Control Sequence Editor

The first track in the workspace window is a control track for control sequences only.
A control sequence is a special object that contains special event data. The data is stored within the sequence on every second sixteenth note.
The color is gray and the length is fixed to one measure. You have 31 control sequences available and those can be further copied as alias objects like the other sequences.
Control sequences only exist within the control track and cannot be moved or copied outside of it.

The control sequence editor is where you edit the control objects. It's a modal window that opens up when double-clicking a control sequence.
Double-clicking an alias object will give you the choice of either editing the original data or to create a new copy.

The data is laid out in eight columns with one row for every type. The columns represent every two sixteenth notes in the timeline. You change the value by clicking on it and move the mouse up and down.

The types of data events you can store in the control sequences are:

Tempo Changes

The first row stores information about tempo changes. If you set a value in any of the eight time positions the tempo will change at that position in the song.

Synchronization Resolution

The second row is where to put changes in synchronization resolution. That is whether to run on 24 or 48 tics per quarter note.

Volume Change

Volume changes are stored in the third row. Values go from 0 to 15 and affect both SID #1 and SID #2 (if installed).

Shuffle Change

Second row from the bottom stores shuffle changes. Values go from 0 to 7. A zero equals no shuffle.

Note:

MSSIAH Sequencer does not automatically restore the tempo, volume or shuffle levels. Whenever you change these, you will have to manually change them back or add another control sequence to do it for you.
Tempo and shuffle can be manually altered in the transport window. Volume does not have a manual control.

Pattern Select

MSSIAH Sequencer is capable of sending pattern select messages on the user port to communicate with Prophet64 applications (http://www.prophet64.com).
The MSSIAH applications use MIDI instead of the user port to switch patterns. If you do not own a Prophet64 Cartridge or have no intentions of using this function you can skip this section.

The last row in the control editor is used for user port pattern select.
There are eight positions to send this information but since the receiver will not switch pattern until the start of the next measure thus only using the last one sent it's pointless to hammer away several pattern selects.
To make sure the receiver catches up though, place the select command a couple of sixteenth notes ahead of the next measure.

Remember that pattern selects lock up the receiver's pattern until sync mode is switched back to internal clock.

The Sequencer mirrors the synchronization signal on the user port too so that the other connected computer can follow it.

Note:

The booklet *MSSIAH – Getting Started* contains specs for the user port connections.

Instrument Editor

The MSSIAH Sequencer has a total of 32 instrument "slots". You edit those in the instrument editor window by choosing the *Instrument Editor* option in the *AUDIO* menu.

The editor window has two pages to access all parameters.
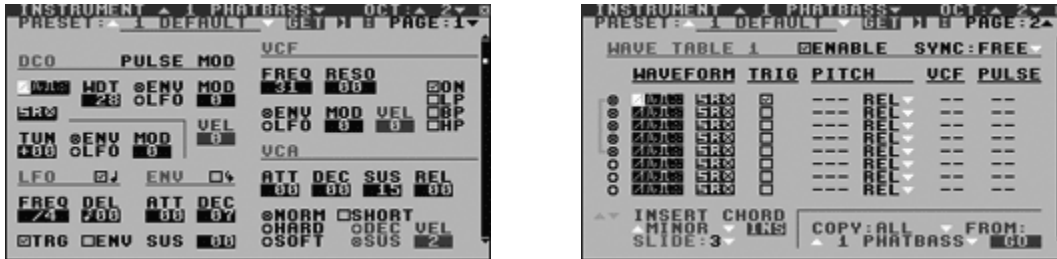
Note:

If you are a complete newbie to synthesizer sound editing, this manual will not be of much help. You should first get information on how to create and edit synthesizer sounds elsewhere.

Selecting Instrument

The title bar of the instrument editor window displays the current selected instrument, its name and which octave to use for playing.

The selected instrument is the same as in the grid editor. When you change it there, it also changes in this window and vice versa. Use the arrows to alter instrument and octave.

Naming an Instrument

Double-click the instrument name in the title bar and enter a new name. Press **RETURN** key when ready.

Factory Presets

To simplify the instrument creation process a total of 68 factory presets were included in the application. These can be loaded into an instrument slot for direct usage or further edits.
Even if you are a pro on editing instruments the presets are a fast point to start.
A newbie will certainly benefit from the easy access to lots of classic sounds from the SID and that is why this chapter starts by focusing on those presets.

The 68 presets can be loaded into any of the 32 instrument slots. However instruments no. 17-32 does not have wave-tables so it is not a good idea to load a wave-table preset into any of those slots. You recognize wave-table presets by the dash sign next to the preset number.
Some sounds are also using filters and therefore vary in quality in between SID revisions.

The first preset named *Default* is the same as the startup instrument loaded into all the slots. With a simple saw tooth waveform and a sustain-only envelope it's very basic and great to start with when creating new sounds. It's a quick patch to play with when learning the application (or if you're just in the mood for some early 90s gangsta funk!).

To use a preset, click the arrow buttons to find a sound of interest and then double click *Get*.

1. DEFAULT	18. BASSGTR3	-35. OP HIHAT	52. DYNASTY
2. BEEFSTEAK	19. SYNBASS1	-36. COWBELL	53. ELECSNAP
3. SYNPAD	20. SYNBASS2	-37. SIMMONS	54. WHEELER
4. EUROPAD	21. 8580 BASS	-38. DISCOTOM	55. GOGETIT
5. NICEPAD	22. POP BASS	-39. BIGSLOPE	-56. LASTNINJA
6. C64LEAD1	-23. C64 BASS	40. VELOPULSE	-57. CHDMINOR
7. C64LEAD2	-24. HUBKICK1	41. ANALOGVL	-58. CHDMAJOR
8. C64LEAD3	-25. HUBKICK2	42. BANJO	-59. FALLING
9. JR EWING	-26. POP KICK	43. TUBA	-60. BASS BD
10. VACUUMDOG	-27. ELECKICK	44. FLUTE	-61. BASS SD
11. LEAD US	-28. DEEPKICK	45. MELOTRON	-62. BASS HH
12. PAN PIPE	-29. HUBBSNR1	46. CLAVINET	-63. AREA 51
-13. STARLEAD	-30. HUBBSNR2	47. CHINA	-64. POLE POS
-14. WARPLEAD	-31. POPSNARE	48. WHINING	65. DUCKTALK
15. NEATLEAD	-32. SOFTSNR1	49. CHARMED	66. CHEVY9C1
16. BASSGTR1	-33. SOFTSNR2	50. INFECTED	-67. LASERHIT
17. BASSGTR2	-34. CL HIHAT	51. RATTLER	68. BOEING737

Testing Instruments

 You can use the C64 keyboard or MIDI keyboard to play the instrument live as long as the Input-button is active. For C64 keyboards, use the keys **ZSXDCV**… for the lower octave and keys **Q2W3ER**... for the higher octave.

The lower part of the C64 keyboard follows the default octave in the window title bar.
The instrument plays in the track of the last selected sequence.
MIDI keyboards are restricted to use keys between C_2 to F_4 but the selected octave transposes incoming notes so you can reach the full scale of the SID.
(When running the Sequencer in MIDI mode there are no such restrictions)

Sound Layout

MSSIAH Sequencer instruments have settings for oscillator (DCO), filter (VCF) and amplitude envelope generator (VCA). Added to this are three independent sources of modulation, a wave-table for instrument 1–16 (can be reused for instr. 17-32) and additional settings like envelope initializations (hard restart) and tuning.

Modulators available are the low frequency oscillator (LFO) and the software envelope (ENV). Both of them can be routed to pulse, pitch or filter frequency.

For greater flexibility the LFO can also act as a simple envelope and the envelope can be set to repeat like an LFO.
Note velocity is available as a real time controllable modulator to affect pulse, filter and VCA.

The wave-table has eight rows of data to change waveform, pitch, filter and pulse settings. You can loop any positions within the table and synchronize it to either internal/external clock, 16th notes, 32th notes or just let it run free (classic C64).

Editing

Click the left mouse button in the black region surrounding the numbers and move the mouse up/down to alter the value. Keep both mouse-buttons depressed to reset the value. Radio buttons and check boxes are checked or toggled with the left mouse button as usual.

DCO

The DCO section includes settings for waveform, pitch and pulse modulation.
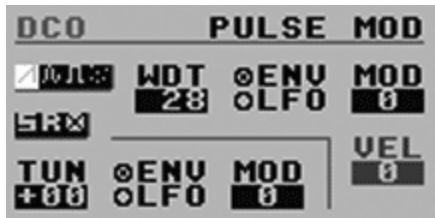
The four leftmost buttons select waveform(s). Click on the one(s) that graphically represents the SID waveform(s) you want: Saw tooth, Sine, Pulse or Noise. On the SID 8580 R5 any of the waveforms except noise can be mixed. The SID 6581 can only mix pulse and sine, all other combinations result in silence.

The three buttons below the waveform buttons select built-in effects for the SID DCO:

Waveform Synchronization
This means that the frequency of this oscillator is synchronized with the frequency of another oscillator playing on a different track.

Ring modulation
This means that the saw tooth output of this oscillator is replaced with a ring modulated combination of this oscillator and another oscillator's output playing on a different track. Ring modulation is often used to create the sound of bells (*Top Gun*, anyone?).

Oscillator Disabled
This turns off the oscillator completely.

Which oscillator is affected?
When using sync and ring mod the corresponding oscillator that affects this instrument's oscillator depends on in which track the instrument is playing.
(Note: here we use the Sequencer term "track" when actually referring to another oscillator)

Take a look at this table:

SID #	Sync/Ring mod instrument played in track:	Affects instrument playing in track:
1	1	3
1	2	1
1	3	2
2	4	6
2	5	4
2	6	5

Example:
Let's say you have created an instrument with oscillator synchronization currently playing in track 2. Looking up track 2 in the second column shows that the other instrument (oscillator) playing in track 1 is the one affected (third column).

If you copy the sequence from track 2 to track 1 the terms are changed. Now as the sequence is playing in track 1, it will affect the instrument playing in track 3.
If you didn't get that, take a look at the table: Instrument played in track 1 affects instrument played in track 3.
It's not really that hard; just remember that you are not totally free of choosing tracks for your sequences when using sync and ring.mod effects. Use the table as guidance.

Note:

You should only set sync or ring mod on the instrument playing in the first track not the corresponding one. That will cause another sync/ring mod to occur.
Playing polyphonically in MIDI mode using ring modulation can make cool effects but you have no control over it since the MSSIAH MIDI engine fully controls the polyphony.

Pulse
The width of the pulse waveform is defined and modulated in the DCO pulse section.
The *WDT* parameter is for basic pulse width, any other influence from either *LFO* or *ENV* will use this width-setting as a base point.
If you apply velocity modulation both LFO and ENV are inactivated for pulse mods.

Pitch
The pitch of the oscillator can be modified with either *ENV* or *LFO* for effects like vibrato, sirens, drum slopes etc.

Tune
Tune is to compensate extreme pitch modulations or create effects if you play two similar instruments on different tracks. Detuned in each direction they form the classic 'euro' sound of modern dance music.

LFO

The LFO is a software Low Frequency Oscillator that can also function as a simple envelope.

The frequency operating range is between 0 and 127. Lower values make a slower oscillation whereas higher ones make the LFO go faster.
A zero value equals no oscillation at all.
You can delay the LFO operation with up to 15 sixteenth notes by setting the *DEL* value.

LFO Delay has an additional function when running the Sequencer in MIDI mode. A value between 1 and 7 then sets the modulation wheel top limit instead of LFO delay. I.e., a value of 4 will not allow the pitch modulation to go higher than 4 when pushing the mod lever on your keyboard.

The LFO runs continuously and resets only when a program change switches to another instrument. If you wish to retrigger the LFO at every strike of a new note check the *TRG* box.
As you do this you will notice another checkbox appearing named *ENV*.
When checking *ENV* the LFO turns into a rudimentary envelope using the frequency setting as a decay value. Lower values make a slower decay whereas higher values speed it up.
Unlike real envelopes, the LFO envelope stops when it reaches zero. There are no sustain or release settings and no attacks either.

LFO Sync
If you click the note symbol in the LFO section you activate the LFO synchronization mode. The LFO rate now displays a set of intervals the LFO cycles when playing. For example, if you choose to sync the LFO every second measure (a value of 2) the full LFO sweep from low to high and back will be exactly two measures according to your internal or MIDI clock signal.
Since LFO sync demands more system resources than normal LFOs, do not check the sync box if you do not use it. Same goes for tracks not used, make sure the current instrument on those tracks hasn't got the LFO sync checked. Even with no notes playing, the sound itself on that track is still active consuming system resources.

ENV

The software envelope is a basic attack-decay-sustain envelope with the ability to also function as a simple yet quite controllable LFO.
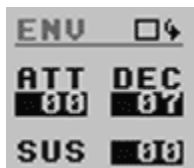
The different phases of the software envelope works just like a "real" envelope. You have 15 fixed values for every parameter.

It starts with the attack phase and moves on to the decay phase and then stops when it reaches the sustain level.

By checking the loop symbol the envelope turns into an LFO.
It then loops the attack and decay phase endlessly giving you two alternating speeds when oscillating. If you want a standard sine wave set the same value for attack and decay.

VCF

The SID has got only one filter that can be turned on or off for each of the oscillators. This requires some special treatment to get it right. More on that in a second, first let's have a look at the parameters:
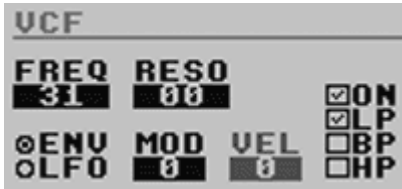
The filter is activated when you check the *ON* checkbox. An additional checkbox appears with filter type options. These are: Low Pass (*LP*), Band Pass (*BP*) and High Pass (*HP*). Any of those types must be selected in order for the filter to function properly. Several types can be mixed.

You can set frequency and resonance and modulate the frequency directly with either *ENV* or *LFO*. Select the source of modulation with the radio buttons and then set the modulation amount (*MOD*).

The current frequency setting affects how low the filter goes. This comes in handy when modulating the filter frequency with a slow LFO to not shut the sound off completely as the LFO reaches a zero value.

(On that note you should know that all SIDs are different so there are no guarantees where you find the exact cutoff position for absolute silence, if any.)

By turning up the *VEL* parameter you apply velocity modulation directly to the filter frequency. Setting the *MOD* parameter at the same time will make velocity affect modulation depth instead.

How to Apply the Filter

The SID filter has to be turned on and off individually for each oscillator that uses it. MSSIAH Sequencer handles this automatically whenever it encounters a program change with a filtered instrument. You can watch as it happens by looking at the *F*-icons lighting up when a filter instrument is playing.
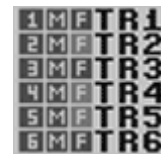
As an unfiltered instrument comes up, the application turns the filter off again and you will notice how the *F*-icon for that track goes out.

MIDI mode handles the filter on/off control automatically too, though you wont be able to see the *F*-icons since the screen is blanked out.

With no doubt this built in filter control is a convenient way not to worry about turning on and off the filters, just click the checkbox. Unfortunately the SID uses the same filter for all oscillators. In practice this means that two filtered instruments playing on two different tracks within the same SID (track 1-3 or 4-6) will share the same frequency and resonance parameters. To not cause unwanted noise because of this filter conflict MSSIAH Sequencer gives the highest track priority. Though two instruments have completely different filter sounds the one playing on the track with the highest number "wins".

MIDI mode is reversed: lowest numbered track in each SID gets the priority.

You cannot play individual filtered bass and lead sounds simultaneously unless you put them in tracks on separate SIDs. You can however use two sounds with different timbres and characteristics on two tracks playing the same notes and let the one on the highest track control the filter, as long as the "lower" instrument has the filtered switched on too.

VCA

The VCA section controls the SID VCA envelope, sound triggering and velocity.

VCA envelope has separate controls for Attack, Decay, Sustain and Release.
These are the only parameters available for manipulating SID oscillator volume.
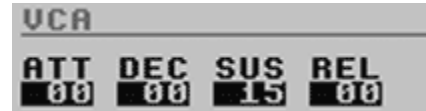
Additional VCA Settings

The controls beneath the envelope handle triggering, note trig-offs and velocity modulation.

Triggering includes three types:

NORM
This is the setting for a normal trigger without any hard restart of the SID registers.

HARD
The HARD setting sets all SID registers to zero on the current track for each new note before the note is triggered.
When using full MIDI mode the HARD setting means that a hard restart is performed the moment a note is released. Full MIDI mode also gives you control to choose the type of initialization (control change no. 65) and uses it as default until you select another one.

SOFT
Instead of zeroing out the envelope this setting preloads the SID registers with the new parameter values. It gives a somewhat better result on various sounds like drums wave-table effects and sounds that vary in velocity volumes a lot.
The initialization will occur shortly before the note triggers depending on the speed of the song whether it runs on internal or external clock.
In MIDI mode, the SOFT setting means wave-table instruments are pre-triggered. This results in the sound being delayed by 20-30 milliseconds but triggers more accurately. If the instrument does not have a wave-table activated then this setting will have no effect.

SHORT
By checking the *SHORT* option the note is shut off a little earlier, like a TB-303. This will make hard restarts (HARD and SOFT settings) trigger earlier too. Use it for 303 style note length or when playing at high speed using hard/soft initialization.
This setting has no effect in MIDI mode since note lengths are completely determined by your MIDI data.

Velocity
Setting the *MOD* parameter routes note velocity to the VCA envelope.

The higher the mod value the more effect of the velocity span.

With a value of 3 the velocity curve is applied to the VCA envelope destination parameter directly. The modulation destination is either decay (*DEC*) or sustain level (*SUS*) of the VCA envelope.

Sustain velocity

```
ATT  DEC  SUS  REL
 00   00   15   00
```

SUS makes the modulation affect the sustain level only. This makes perfect velocity sensitive sounds if attack, decay and release settings are all left at zero, like the default sound.

Decay velocity

```
ATT  DEC  SUS  REL
 01   09   02   00
```

DEC works better when using envelope initialized sounds, for example drums.

If you try to make a sound with VCA decay and low sustain value and you don't hear any effect it's most likely because of the velocity *MOD*. Turn VEL off by setting it to zero.

When playing in MIDI mode and using VCA velocity the SID has a strange quirk that does not trig a new sound with higher sustain value than the previously struck note. If you're experiencing weird drop-outs when playing velocity sensitive parts that might be the problem.

How to master the SID envelopes

By now you have probably learned that the SID envelope occasionally triggers quite poorly. This happens every 8 notes or so and is impossible to predict.

Back in the C64 heydays clever coders and musicians examined the SID carefully and came up with a cure, *hard restart*.

The idea behind hard restart is to initialize the SID envelopes a given amount of time before trigging the note, 33 ms considered optimal. Hard restart does not allow envelope release if two notes are triggered close together because it cuts off the sound completely. The upside however, is that the envelope triggers much better.

All envelope settings do not work in every given situation. For example, wave-table sounds with a textured content and rapidly switching the sound in between notes can be a bit tricky for the SID. So even if using envelope init you still need to tweak the ADSR to find the right settings. This is what defines a good SID musician. Learn to master the envelope and how to find solutions in different situations and spend a little more time to experiment and get the envelopes right.

A concrete example of a problem you will encounter when working with SID and wave-tables is starting a wave-table sound with the noise waveform.

These are known to cause trouble when trigging, especially after a release phase from a previously played sound. The oscillator is then kept busy which is good in some occasions but really bad in others.

ATT DEC SUS REL
00 08 04 04

Another example is using a fast decay for snappy sounds. Even with initializing, the envelopes might fail. Mostly this is due to the song's tempo making pre-trig time deviate too much from the optimal 33 ms value.

ATT DEC SUS REL
01 08 02 00

A trick to get around it is to use the *Short* option which re-triggers a little earlier, another is to apply a value of 1 on the attack setting.

As you see, there is no one-fits-all solution for SID envelope init. It takes a little experimenting before you find an acceptable workaround.

Envelope Initialization via MIDI

MIDI mode offers three ways of initializing the envelopes. These work best in multi-mode since polyphonic modes cannot always predict which oscillator is to be used next. Therefore envelope init in poly mode simply restart all the available oscillators.

Control Change #65

You can at any time send the control change message #65 on a MIDI channel to reset that oscillator immediately. Following the #65 message is a value between 1 and 8 that sets the mode of initialization. For example the value 2 means that the ADSR is reset with a full decay value (the rest being zero) and the envelope trig is set to 8 (disable oscillator).
The value 6 is a "reload" meaning the ADSR is reloaded with the current envelope setting instead of an extreme restart value. For a full list of init modes, see the *MIDI Controller List* chapter.
The last sent init mode is buffered so that *init at release* (see below) can use it. It resets to mode 1 when MIDI mode is quit.
Using values 9, 10 or 11 with cc #65 sets the *Hard* and *Soft* (or none) settings (see below).

Init mode 0 and 1 will probably work best most of the times. 7 and 8 gates the envelope (same as soft setting for wave-table sounds) which will make most sounds inaudible.

Init at Release

In MIDI mode the VCA section's *HARD* setting means that the current oscillator's envelopes are initialized using the last init mode (sent via control change #65) every MIDI note off. This is the quickest and simplest way to get an envelope init without having to send cc #65s, just release the key and you'll get an envelope init. Just make sure you have sufficient time between the note offs and ons.
Init at release works best in multi-timbral mode.

Wave-Table Pretrigger

In MIDI mode the VCA section's *SOFT* setting pretriggers the wave-table (if activated).
The envelope is preloaded with the ADSR setting and set to trig without a waveform. It works quite well with wave-table sounds. The downside is that the wave-table sound triggers late with about 20-30 milliseconds. You can adjust it by setting the same time delay on your sequence. If playing live, you can create a feel for this and adjust your playing accordingly.

The type of reset and init mode that will work best depends on your sound and various other situations. For example, initializing wave-table sounds can be quite tricky since they often are made up of many different waveforms. Pretriggering (soft) is probably best most of the times.

Generally the init mode depends mostly on the ADSR setting. When tweaking that MIDI sequence to perfection, you will probably need to try out a couple of different init types before you find the perfect solution.

Tips:

When using control change #65 to init envelopes, a good idea is to put the #65 message on the same events as the notes but in an empty sequence on the same MIDI channel. By altering the delay property for that sequence it can be made to play back approx. 33 ms ahead of the notes.
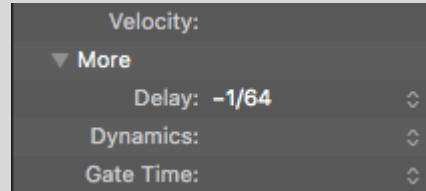
To really nail it and have a perfectly triggered SID envelope you may have to play around with the delay time as well as the init mode 0-8.

Wave-Tables

Wave-table is the accepted term for a predefined list of changes applied to waveform and pitch periodically about every 20 ms (classic C64). Another word often used is *arpeggio*, the technical term for broken chords.
It is the trick behind the famous drum and chord sounds of the C64 era.

In the past most wave-table editors were pretty hard to grasp. Parameters, waveforms, pitches and repeat points all had to be altered in hexadecimal numbers. Often the users also had to learn the control bits for different functions and manage all the memory themselves.
The MSSIAH Sequencer provides a fully graphic interface, completely mouse controlled, just left-click the parameter and move the mouse up or down to change the value.

Each instrument has a wave-table available to edit. However, instruments 17-32 reuse the ones for instrument 1-16. I.e., instrument 17 uses the same wave-table data as instrument 1, instrument 19 uses the same wave-table as instrument 3 etc. So when you edit the wave-table in instrument 19 you are also altering the wave-table data for instrument 3.

Length is fully variable but has a maximum of eight rows. Each row stores changes in waveform, pitch, filter cutoff frequency and pulse width.

Wave-table settings reside on page 2 of the instrument editor. **PAGE:1▼**
Either use the scroll bar or press the arrow next to the page number display to flip pages.

☑ENABLE

First check the wave-table enable checkbox to activate the wave-table.
The table data turns from gray into black indicating that it is enabled for editing.

When activated, waveform settings on page 1 are turned off and are completely controlled by the wave-table instead.

Loop

The first column displays loop points for the current wave-table.
It's an eight step radio button list where the top button checked is the loop repeat start position and the last one checked is the end point. To visualize it further MSSIAH Sequencer draws a green line between the two points.
The wave-table starts to play from the absolute top and then advances one step at a time when the criteria for sync is fulfilled.
When the end point is reached it starts over from the repeat start point.

Set the repeat start point by left-clicking the radio button at the position you want. Then set the end point by left-clicking the radio button at the requested end position holding the **LEFT SHIFT** key.
Since there is no way to turn off the loop, you need to set the last position of your table as both repeat start and end point if you want it to stop when the table has finished playing. Keep in mind that this will repeat the waveform, pitch, pulse and filter settings of that last row.

Moving a Table Loop

Right under the loop controls are two arrow buttons. These move the whole loop section (the table rows within the 'green' area) up or down.
It does not only move the loop points but everything inside the loop also. Data outside the boundaries is overwritten.

Waveform

The waveform column selects the waveform for the current row.
The four waveform buttons and three additional ones are just the same as in page 1.
Refer to the *DCO* section earlier in this chapter for more info.

Click the buttons to select waveform for each row respectively in the wave-table. Leave it empty if you want the previous waveform, just don't forget to set a waveform for the first row.
As you enable wave-table the DCO section in page 1 becomes inactive and completely relies on these settings.

Trig

The trig column determines whether to trig the sound on or off.

TRIG

To trig a sound set a waveform for the same row and check the trig checkbox.
To trig off a sound set a waveform for the same row but leave the checkbox unchecked.

Do not check the trig checkbox if you don't have a waveform on the same row. That results in no sound at all and might confuse the SID envelope.

Pitch

This column sets the pitch change for the current row.

PITCH

```
C#5  ABS
+03  REL
030  ADD
095  SUB
---  REL
---  REL
---  REL
---  REL
```

The pitch setting has four different modes:

Absolute
In absolute mode you define the note to be played regardless of note and transpose values. The table's pitch column displays the absolute note.

Relative
Relative is the standard mode for wave-table pitches. It transposes the pitch a given amount of semi-notes up or down from the current note, transpose included.
Make three or four relative pitch changes in a harmonic pattern and you've got yourself a chord.

Add
Adding pitch means adding a value to the current frequency. While relative pitch operates in semi-notes, add (and sub) uses direct frequency.
This is ideal to create a pitch slope for drums or sound effects like sirens etc.

Sub
Same as add but subtracts the value instead.

Filter

The filter value in a wave-table row overrides the current filter frequency setting.

If you don't know how the filter works see the *VCF* section earlier in this chapter.

Pulse
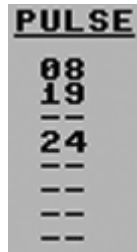
The pulse value in a wave-table row overrides the current pulse setting.

Wave-Table Synchronization

You can choose between four different ways to advance the wave-table row when playing.

FREE
This is classic C64 style. The time in between each row is approximately 20 ms.

TICS
The wave-table advances at every tic from the internal or MIDI clock. There are six tics per sixteenth note in MIDI clock. The result is a slower or faster wave-table sound depending on the current tempo.

1/16
Wave-table advances every sixteenth note.

1/32
Wave-table advances twice as fast as the last option, at every thirty-second note.

You can try out these different sync modes to create interesting sounds.
For example, change waveforms every sixteenth note, perhaps combined with some waveform sync or ring modulation effects, or why not run thirty-second note classic arpeggios.
When using wave-table synchronization in MIDI mode, the MIDI clock advances the wave-table pointer every 16th or 32rd note. If you start playing the note exactly on a MIDI clock event the wave-table might jump ahead a little too fast. If so, try playing it a couple of tics later.

Wave-Table Editing via MIDI

You can input wave-table data via MIDI too. Read more about it in the *Using MIDI* chapter.

Wave-Table Transpose and Pitch Bend

Pitch bends only affect rows using the relative pitch change mode and a zero value (no transpose).

Insert Chord Function

To quickly create chords there is a handy function to insert chords. Just select a type of chord and double click the *INS* button.

The pitch pattern is inserted into the first four rows of the wave-table. All other data is unaffected.

Wave-Table Example: A simple bass drum

To make it easier to understand the wave-table concept, here are two examples of the most commonly used wave-table sounds. Let's start with a bass drum.
To imitate a bass drum sound, we need to break it down to some basic building blocks:
First, there's the initial click of the drum pedal beater.
Second, there is a sloped pitch falling from a medium frequency to the absolute bottom.

To create such a sound with a wave-table we'll use a noise waveform to define the click and switch to a pulse wave to create the slope. You can later experiment with different pulse settings or even change the waveform to a sine or saw tooth.

To make it as simple as possible we use only three rows:

The first row is a noise wave with an absolute pitch pretty high up.
The second row is the first pulse sound. You will need this row to have a reference note for sliding. We choose a medium frequency in relative mode so that you can vary the pitch when playing the sound later on.
The last row is an infinite loop continuously subtracting 151 from the current pitch. That should make a nice slope falling down until it hits the bottom. You probably need to tweak the subtraction value further when adjusting the kick to the tempo and style of your song.

Finally we set the VCA envelope to hide the very last part of the slope. Try these settings:

Wave-Table Example 2: A Simple Chord.

A normal chord such as C-major consists of three or four tones in a harmonic pattern. In this case: C – E – G and possibly an additional C one octave up to thicken the sound.

The wave-table plays through this sequence of notes repeatedly to create the illusion of a full chord. Of course it will not sound like a real chord with three or four voices playing in unison but a very special sound that truly defines the computer game era of the 80s.
Play it back to any old gamer or coder and notice the nostalgic smile on their faces..
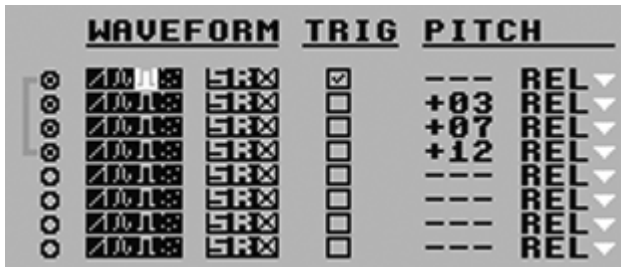
You can also play the fundamental tones of the chord in another sequence to make it more interesting such as starting with the third note one octave lower etc.
Nevertheless, it's recommended to use the *Insert Chord* function to create a wave-table chord from the ground up. It is very convenient and a fast way to get started.

Slide Time

You can set the slide time for every single instrument. Shorter values suits legato (two notes played after each other with no release) whereas higher values gives slow portamento effects. The value of 3 (default) is the classic TB-303 slide.

Slide times range from **1** (fast) to **4** (slow). You change it in the lower left corner of the instrument editor in page 2.

Copy Instruments

Instead of using a pen and paper to write down an instrument's parameters and then re-enter those into another instrument slot the MSSIAH Sequencer has a simple yet very handy copy function. You find it in the lower right corner of the instrument editor window on page 2.

First select if you want to copy all of the instrument's parameters or just the wave-table and then select from which instrument slot to copy. Finally click the *GO* button to execute the copy.
(Note: Trying to copy a table does not have any effect on instruments 17-32.)

Transform

The transform functions are designed to perform time-consuming tasks on a multiple selection of notes. This is very useful when you have many similar changes to make.

Transform functions work with the two types of selections available in the Sequencer:

- Arrange window workspace objects, i.e., sequences (non-alias).
- Grid editor window objects, i.e., selected notes.

To transform a sequence object in the arrange window:

- Select the *Transform* item in the *FUNCTIONS* menu, select a function and set the value.
  Then close the transform settings window.
  Clicking **Ok** will not necessarily start the function.

- Check the *Transform Selections* option in the *EDIT* menu.
- Make the selection as usual:
  Press **LEFT SHIFT** key
  Click the left mouse button and mark out the selection with the mouse.
- As you release either **LEFT SHIFT** key or left mouse button the selection becomes active and the transform function starts.
- Only valid sequences (full non-alias objects within the brackets) are affected.
- After you are done, uncheck the *Transform Selections* option to be sure that you do not accidentally trigger it when making a new selection.

To transform a selection of notes in the grid editor:

- Select the notes you wish to transform
- Open the transform settings window by choosing *Transform* in the *FUNCTIONS* menu and make your choice.
- Click **OK** and the transformation starts.

Notice the difference in how the **OK**-button works in the transform settings window.
Only with an open grid editor window the button executes the function.
That is because the grid editor has a stored selection whereas the arrange window hasn't.
The arrange window needs to execute the function after the selection is made.

To select a function, click the radio button next to the one you wish to use and set the parameter value. The value has a different meaning for every single function.

Transpose

This option transposes the note frequency either up or down. Select a transpose setting to add or subtract from the selected notes.

Set Program

This option alters the program changes (instruments). Select a value between 1 and 32.

Set Velocity

This option sets all note velocities to a fixed value between 0 and 15.

Limit Velocity

This option lets you set a treshold for which the velocity should never exceed.
When the function executes it automatically lowers any velocity above the treshold.

Fixed Note Length

A convenient way to length-quantize all the notes in your selection. You can easily decide that all notes should have the length of, for example, four sixteenth notes.
In practice this requires free space so every note might not be converted. Whenever another note gets in its way the note length is stopped. No overwriting occurs.

Remove Slides/Bends

This option removes slide and pitch bend commands from the sequence.
In the grid editor this function ignores selections. *All* slide and bend commands within the open sequence are removed.

Repeat Objects

This function is very useful if you have a long loop of sequences or notes. It repeats your selection any number of times you like.

Repeating objects in the arrange window means that all valid (objects within the brackets) sequences are copied a predefined number of times as alias objects.
Destination area starts at the end of the active selection.
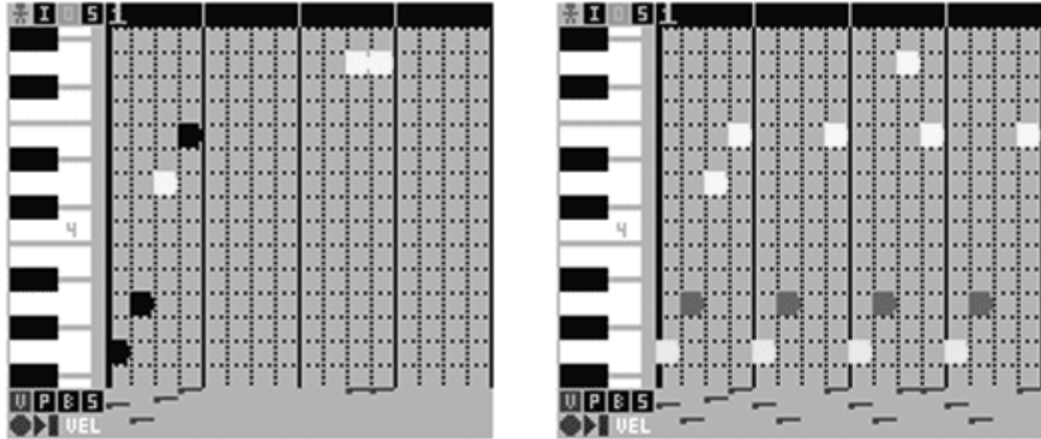
The grid editor handles the repeat objects function by copying selected notes:
The sequence of notes repeated starts at the first selected note and finishes at the last selected one. All selected (black) notes within that range are repeated starting one sixteenth note after the last one selected.

Depending on the current state of the *Overwrite Notes* option in the *EDIT* menu, blocking notes are overwritten or ignored.

Swap Tracks

Swap tracks is for swapping all the sequences inside one track with the ones on another track. There are two ways to do this:

- Select a sequence residing in one track.
- Open the functions window, select *Swap Tracks* and set the value field to the other track.
- Now click **OK** and all the sequences in the first track change places with the ones in the second track. Done!
- If no sequence was selected prior to opening the functions window nothing happens.

Or:

- With no sequences selected, open the functions window and select the *Swap Tracks* function.
- Select the first track in the value field (1-6).
- Close the functions window and activate *Trsf Selection* in the *Edit* menu.
- Select the sequences in the second track. Holding **LEFT SHIFT** key and clicking left mouse button on the first sequence is all it takes, empty spots do not work.
- Release the left mouse button and click **OK** in the *Are you sure?*-dialog (if *confirm actions* is enabled).
- Now all the sequences in the first track change places with the ones in the second track. Done!

Selections (second method) may span several tracks; the swap function only recognizes the selection's first track. Empty selections do not work. You need at least one sequence.

Select Original

When your workspace is crowded with sequences and aliases, finding an original sequence for an alias might be a little tricky. That is when *Select Original* comes in handy.

This function is the only one that takes effect immediately after clicking **OK** in the functions window. If you have selected an alias sequence before opening the functions window clicking the OK-button means that the original sequence is looked up and selected instead.

You can also use the *Trsf Selections* option as long as the first object in your selection is the alias object. Pressing the **LEFT SHIFT** key and left clicking the alias object is all you need to do really. The original sequence is looked up and selected immediately regardless if *confirm actions* is enabled or not.

Crescendo

Crescendo creates a velocity crescendo for all selected notes in the sequence. The crescendo starts with the first selected one and ends with the last one. Only selected notes are affected.
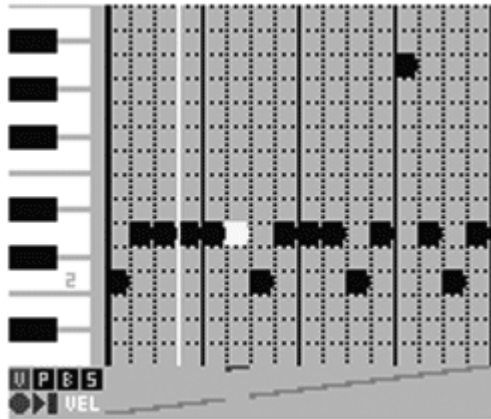
By checking the *Inv* radio button the crescendo gets inverted (decrescendo) so that the first note's velocity starts at full velocity and drops to zero instead.

Crescendo function only works inside the grid editor.

Half Speed

Half speed makes all the notes in the current sequence twice as long and rearranges their start points respectively in order to make the sequence play back at half the original speed. The length of the sequence is not affected whereas notes on the latter half of it will be lost.
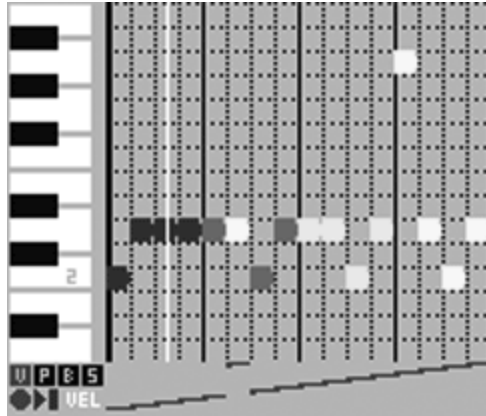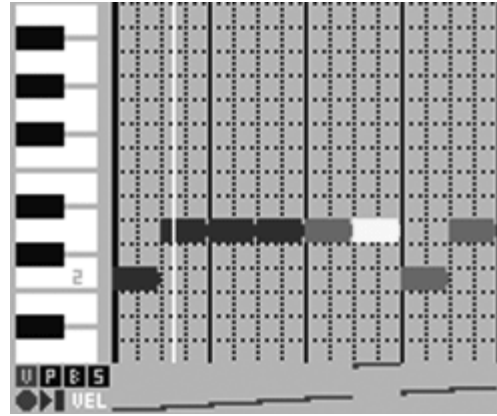
Before   *After*

The half speed function only works inside the grid editor.

Note:

Try out these functions for yourself and learn how to properly use them in your work and how they can help you to be more effective.
Caution! Make sure to uncheck the *Transform Selections* option in the *EDIT* menu when you're done to prevent accidental loss of data

Using MIDI

The MIDI implementation in the MSSIAH Sequencer consists of three different modes of operation. These are run in MIDI mode as the screen goes blank and the Sequencer is ready for input. MIDI mode is a separate window that both contains the MIDI settings and activates MIDI mode.

Access the MIDI window by selecting the *MIDI Mode* item in the *Functions* menu:

MIDI Mode window

The MIDI mode window has settings for MIDI channel, pitch wheel range and channel preset. The settings are enabled or disabled depending on the status of a second SID and whether you have selected a polyphonic or multi-timbral mode.

MIDI Channel

The first row sets the MIDI channel for each track. Channels are selectable 1-16 or Off (- -).
If SID #2 is enabled so are the lower tracks 4-6. If you choose polyphonic mode only channel 1 is enabled.

Pitch Wheel Range

You can set the range up and down independently for all tracks in 24 semitone steps.

Instrument

You can select what instrument to play on each track individually. Default is the channel's last played instrument. It's less important if you plan to set up your tracks from MIDI via program change messages.

Mode

There are three modes of operation in MIDI mode:

Multitimbral
Multi-mode is a multi-timbral mode where each track (oscillator on the SID circuit) listens to its own MIDI channel. Multiple tracks can be assigned to the same MIDI channel for doubling effects. Either way, each track plays monophonically.
With SID #2 enabled MSSIAH Sequencer offers six separate MIDI tracks. With one SID only, that makes three.

Polyphonic
Polyphonic mode plays the same instrument on all three SID oscillators (three voice polyphony) or six oscillators with a second SID enabled. Note that all the voices of SID #1 share the same filter and so does SID #2.

Multi/Poly
This mode runs SID #1 in multi-timbral mode and SID #2 in polyphonic mode. You can thereby sequence SID #1 with drums and bass etc. while playing chords on the second SID.

Voice Stealing

When you play polyphonically with only three voices available (poly mode and multi/poly mode) you can choose how to treat a voice overflow i.e., holding three notes down and then press a fourth one.

The voice stealing patterns available are:

None	No stealing. Fourth note does not play.
Highest	Steals the highest note struck on the keyboard
Middle	Steals the middle note
Lowest	Steals the lowest note
Cycle	Cycles through oscillators, 1-3 etc. Steals the next.
Latest	Steals the latest note struck

Arpeggio Playing

Checking the *Arpeggio* checkbox treats wave-table instruments as live arpeggios. That means it replaces the wave-table's pitch changes and inserts the notes you are currently playing. The result is a classic C64 broken chord that you can play interactively.
Try changing the waveform and wave-table sync settings in the wave-table to produce cool effects. Arpeggio mode is only available in polyphonic modes.

Important: Because of the SID's unwillingness to retrigger sounds at higher sustain levels than the previous one under given circumstances, set VCA velocity level to zero to prevent drop-outs when using arpeggio playing.

Start MIDI Mode

Use the *START* button to start MIDI mode. The screen goes black and Sequencer readily awaits MIDI input. If you haven't plugged in your MIDI cable into the MIDI input of the MSSIAH Cartridge now is the time to do so. Press the **RUN/STOP** key to exit MIDI mode.
Press *CLOSE* button to exit the MIDI window.

Using Control Changes

Make sure to have at least 2-4 ms in between messages when feeding MIDI control changes into the MSSIAH Sequencer. Even though MSSIAH uses buffering to catch up control change data it is not recommended to stress the Sequencer with control changes if you wish to avoid dropouts. Also, be aware of that altering instrument parameters will affect all tracks playing the same instrument as they use the same buffers.

Using the Modulation Wheel

The modulation wheel can be applied to pitch modulation depth. That means the more you push the modulation lever/wheel (depending on your keyboard) the more increase in pitch mod depth you will get.
The maximum level is set with the LFO delay parameter with a value between 1 and 7.
LFO delay itself is not used in MIDI mode; this parameter is instead fully dedicated to mod wheel depth. A value of zero means no mod wheel effect.

Envelope Inits

When playing instruments on different tracks MSSIAH Sequencer accepts control change #65 to initialize the current envelope. This way you can control what is known as hard restart in the C64 world, via MIDI. Read more about the technique of initializing envelopes in the *How to Master the SID Envelope* section of the *Instrument Editor* chapter.
Control Change #65 offers eight modes of envelope initialization. You will probably need to try them since their effect varies on different types of sound. The recently used mode is set as default the next time a CC #65 is sent until MIDI mode is quit.
You will find a complete list of all modes in the *MIDI Controller List* chapter.

Legato/Slide

In monophonic modes, playing two notes after each other without releasing the first one is called legato. Legato on the MSSIAH Sequencer also triggers a slide between the two notes. If you wish to lessen the slide effect, set a lower slide value for the instrument.

Note Length Trig Problem

Most grid editors found on popular PC/Mac sequencers will default the note length to a full 16th or 32rd note (see left image on next page).

That means the note off is sent just before the next adjacent (if any) note triggers.
Though most synthesizers handle this well the SID does not. When trigging off a SID oscillator the chip needs a little extra time to recover before the next trig occurs.

Therefore, when working with an external sequencer, shorten the length of notes so that note off do not get too close to the next note on (right image).

Programming Wave-Tables via MIDI

The list of control change messages for the MSSIAH Sequencer even includes editing wave-tables via control data. That means you can fill a whole wave-table with a drum sound, a chord or what not by sending a series of control change messages and values.

The actual wave-table data that is being altered is the one residing in the MIDI channel's current instrument. As you learned in the *Instrument Editor* chapter, instruments 17-32 reuse the wave-tables for the lower instruments. So when entering wave-table data for instrument 17 you're in fact altering instrument 1's wave-table, 18 uses no. 2's etc., 19 no. 3 etc. Keep that in mind!

The control change messages available for wave-table data programming are:

  96   Wave-table on/off 0-1 (1 = activate)
  97   Wave-table sync 0-3
  98   Loop point start
  99   Loop point end
100   Set row for entry 0-7 (at what row do you want to place the data?)
101   Waveform/sync/ring mod at position. 0-32.
102   Trig on (1) or off (0)
103   Pitch type 0-3. Absolute, relative etc.
104   Pitch low 0-127
105   Pitch high 0-127
106   Filter cutoff frequency override 0-32
107   Pulse width override 0-31

It's pretty straightforward.

- First set the position with cc #100.
- Then set the waveform, trig, pitch etc.
- Once again change the position with cc #100 and enter the next row.

For more details on these messages, see the *MIDI Controller List* chapter.

1 1 1	1	Control	1	100	0
1 1 2	1	Control	1	101	2
1 1 3	1	Control	1	102	1
1 1 4	1	Control	1	103	0
1 2 1	1	Control	1	104	0
1 2 2	1	Control	1	100	1
1 2 3	1	Control	1	103	0
1 2 4	1	Control	1	104	3

Pitch Settings

When setting pitch you first define if it's relative, absolute or add/subtract.
Then you set the pitch setting itself. Now this is a little harder…
Pitch settings go from 0-255 whereas MIDI data only takes 0-127. Therefore two different control
change messages, *pitch low* and *pitch high*, are provided to access 0-127 and 128-255
respectively.

If your pitch type is add or subtract then it's quite simple. The value sent (for example, pitch high
of 102) is applied to add/sub with its reference added. Pitch low adds nothing and pitch high adds
128 making 102 = 230.

Using relative values pitch high is an addition, i.e., value 12 means "add relative pitch of 12".
Pitch low however, enters the subtract value and it's a little different. Those values are inverted so
you need to recalculate. 127 means -1 and goes down from there making 126 = -2 etc.
You can use the formula: (TRUE VALUE) – 128 = (DATA VALUE)
So if you want the relative pitch to be -12, the formula is:
12 – 128 = -116
So you enter the control change message #105 and the value of 116.

Absolute values are only valid between 0 and 95 using pitch low. It's actually possible to enter
bigger values but that will only produce weird results.

Advanced Random Composer

The Advanced Random Composer is a built in tool to create cool random sequences. It is accessed in its own modal window or inside the grid editor.

Your C64 needs to be equipped with a fully operational SID in the original socket (SID oscillator #3 is used to obtain random numbers). Control sequences and alias sequences are not affected.

The A.R.C. has parameters for the number of notes to use, which ones to include and the range to operate. The result is stored in your current selected sequence and can be played back or further edited just like any other object. Depending on your input the result can be very harmonically interesting.

Open the Advanced Random Composer by selecting *A.R.C.* in the *FUNCTIONS* menu.

Lock Notes

Click the left mouse button on the notes you wish to lock (i.e., include in the random process). Click once again to unlock (exclude).

You can also use the upper and lower part of the computer's keyboard as a piano keyboard to toggle the locked notes. If you wish to clear the whole keyboard press the **CLR HOME** key.

Range

Range is the span of octaves to use.

RANGE:6

The random process always starts with the currently selected octave (shown in the title window of either grid editor or instrument editor). The range you decide is then randomly added to the current octave. A value of 1 keeps it within the same octave at all times.

Steps

Steps determine the maximum amount of notes to be included. This depends on the length of the selected sequence. *RND* means A.R.C. randomly decides the amount of notes.

STEPS:RND

Press the left mouse button and move the mouse up/down to alter the step value.

Slide

Select yes to let A.R.C. randomly decide whether to add slide or not.

SLIDE:⊙YES
⊙NO

Velocity

Select the maximum range to randomly decrease note velocity.

VEL. :-15

Lower values will increase the velocity span. A value of zero sets maximum velocity on all notes.

Start Randomizing!

Click on the randomize button to start.

RND

You can interrupt the process at anytime by pressing the **RUN/STOP** key.

Example

Look at the overall A.R.C. picture in the top of this chapter and input the same parameters. Those settings produce pretty interesting results. Try it out, add some notes, and try it with or without slide.

Learn to use the Advanced Random Composer as a tool to complement your creativity, or for that matter a last minute help in absence thereof.

Files

The file operations in the MSSIAH Sequencer have a separate screen window. Even though accessed via the *FILE* menu there is no further mouse control once the file screen is entered. Use the **CRSR** keys and **RIGHT SHIFT** to navigate and **RETURN** key to execute a function and select files etc. Use ← key to cancel/step back.

Media

The Sequencer can load and save data from floppy disk only. Tape is not supported.

All disk operations start by asking you to choose device number:

Unless you have changed your disk drive's device number, 8 is default, use **CRSR** keys to change device number.

Loading from disk means that a directory window opens with a list of valid files on your floppy. You then select the file you wish to load.
The directory window shows the amount of free blocks in the upper right corner.

The file operations for the floppy drive make use of the operating system's basic disk functionality. There are no delete-functions and no replace-and-save options built in. If you try to save the file onto disk with a name that already exists, the save is interrupted and the drive light flashes.

When reading the directory the correct type of files is automatically collected.
If there are no files of that particular type on the disk you will get a *No Files* error. It does not necessarily mean that the disk is empty rather than empty of that type of files.
The *No Files* dialog displays the number of blocks free on the disk in the upper right corner for you to see whether it's totally empty or not.

The file type depends on the file operation you selected, whether it's a full project load or a specific import.

MSSIAH Sequencer File Types:

File suffix	Disk space		
.ARR	77 blocks	> 19 Kb	Sequencer project including instruments
.SEQ	2 blocks	< 1 Kb	Single sequence export
.INS	1 blocks	< 1 Kb	Single instrument export

Opening the Demo Arrangement

The demo arrangement for the MSSIAH Sequencer is a draft that has been lying in our drawer for ages. It's a funky background with a classic lead melody and a bridge section. It's up to you to finish it, remix it, learn from it or just get some inspiration. Have fun!

Note that you need two SIDs installed (using a SID2SID for example) to fully enjoy the demo arrangement.
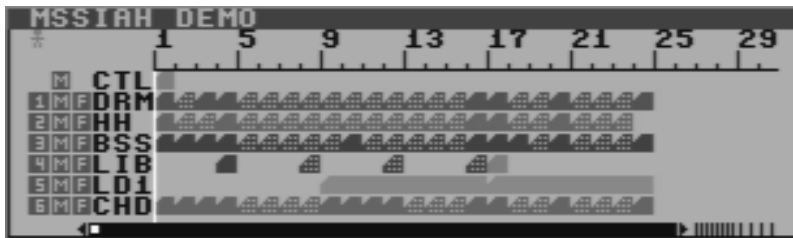
Right after hitting play you should activate cycle mode to make the music repeat.
Do this by clicking the cycle icon in the Transport Window or simply pressing the **C** key.

To open the demo arrangement:

- Select *Open* in the *FILE* menu.
- Select the menu item *DEMO* with the **CRSR** keys.

- Press **RETURN** key to select to open the demo song.
- Press **Y** key or **RETURN** key to confirm. The **N** key or ← key cancels.
- When the demo is opened (only takes a second) press ← to return to the arrange window.

If you are running the program on a Commodore 64 built for the NTSC TV system you must adjust the Sequencer to NTSC. See the chapter *Using the MSSIAH Sequencer* for more info.

Save Project

A project save includes arrangement data, sequences, instruments and settings.
Make sure to save often to avoid losing your work!!

To save a Sequencer project:

- Select *Save* in the *FILE* menu.

![FILE EDIT menu with SAVE selected showing NEW, OPEN, SAVE, IMPORT, EXPORT, QUIT](menu)

- Enter a non-existing filename in the filename dialog.

You can use all letters from *a-z* and *0-9* as well as some additional characters. Use **INST/DEL** key with and without the **LEFT SHIFT** key to insert/delete text.
Press **RETURN** when ready or ← to cancel and go back.
- Select device (8 is default).
- File saves onto disk. After saving is done press ← key to return to the arrange window.
- If the disk already contains a project file with the same filename the drive light flashes and you are notified with a *Save Error* message box.
- If you are using a USB memory with Savyour in *Light Mode* MSSIAH will detect it and ask if you want to use the burst function when saving.

Burst mode saves Sequencer arrangement files in a couple of seconds.

Your MSSIAH needs to have the Directory Viewer application in the start menu to be compatible with the Savyour burst mode.

Open Project

To open a Sequencer project:

- Select *Open* in the *FILE* menu.

![FILE EDIT menu with OPEN selected showing NEW, OPEN, SAVE, IMPORT, EXPORT, QUIT](menu)

- Insert the disk with the project file you wish to open.
- Select device (8 is default) and wait for directory to load.
- In the directory window use **CRSR** keys to navigate and keys **F1** and **F7** to page scroll.
  Press **RETURN** key to load or cancel and go back one step with the ← key.
  No files means no Sequencer files on disk. Go back, insert a new disk and try again.
- When the file is loaded you press the ← key to exit the files screen.
- Using a USB memory with Savyour in *Light Mode* enables burst mode.

Burst mode loads Sequencer arrangement files in a couple of seconds.
Your MSSIAH needs to have the Directory Viewer application in the start menu to be compatible with the Savyour burst mode.

Note:

Important! Interrupting a Sequencer project load can corrupt vital data causing fatal crashes. Therefore you are advised to initialize memory if the load for any reason is interrupted.
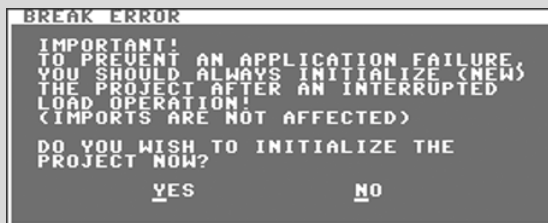
Press **Y** key or **RETURN** key to initialize the memory.

This message will pop up for interrupted imports too but as they do no harm the warning can be ignored.

Export Sequence

You can export the full content of a sequence to disk.
All notes, velocity values and note controls are saved, color and transpose settings are not.

To export a sequence:

- Select *Export* in the *FILE* menu.

- Use **CRSR** keys to select to export a sequence then press **RETURN** key.

- Use **CRSR** keys to select which sequence to export, then press **RETURN** key. Note that sequences that actually exist are displayed in white color. Black ones are non-existing thus not selectable.

- Enter a non-existing filename in the filename dialog. You can use all letters from *a-z* and *0-9* as well as some additional characters. Use **INST/DEL** key with or without the **LEFT SHIFT** key to insert/delete text.
- Press **RETURN** key to start saving or ← to cancel.
- Select device (8 is default)
- When done saving, press ← key to return to the arrange window.
- If the disk you have inserted already contains a sequence file with the same name the drive light flashes and you are notified with a *Save Error* message box.

Import Sequence

Exported sequences can be imported into existing ones. You will first need to select a destination sequence where to store it. The length must be equal to or longer than the sequence you import.

To import a sequence:

- Select *Import* in the *FILE* menu.

- Use **CRSR** keys to select to import a sequence then press **RETURN** key.
- Use **CRSR** keys to select into which sequence to import.
  Existing sequences are displayed in white color. Black ones are not selectable.
- Press **RETURN** and select device (8 is default)
- Select a file in the directory list.
  (If the disk you have inserted does not contain any sequence files you are notified with the *No files* message box.)
- Press **RETURN** key to start loading.
- When done loading, press ← key to return to the arrange window.

IMPORT ERROR
SEQUENCE
TOO LONG!

If you try to load a file longer than the destination sequence you are notified that the sequence length is wrong. In that case select another (longer) sequence as an import destination.

Export Instrument

You can export a full instrument including the wave-table to disk.

To export an instrument:

- Select *Export* in the *FILE* menu.
- Use **CRSR** keys to select to export an instrument then press **RETURN** key.

SELECT
SEQUENCE
INSTRUMENT

- Use **CRSR** keys to select which instrument to export, then press **RETURN** key.

INS
01

- Enter a non-existing filename in the filename dialog. You can use all letters from *a-z* and *0-9* as well as additional characters. Use **INST/DEL** key with or without the **LEFT SHIFT** key to insert/delete text.
- Press **RETURN** key to start saving or ← to cancel.
- Select device (8 is default)
- When done saving, press ← key to return to the arrange window.
- If the disk you have inserted already contains an instrument file with the same name the drive light flashes and you are notified with a *Save Error* message box.
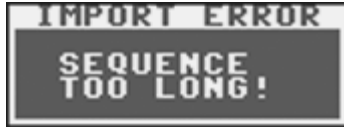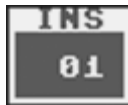
Import Instrument

You can import an instrument into any of the 32 slots. The first 16 slots accept full instruments, the last 16 (17-32) will only load basic instrument data, no wave-tables.

To import an instrument:

- Select *Import* in the *FILE* menu.
- Use **CRSR** keys to select to import an instrument then press **RETURN** key.
- Use **CRSR** keys to select which instrument slot to import into and then **RETURN** key.
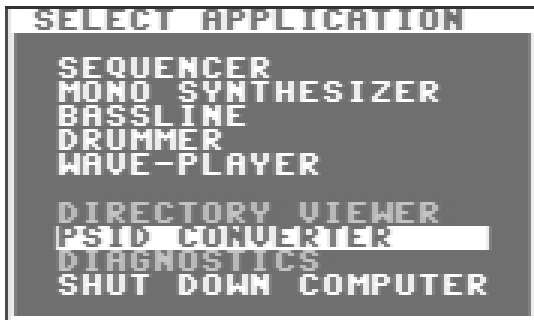- Select device (8 is default)

- Select a file in the directory list.
  (If the disk you have inserted does not contain any instrument files you are notified with the *No files* message box.)
- Press **RETURN** key to start loading or ← to cancel.
- When done loading, press ← key to return to the arrange window.

Making PSID Files

The MSSIAH Cartridge features a separate application that converts your Sequencer project to either a stand-alone C64 executable file or a PSID file to be played on a PC.

The Sequencer files are not made to be compact in size or even optimized for CPU performance. In fact they eat both memory and CPU power.
Those looking for a player to include MSSIAH Sequencer projects in demos or games will be disappointed to find it not possible. The Sequencer was primarily developed as a music sequencing tool and MIDI synthesizer for recording studios, not to make game or demo music.

```
SELECT APPLICATION

 SEQUENCER
 MONO SYNTHESIZER
 BASSLINE
 DRUMMER
 WAVE-PLAYER

 DIRECTORY VIEWER
 PSID CONVERTER
 DIAGNOSTICS
 SHUT DOWN COMPUTER
```

Select the menu item *PSID Converter* in the startup menu and press the **RETURN** key to start the application.

Loading a Sequencer Project

When the application starts you have one option only and that is to read the directory to load a Sequencer project file.

```
LOAD FILE

 READ DIRECTORY
```

- Insert the floppy disk containing your Sequencer project and hit the **RETURN** key to load the directory. (PSID Converter only reads disks on device #8).
- Select the project file you wish to convert in the list of appropriate files (only *.ARR* files are listed).
- At this point you can either cancel and return to the main startup menu using the ← key or continue and start loading the file with the **RETURN** key.

Set Properties

When the file is loaded the main window opens with file properties and output file options.

You fill out the form and press *SAVE!* to start compressing and saving the final file.

When the file is saved the application returns to the MSSIAH Cartridge startup menu.

Note that you cannot escape to the startup menu from the property window other than to save the file unless you switch off/on the power on your C64.

Making a C64 stand-alone exe file

To create a file that plays directly on a C64 (or a PC-emulator):

- Select *C64* as the type using **CRSR** keys left and right.

- Enter a filename for the output file. Make sure it does not already exist.
- Enter a title, author and copyright statement for your song.
- If you want to target a SID select either *6581* or *8580* or *No* if it doesn't matter.
  In this case the target SID does not have any other effect but to show the listener for which SID version the song was originally composed.
- If using SID #2 you can set a base address to access the SID. For C64 exe files this is used as guidance only since the user is free to set this address when starting the file later on. If you wish not to playback any additional SID #2 tracks or your song is made for one SID only, select *Off*.
- Select *SAVE!* and the file compresses and saves.
- When done saving you are returned to the main startup menu.

Playing the file on a C64

To play the file on a real C64 or an emulator:

- With the MSSIAH Cartridge removed, load the executable file from the C64 startup screen using the basic disk load command:
  ```
  LOAD "filename",8,1
  ```
  (Exchange "filename" with the name of your file enclosed with double quotes.)
- Press **RETURN** key.
- File starts to load. When ready enter:
  ```
  RUN
  ```
- Press the **RETURN** key.

The player program starts up.
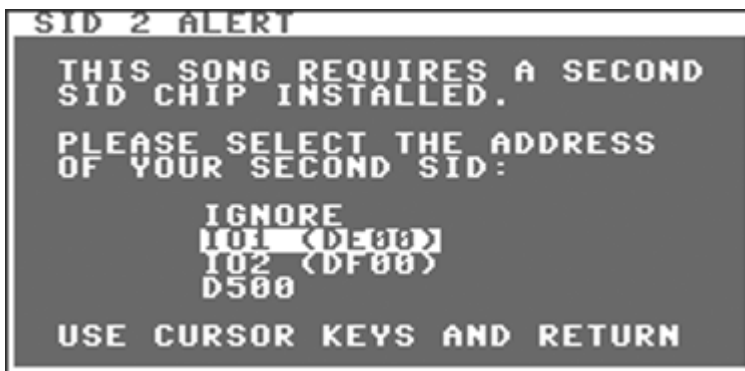
If the song uses SID #2 you are first presented with an option where to address the second SID.
If you don't have a second SID installed you can select to ignore. Note that you won't hear all six tracks with only one SID installed.
Ignoring also means that the program won't cause conflicts with fast loader cartridges etc. that might be present on the expansion port.
Read more about accessing the second SID in the end of this chapter.


While playing, pressing **SPACE BAR** key blanks out the screen to improve audio quality.
RETURN key restarts the song.

Loops

Important to know when saving your Sequencer project is to decide how to loop the song.
If you leave cycle mode activated the playback will loop the cycle range.
If you save the file with cycle mode off the playback will loop the last measure defined as the song's end point.
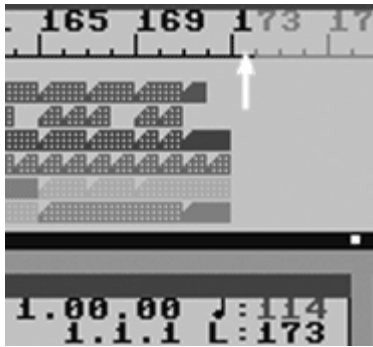
If you want the song to stop make sure you set the end point one measure after the last object (see picture on the left).

It is recommended to always leave cycle mode activated and define a cycle to play even if the looped range is a completely empty area.

Playing the file in the VICE emulator

VICE is one of few (the only?) PC-emulators capable of reproducing a second SID.
Though versions of the VICE emulator might differ, here is a general explanation on how to play a double-SID version of your song in that emulator. VICE version used in this example is 1.14

To activate the second SID:
Select the window for SID settings in the VICE emulator.
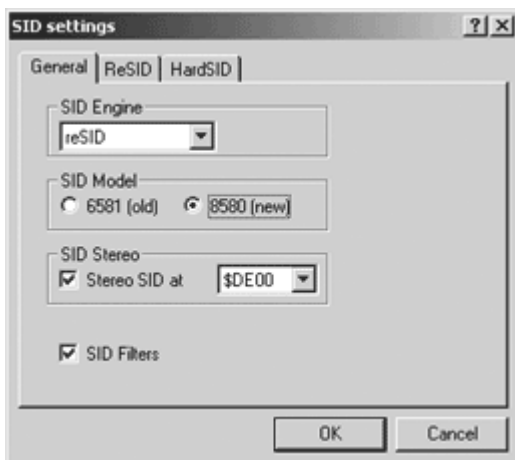
Activate the SID Stereo option and select the same address you chose in the menu when starting to play the song. $DE00, $DF00 or $D500 are your alternatives even though VICE gives you lots of options. To keep it simple, use the same address MSSIAH is originally designed for: $DE00.

Note that the sound quality in VICE is reduced when emulating six SID oscillators compared to only three.

Making a PSID File

The procedure of making a PSID file is somewhat similar to making a C64 executable file.

-If you haven't already, read the section on *loops* earlier in this chapter to understand how to set the cycle correctly.

- Select *PSID* as the type using **CRSR** keys left and right.　　　TYPE: PSID

- Enter a filename for the output file. Make sure it does not already exist.
- Enter a title, author and copyright statement/release year for your song (the copyright field is labeled *released* in PC players referring to the year of release).
- If you want to target a SID select either *6581* or *8580*. Select *No* if it doesn't matter.
- Currently there are no PSID players capable of generating an extra SID. Therefore it's best to turn SID #2 *Off*.
- Select *SAVE!* and the file compresses and saves. When done saving you are returned to the main startup menu.

- Transfer the saved **PRG** file to a PC computer (This is not covered in this manual. There are numerous programs and explanations on how to do this on the net).

  To run the file in a program such as *SIDplay* you will need to remove the **PRG** header before renaming the file to *.SID*.
  The header is really nothing else than two bytes determining its memory location within the C64 memory.

- Install a program capable of editing binary files. Any hex editor will do, in this manual we use Microsoft Visual Studio as an example. Just be aware that MS Notepad or similar text editors will not do!
- Rename the *.PRG* file to *.BIN*
- Open the .bin file in the hex editor.
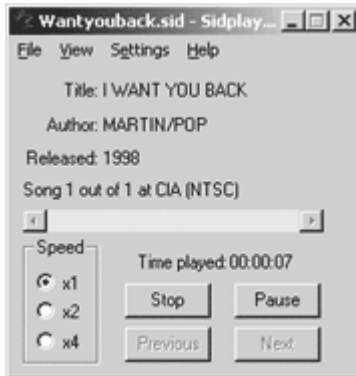- Remove the two very first bytes in the file.

- Save the file
- Rename the file extension to *.SID*
- Load it into SID-play and try it out.

Playing the file in SID-play

In SID-play, select to open a SID-file and pick the one you just converted.
The song starts playing automatically when loaded. The title, author and copyright fields are all displayed in the main window (left picture).

If you choose the *only when not known*-option for clock speed and SID model (right picture), the song will play back with the correct speed and SID model according to the file properties.

Accessing the SID #2

The SID #2 can be accessed in different ways. The most common technique is to 'hijack' one of the two address lines of the cartridge expansion port.
Needless to say, a cartridge present in the port needs at least one and sometimes both of these addresses thereby causing a conflict with the second SID.

The address lines are called IO1 ($DE00) and IO2 ($DF00).
MSSIAH Cartridge uses IO1 to access the second SID. That is the address line you solder from the SID2SID onto the seventh pin on the back of the expansion port (inside the computer).

When playing back a stand-alone compressed Sequencer file it is possible to choose either IO1 or IO2 as second SID base address. It is also possible to choose $D500 as the base address.
However, $D500 requires special decoding circuits to allow a proper access to the second SID.
If your computer is not modified with such logic, do not select $D500 as the base address. It will only sound weird or be completely silent.

When playing back the song on an emulator such as VICE, these addresses are virtual so it does not matter whether you choose $DE00, $DF00 or $D500. Just make sure you set the same address for the VICE's second SID as you did in the MSSIAH executable startup-window.

MIDI Implementation Chart

MSSIAH Sequencer		MIDI Implementation Chart		Version: 1.00
	Function	Transmitted *1	Recognized	Remarks
Basic Channel	Default	X	1-16, off	Memorized
	Changed	X	1-16, off	Memorized
Mode	Default	X	Mode 4	
	Messages	X	X	
Note Number:		X	12-107 (C$_{-1}$ – B$_6$)	C$_2$ – F$_4$ in Instrument
	True Voice	X	12-107 (C$_{-1}$ – B$_6$)	and Grid Editor
Velocity	Note On	X	9nH, v=1-127	
	Note Off	X	9nH, v=0 or 8nH	
After Touch	Key's	X	X	
	Channel's	X	X	
Pitch Bend		X	o	0-24 semitone steps (14 bit resolution)
Control Change	1	X	o	
	7	X	o	*2
	65-104	X	o	*2
	120	X	o	
	123	X	o	
Program Change:		X	o	
	True #	X	1-8	*2 *3
System Exclusive		X	X	
System Common:	Song pos	X	X	
	Song sel	X	X	
	Tune	X	X	
System Real Time:	Clock	X	o	
	Commands	X	o	Start, Stop
Aux Messages:	All Sound OFF	X	(120) o	
	Reset Cntrl	X	o	Pitch Wheel only
	Local ON/OFF	X	X	
	All Notes OFF	X	(123) o	
	Active Sens	X	X	
	System Res	X	X	
Notes		*1 MSSIAH Cartridge does not transmit MIDI. *2 Values outside of limits are recognized as top or bottom value. *3 Program changes switches patch on next note on.		

Mode 1: OMNI ON, POLY   Mode 2: OMNI ON, MONO   o : Yes
Mode 3: OMNI OFF, POLY   Mode 4: OMNI OFF, MONO   X : No

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MIDI Controller List

No.	Function	Limit	Remarks
1	Modulation Wheel	0-127	
7	Main Volume	0-15	Affects both SIDs
64	Sustain Pedal	0-127	0 = Off, > 0 = On. Poly mode only
65	Envelope Init (hard restart)	0–8	0 = ADSR=0000, Trig=0 1 = ADSR=0000, Trig=8 2 = ADSR=0F00, Trig=8 3 = ADSR=00FF, Trig=8 4 = ADSR=FFFF, Trig=8 5 = ADSR=0F0F, Trig=8 6 = ADSR=reload, Trig=8 7 = ADSR=0000, Trig=9 8 = ADSR=0000, Trig=1 9 = Init Type : Hard 10 = Init Type : Soft 11 = Init Type : None
66	Slide Time	1-4	
67	Osc Waveform	0-32	See separate table below
68	Pulse Width	0-31	
69	Pulse Modulation	0-1	0 = Envelope, 1 = LFO
70	Pulse Modulation Depth	0-7	
71	Pulse Velocity Depth	0-3	
72	Tuning	0-127	64 = middle
73	Pitch Modulation	0-1	0 = Envelope, 1 = LFO
74	Pitch Modulation Depth	0-7	
75	LFO Frequency	0-127	0-13 if LFO MIDI clk sync. See table below
76	LFO Trig	0-1	0 = Off, 1 = On
77	LFO Envelope Mode	0-1	0 = Off, 1 = On
78	LFO Clock Sync	0-1	0 = Off, 1 = On
79	LFO Delay / Modulation Wheel	0-15 0-7	LFO Delay (N/A in MIDI mode) Mod Wheel max pitch mod depth
80	Envelope Attack	0-15	
81	Envelope Decay	0-15	
82	Envelope Sustain	0-15	
83	Envelope Loop Mode	0-1	0 = Off, 1 = On
84	Filter Cutoff Frequency	0-31	
85	Filter Resonance	0-15	
86	Filter Modulation Depth	0-7	

87	Filter Velocity Depth	0-3	
88	Filter Modulation	0-1	0 = Env, 1 = LFO
89	Filter Type	0-7	0 = Off 1 = Lowpass 2 = Bandpass 3 = Highpass 4 = Lowpass + Bandpass 5 = Lowpass + Highpass 6 = Bandpass + Highpass 7 = Lowpass + Bandpass + Highpass
90	VCA Attack	0-15	
91	VCA Decay	0-15	
92	VCA Sustain	0-15	
93	VCA Release	0-15	
94	VCA Velocity Depth	0-15	
95	VCA Velocity Type	0-1	0 = Sustain, 1 = Decay
96	Wave-Table	0-1	0 = Off, 1 = On
97	Wave-Table Sync	0-3	0 = Free run 1 = Clk tics 2 = /32 3 = /16
98	Wave-Table Repeat Start	0-7	
99	Wave-Table Repeat End	0-7	
Wave-Table Edits:			
100	Wave-Table Row to Edit	0-7	Resets when quitting MIDI mode
101	Waveform	0-32	See separate table below
102	Trig	0-1	0 = Trig Off, 1 = Trig On
103	Pitch Type	0-3	0 = Relative 1 = Absolute 2 = Add 3 = Subtract
104	Pitch Low byte	0-127	
105	Pitch High byte	0-127	True# 128-255
106	Filter Cutoff Freq Override	0-32	0 = No, 1-32 = Cutoff Frequency 0-31
107	Pulse Width Override	0-31	28 = 50/50
120	All Sound Off	-	
123	All Notes Off	-	

Osc Waveforms (Control Change #67, # 101)

	+ Ring mod.	+ Sync	+ Ring mod + Sync
0 OFF			
1 Sine	9	17	25
2 Saw	10	18	26
3 Pulse	11	19	27
4 Noise	12	20	28
5 Sine + Saw	13	21	29
6 Sine + Pulse	14	22	30
7 Saw + Pulse	15	23	31
8 Saw + Sine + Pulse	16	24	32

LFO Frequency Clock Sync (Control Change #75)

0	/32
1	/16
2	/8
3	/4
4	/3
5	/2
6	1
7	2
8	4
9	8
10	12
11	16
12	24
13	32

MIDI channel and bend ranges are saved in between sessions and even when the computer is switched off if you choose to save your changes when shutting down the MSSIAH.