What is MIDI ? What is GENERAL MIDI ?

Musical Instrument Digital Interface

Background

In 1983 the MIDI (Musical Instrument Digital Interface) opened the door to communication between various musical instruments and computers. Compatibility at a basic level was consistent and reliable but each manufacture and each model used various technologies, and had varying features. There had been a great variation in features of various sound generating devices, such as tone choices and locations, MIDI Channel assignments, etc.

The General MIDI System Level 1 (adopted in 1991) is a set of specifications for sound generating devices which has been agreed upon by both the Japanese MIDI Standards Committee (JMSC) and the American MIDI Manufacturers Association (MMA). These specifications seek to allow for the creation of music data which is not limited to equipment by a particular manufacturer or to specific models.

The General MIDI system defines data events such as the minimum number of voices that should correspond to which Program Change numbers, and the layout of Rhythm sounds on the keyboard. Thanks to these specifications, any device that is equipped with sound sources supporting the General MIDI system will be able to accurately reproduce General MIDI Scores (Music Data created for the General MIDI System), regardless of the manufacturer or the model.
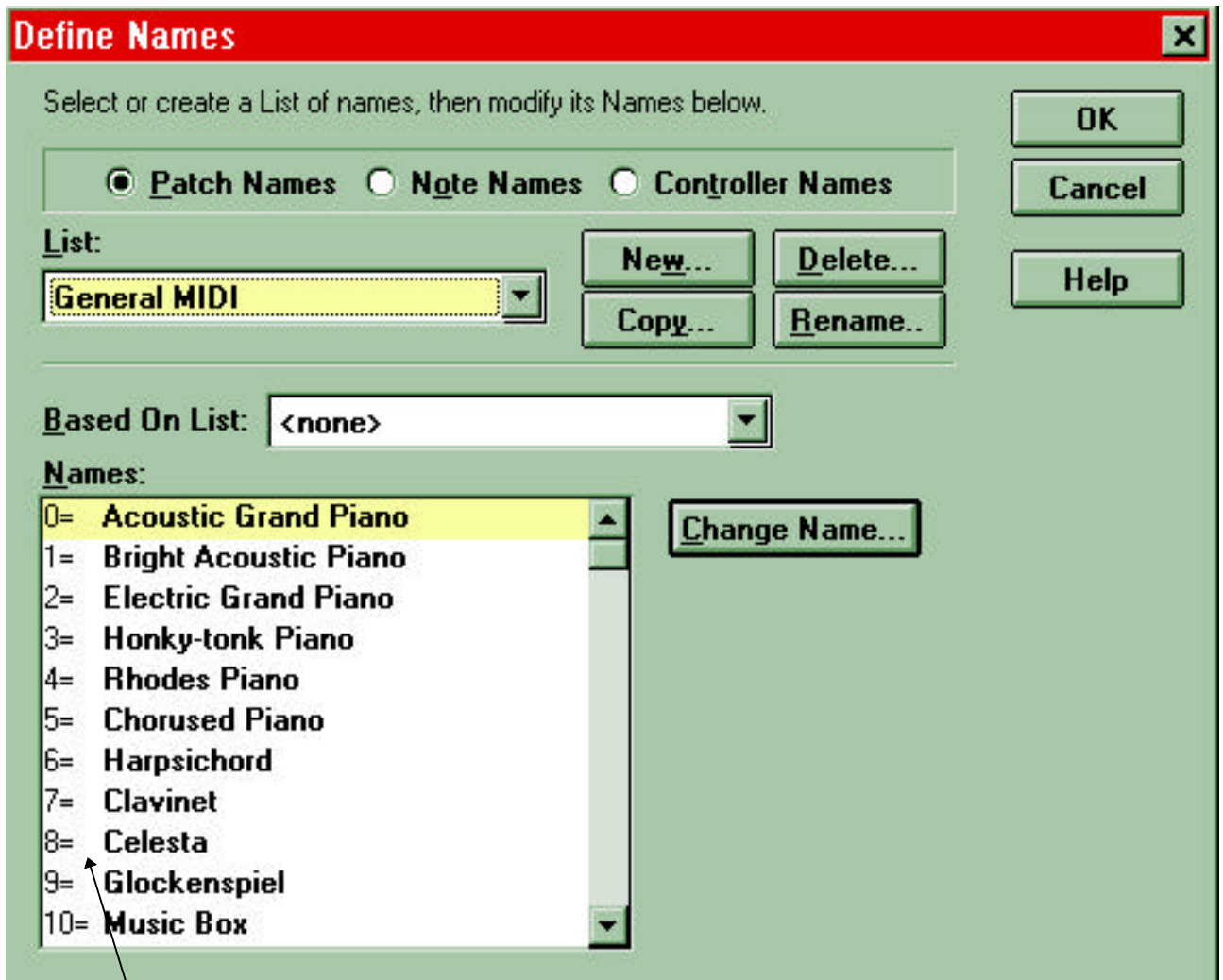
How to make it compatible ?

The General MIDI Patch

A piano track on my system does play a piano track on your system

Because General MIDI gives an instrument a patch number it means that when you write a song with a piano track, if you're using General MIDI then you can be sure that it plays back on another General MIDI PC correctly (i.e. - not having the piano track played with a drum sound !).

You could term this as a General MIDI sound set, and the General MIDI standard supports this by giving each instrument a name - sometimes referred to as a 'patch number' or 'program number'. General MIDI defines that there are 128 instruments ranging from acoustic pianos, through guitars, basses, reed instruments, brass instruments, percussion up to sound effects like 'applause' and 'gunshot' ! Each of this instruments is given a number from 1 ~ 128.

Next is a screen dump from a MIDI sequencing software which allows you to choose or change any instrument to one within the General MIDI sound set, providing you are using a General MIDI compatible sound chip (all of the sound cards included on this MMCD will respond to General MIDI commands, whether the chip is FM or Wavetable).

Define Names ☒

Select or create a List of names, then modify its Names below.

⦿ **P**atch Names ◯ N**o**te Names ◯ Con**t**roller Names

OK

Cancel

Help

List:

General MIDI ▼

New... **D**elete...
Copy... **R**ename..

Based On List: <none> ▼

Names:

0=	**Acoustic Grand Piano**
1=	**Bright Acoustic Piano**
2=	**Electric Grand Piano**
3=	**Honky-tonk Piano**
4=	**Rhodes Piano**
5=	**Chorused Piano**
6=	**Harpsichord**
7=	**Clavinet**
8=	**Celesta**
9=	**Glockenspiel**
10=	**Music Box**

Change Name...

You can see the General MIDI 'patch numbers' which are associated with a specific instrument.   This is the standard.

In the '**Presto Arranger'** software included as part of the Willowpond Sound Utilities on this MMCD, you can open one of the MIDI songs included here and then experiment with re-arranging the songs by change the instruments for each track.

In Presto Arranger, by clicking on the 'Instrument' field you will see a screen where you can choose any of the General MIDI instruments for that particular track of music.
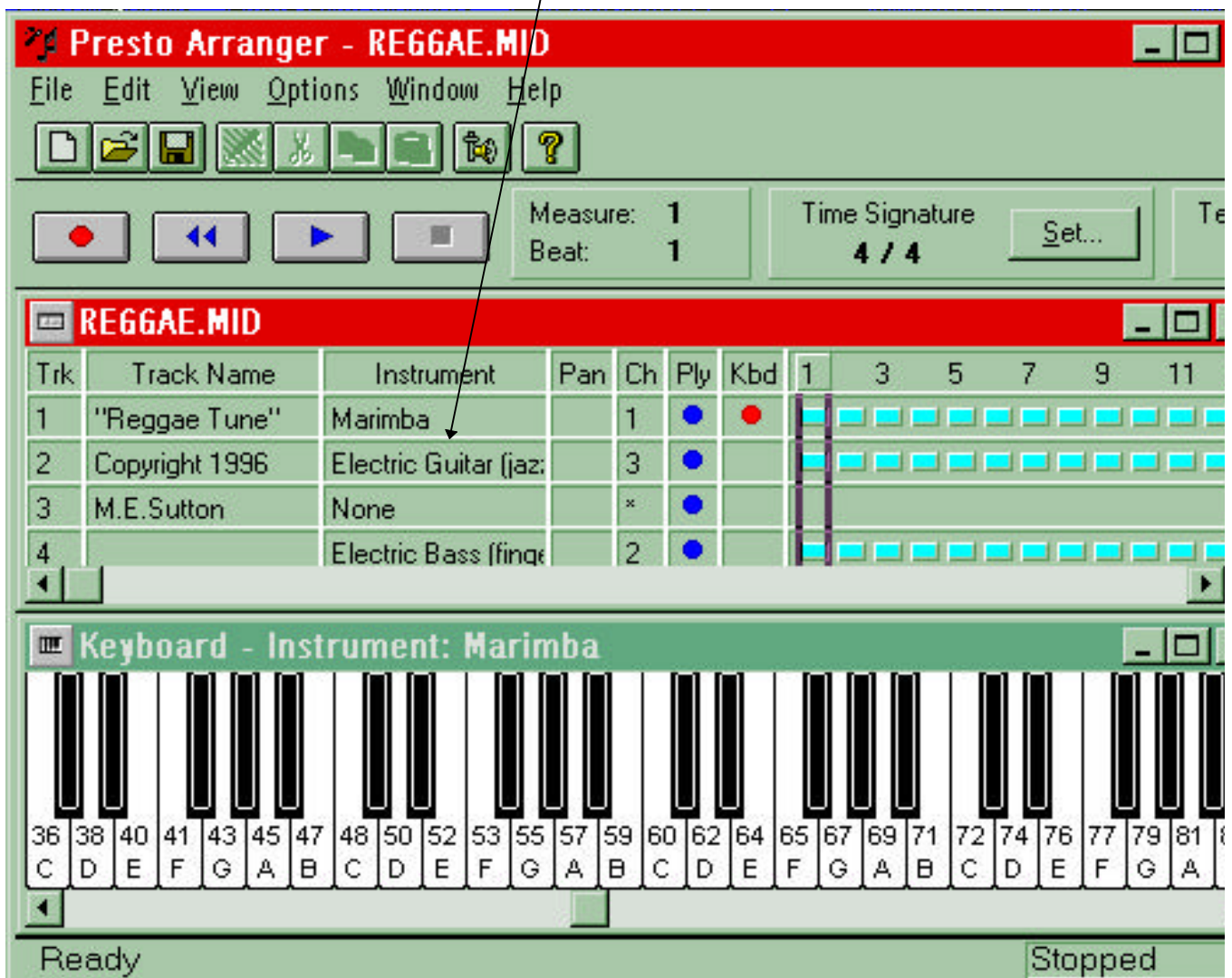
The 128 sound can be grouped first in to 'families' of sound as follows...

1-8	Piano	65-72	Reed
9-16	Chromatic Percussion	73-80	Pipe
17-24	Organ	81-88	Synth Lead
25-32	Guitar	89-96	Synth Pad
33-40	Bass	97-104	Synth Effects
41-48	Strings	105-112	Ethnic
49-56	Ensemble	113-120	Percussive
57-64	Brass	121-128	Sound Effects

And here's the full list of sounds...

1. Acoustic Grand Piano
2. Bright Acoustic Piano
3. Electric Grand Piano
4. Honky-tonk Piano
5. Electric Piano 1
6. Electric Piano 2
7. Harpsichord
8. Clavinet
9. Celesta
10. Glockenspiel
11. Music Box
12. Vibraphone
13. Marimba
14. Xylophone
15. Tubular Bells
16. Dulcimer
17. Drawbar Organ
18. Percussive Organ
19. Rock Organ
20. Church Organ
21. Reed Organ
22. Accordion
23. Harmonica
24. Tango Accordion
25. Acoustic Guitar (nylon)
26. Acoustic Guitar (steel)
27. Electric Guitar (jazz)
28. Electric Guitar (clean)
29. Electric Guitar (muted)
30. Overdriven Guitar
31. Distortion Guitar
32. Guitar harmonics
33. Acoustic Bass
34. Electric Bass (finger)
35. Electric Bass (pick)
36. Fretless Bass
37. Slap Bass 1
38. Slap Bass 2
39. Synth Bass 1
40. Synth Bass 2
41. Violin
42. Viola
43. Cello
44. Contrabass
45. Tremolo Strings
46. Pizzicato Strings
47. Orchestral Harp
48. Timpani
49. String Ensemble 1
50. String Ensemble 2
51. SynthStrings 1
52. SynthStrings 2
65. Soprano Sax
66. Alto Sax
67. Tenor Sax
68. Baritone Sax
69. Oboe
70. English Horn
71. Bassoon
72. Clarinet
73. Piccolo
74. Flute
75. Recorder
76. Pan Flute
77. Blown Bottle
78. Shakuhachi
79. Whistle
80. Ocarina
81. Lead 1 (square)
82. Lead 2 (sawtooth)
83. Lead 3 (calliope)
84. Lead 4 (chiff)
85. Lead 5 (charang)
86. Lead 6 (voice)
87. Lead 7 (fifths)
88. Lead 8 (bass + lead)
89. Pad 1 (new age)
90. Pad 2 (warm)
91. Pad 3 (polysynth)
92. Pad 4 (choir)
93. Pad 5 (bowed)
94. Pad 6 (metallic)
95. Pad 7 (halo)
96. Pad 8 (sweep)
97. FX 1 (rain)
98. FX 2 (soundtrack)
99. FX 3 (crystal)
100. FX 4 (atmosphere)
101. FX 5 (brightness)
102. FX 6 (goblins)
103. FX 7 (echoes)
104. FX 8 (sci-fi)
105. Sitar
106. Banjo
107. Shamisen
108. Koto
109. Kalimba
110. Bag pipe
111. Fiddle
112. Shanai
113. Tinkle Bell
114. Agogo
115. Steel Drums
116. Woodblock

53.	Choir Aahs	117.	Taiko Drum
54.	Voice Oohs	118.	Melodic Tom
55.	Synth Voice	119.	Synth Drum
56.	Orchestra Hit	120.	Reverse Cymbal
57.	Trumpet	121.	Guitar Fret Noise
58.	Trombone	122.	Breath Noise
59.	Tuba	123.	Seashore
60.	Muted Trumpet	124.	Bird Tweet
61.	French Horn	125.	Telephone Ring
62.	Brass Section	126.	Helicopter
63.	SynthBrass 1	127.	Applause
64.	SynthBrass 2	128.	Gunshot

And then, for drums sounds, the 'General MIDI Drum Set' is a standard which defines each key of the keyboard to a specific drum sound as follows, so you don't have bass drum notes being played against a cymbal sound..

Bass Drum — Note 36

Snare 1 — Note 38

Snare 2 — Note 40

Closed Hi-Hat — Note 42

Open Hi-Hat — Note 46
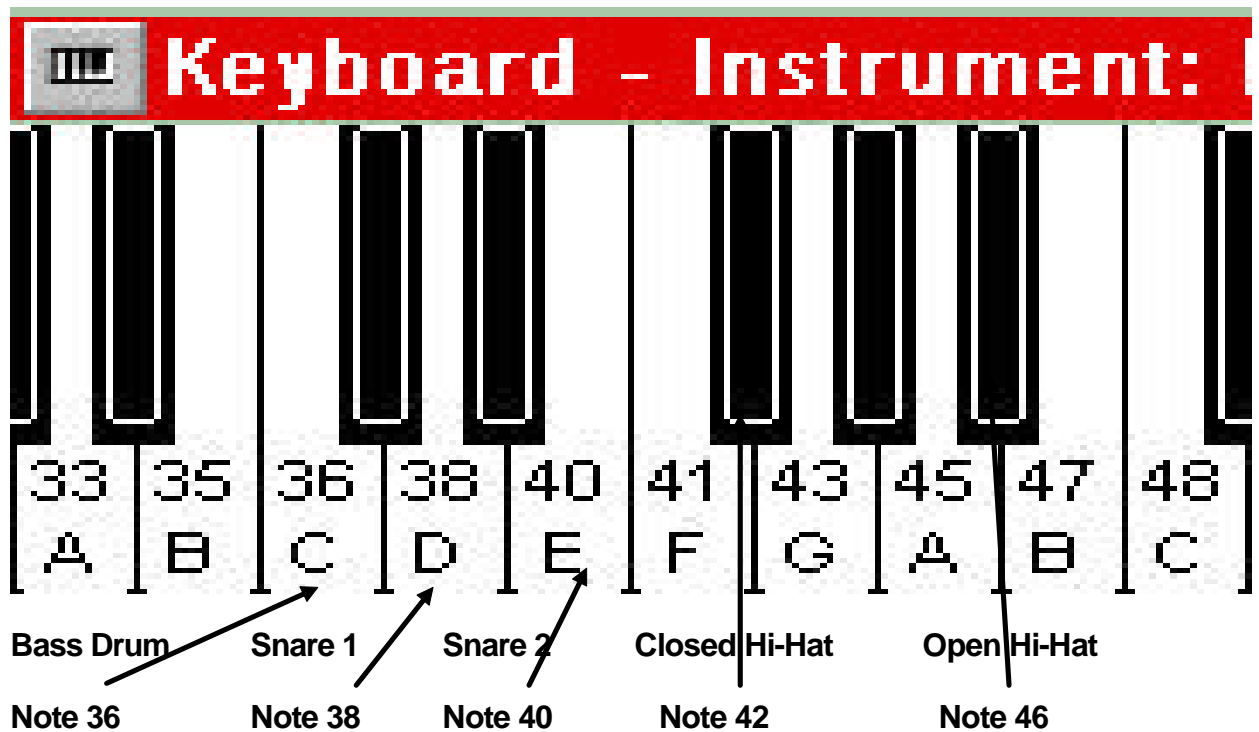
35 Acoustic Bass Drum	59 Ride Cymbal 2
36 Bass Drum 1	60 Hi Bongo
37 Side Stick	61 Low Bongo
38 Acoustic Snare	62 Mute Hi Conga
39 Hand Clap	63 Open Hi Conga
40 Electric Snare	64 Low Conga
41 Low Floor Tom	65 High Timbale
42 Closed Hi Hat	66 Low Timbale
43 High Floor Tom	67 High Agogo
44 Pedal Hi-Hat	68 Low Agogo
45 Low Tom	69 Cabasa
46 Open Hi-Hat	70 Maracas
47 Low-Mid Tom	71 Short Whistle
48 Hi Mid Tom	72 Long Whistle
49 Crash Cymbal 1	73 Short Guiro
50 High Tom	74 Long Guiro
51 Ride Cymbal 1	75 Claves
52 Chinese Cymbal	76 Hi Wood Block
53 Ride Bell	77 Low Wood Block
54 Tambourine	78 Mute Cuica
55 Splash Cymbal	79 Open Cuica
56 Cowbell	80 Mute Triangle
57 Crash Cymbal 2	81 Open Triangle
58 Vibraslap	

MIDI in Summary........

After all of this is settled it means that songs written in MIDI format, and General MIDI format, can enjoy compatibility with hundreds of thousands, (if not millions) of sound cards, systems and MIDI musical keyboards.

And a MIDI song being made up of thousands of binary code instructions (0 1 1 0 0 1 1 0) will take up 'bytes' of space rather than 'megabytes' of space ...

FM or Wavetable ?

Synthesis wars

Artificial or Real

FM SOUND   This is a method of generating sound by means of Frequency Modulation. This basically re-creates sounds by synthesizing a 'signal' and adding modulation etc. To do this you need signal generators or 'operators'. In basic terms the more 'operators' you have the richer the sound quality.   This method is great for creating synthesized sounds but can lack in quality when multiple (or 'multi-timbral') 'real' instrument sounds are required. 'FM' was pioneered by YAMAHA, and significant advances have been in FM synthesis by other sound chip manufacturers as well, such as ESS who provide a 72 operator solution (as opposed to the previous standard of 36 operators).

WAVETABLE   The difference between wavetable and FM synthesis is that wavetable sounds are actual 'samples' of the original sound source (or instrument).   These are sometimes referred to as 'TONES'. These sounds form the term 'table' (a table of sounds) and they can be subject to a variety of waveforms (the term 'wave') to add depth & quality to the original sound (such as adding a particular waveform to create a tremolo effect for a violin sample). The overall quality of wavetable sound depends on two things. First, the KHz rate at which the original instrument sound was recorded at, and secondly the size of that recording. Generally 1MB of wavetable ROM (Read-Only-Memory) is sufficient for sound cards in order to provide the 128 General MIDI sound set, however for professional keyboards it is common to see something like 64MB of wavetable ROM included !

But....Just when you thought you'd made up your mind on which way to go - in comes Software Wavetable !

A Softer Wave ?

A recent development is Software Wavetable.   In theory it makes sense, by loading the sample waveforms to your hard disk and then recalling them when needed. However there are some drawbacks to this system. First the difference in access times of an on-board ROM compared to a hard disk is considerable, and this could lead to delays in generating the wavetable sounds after receiving the MIDI data.   Second, a software wavetable would then have to be loaded into system memory (continuously taking up around 1.5MB of your SIMM RAM space).   Third, the wavetable will react in accordance with the current loading on the system CPU, and the overall performance of the system itself (therefore although software wavetable manufacturers will tell you a Pentium 66MHz will do the job, in reality a 133MHz + is required with adequate system memory - SIMM).   A poor system will result in a cut off in the amount of notes or instruments that can be played at one time, or very annoying 'stuck-notes' where the 'note-off' signal has been lost somewhere in space between your CPU / Hard Disk and Planet Mars !   But all is not lost here. Quite often chipset manufacturers will bundle a software wavetable with their FM sound chipset, so the added cost when you see this would be the cost of the diskettes to copy this too (or MMCD if you're lucky !).   In this case Software Wavetable could be seen as a nice stepping stone between FM synthesis and true hardware wavetable synthesis.   If can the user an opportunity to understand wavetable synthesis a bit more and taste a little of the added features and sounds.

Now I'm confused - What, exactly, is the difference between all of these types of synthesis ?

## Try out the difference between FM, Hardware & Software wavetable

So you have some idea on how each of the three sound technologies actually sound we have recorded the same (funky!) song using the Model # **2521/2526 YAMAHA sound card** . We took a cable from the line-out and input this to the line-in. (This also demonstrates one of the features of this card - it being "Full Duplex" = simultaneous playback & recording). We recorded the song four times using (1) FM Synthesis (2) Hardware Wavetable synthesis (3) Software wavetable synthesis sample #1 (see below) (4) Software Wavetable synthesis sample # 2 (see

below).....Simply click on the relevant icon to listen to each song.   Each song was recorded at 22.05kHz Stereo (representing around 5~6MB per minute)....

Now listen to the results....Click each 'hands-on' icon to listen to the difference.
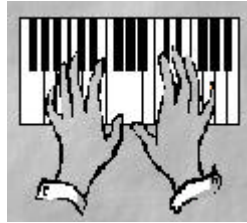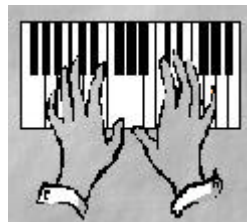
YAMAHA FM Synthesis
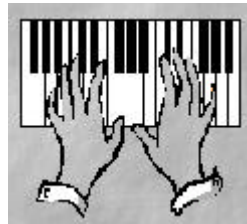
YAMAHA OPL4-ML Hardware Wavetable synthesis

YAMAHA OPLSoft Software Wavetable synthesis #1 ('Normal' Mode)

YAMAHA OPLSoft Software Wavetable synthesis # 2 (Enhanced Mode)

The YAMAHA Model # 2521/2526 sells with a software wavetable included. This application's sound quality very much depends on the power of your computer. For example a Pentium 133MHz system with sufficient RAM (16MB or more) will produce the highest quality sounds and number of voices, whereas a 486 or lower-end Pentium system may only be able to work under 'Normal' conditions. For more information refer to the Model # 2521/2526 manual. You will notice that the software wavetable application will appear as follows in your system Control Panel. Here you can change the software wavetable settings to suit your particular system performance, and required sound quality..
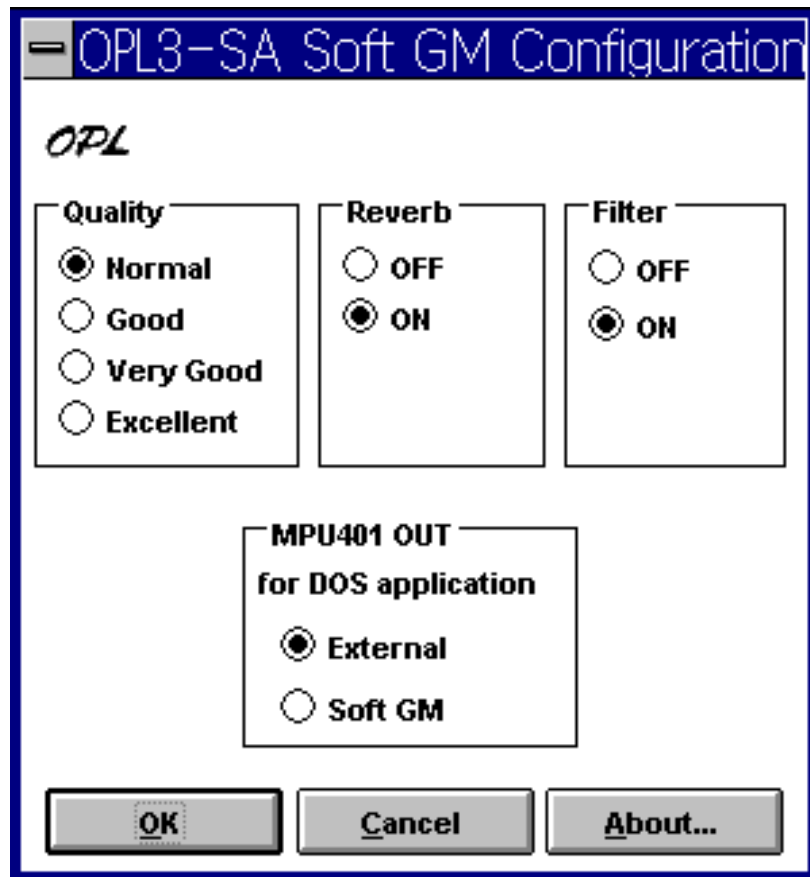
In summary we hope that you can choose which type of sound technology best suits your particular needs. In general terms hardware technology will always win over software technology, due to the fact that more and more these days the computer system is replying upon software 'add-ons' to produce the required result.

How do I upgrade my existing FM Sound card to wavetable synthesis ?

Most sound cards have an option for a **wavetable daughterboard** . This upgrade is through a standard 13 x 2 pin (26-pin) wavetable upgrade connector that can be found on all quality sound cards.   It provides the user with a simple upgrade solution to migrate from FM synthesis to wavetable synthesis.   The upgrade does not usually require any software installation, and the wavetable synthesis chip should be recognized by the computer system automatically, therefore installation is relatively simple.   Once in place you can usually choose between either FM or Wavetable synthesis when playing back MIDI songs or other types of music through your PC's sound card. Which type of synthesis you prefer to hear very much depends on your personal taste and the type of sound track you're about to listen to. However as a general guide we could say that for sound tracks which are musical (in the sense that they have specific music/song tracks written for the game) then wavetable is better. If you require something to make 'bomb' and 'lasergun blaster !' sounds, with occasional musical backing, then a good FM synthesis sound card may well be enough.

What is an MPU401 & do I need one for MIDI ?

To use MIDI with a personal computer you need a PC-to-MIDI interface. The standard interface was developed by Roland and is called an MPU-401. Almost all MIDI hardware and software packages available today support this interface, so when buying a sound card you should always look to this option if you intend to use MIDI.   This interface can be seen as acting 'internally' and 'externally'. Internally it is the 'policeman' which interfaces between the FM or wavetable sound chips and MIDI commands,   and externally it is the interface which allows external musical keyboards (with a MIDI capability) to connect to the sound card / PC and input MIDI data, or respond to outgoing MIDI data from the computers MIDI sequencer software package (like the 'Presto Arranger' software incl.)
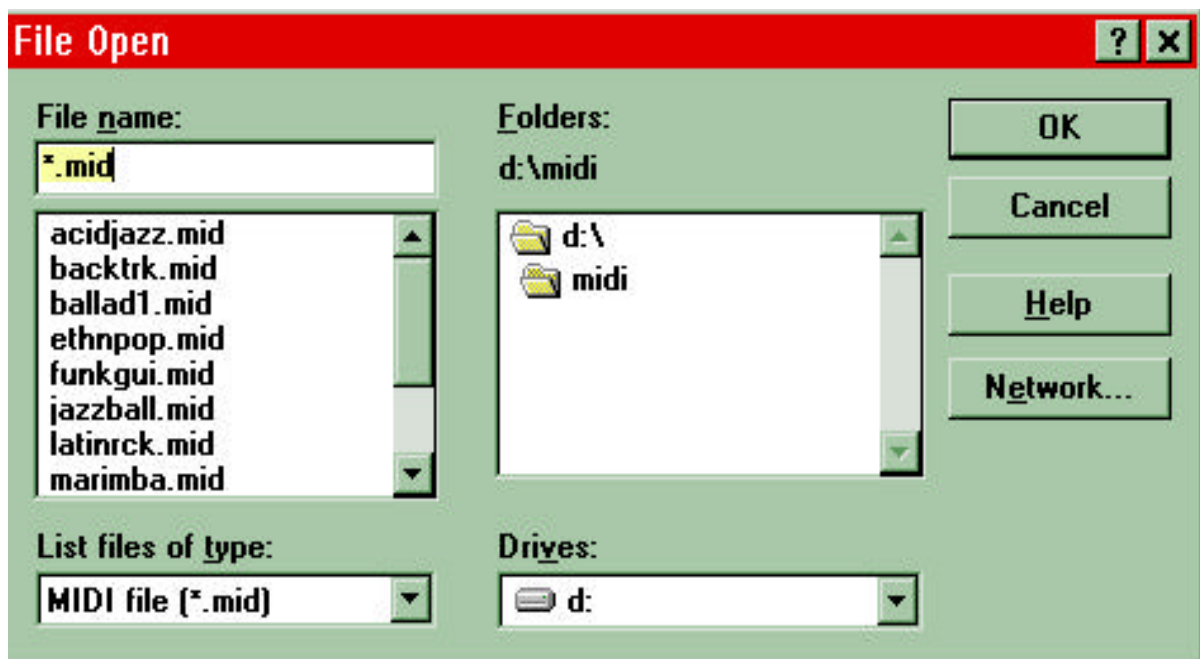
Putting it all together

MIDI Songs Included

MIDI Song files included

We've put together some MIDI song files on this MMCD for you to play along with, compose more tracks to, or re-arrange the songs to your liking. These songs were written by one of the MMCD writers, and are not subject to copyright laws & regulations, so you are free to use them and change them as much you like. Our idea here is to teach you how to use MIDI to (part) of it's full potential..

First, if you have not loaded the Willowpond software then go to the Willowpond page on this MMCD and install the Willowpond Sound Utilities software's. Once installed run Presto Arranger. Choose File and then Open . Then locate the folder on this MMCD named midi Here you'll see a list of MIDI (.mid) songs.

File Open ? X

File name:
`*.mid`

acidjazz.mid
backtrk.mid
ballad1.mid
ethnpop.mid
funkgui.mid
jazzball.mid
latinrck.mid
marimba.mid

Folders:
d:\midi

d:\
midi

List files of type:
MIDI file (*.mid)

Drives:
d:

OK

Cancel

Help

Network...

The types of songs vary, and their file name generally describes the musical style. Almost all of these songs have each instrument recorded on separate tracks (multi-timbral), so this gives you an opportunity to change the individual instrument sounds using the General MIDI sound set. Click the song you want to listen to and then click on OK

In the Presto Arranger title bar choose Options and then Output Devices. This will show you the various options you have for routing the MIDI song file. It can be either the internal FM, or wavetable synthesis, or external MIDI instrument. If you have a wavetable upgrade daughterboard or wavetable onboard sound card then you can try experimenting using the FM synthesis chip against the wavetable synthesis chip. Next click the play button to listen to the song.

Changing the General MIDI instrument type

When you've chosen the MIDI song file it's instrument tracks will appear in the track view area of the Presto Arranger software window..
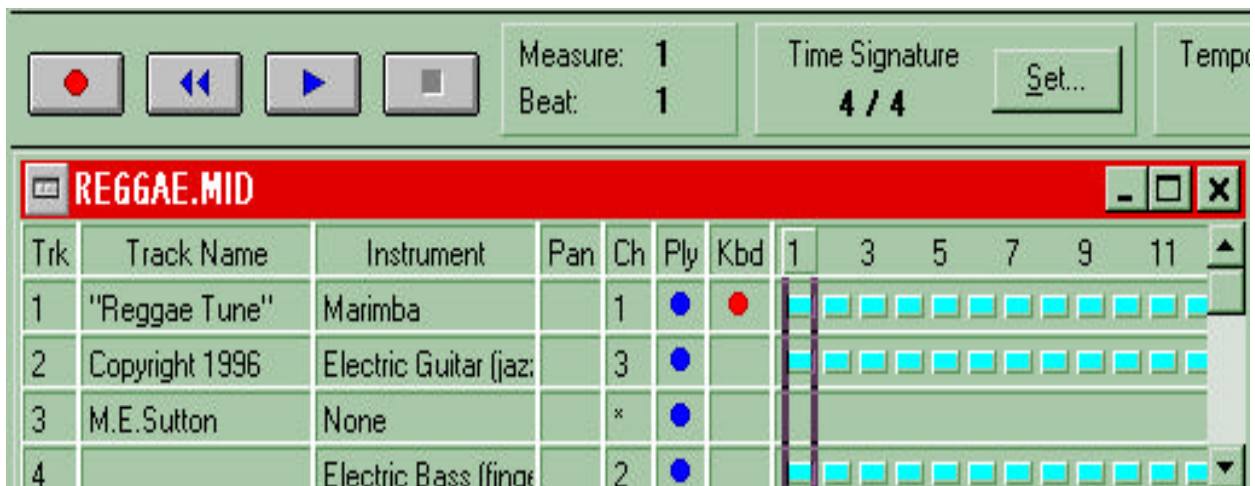

The 'instrument' field contains the General MIDI instrument name / patch assigned to that track. By clicking in the 'instrument' field it will produce a screen detailing the 128 General MIDI sounds. Choose a different sound if you like, and then click on OK

If you wish to PAN the sound between left & right speakers, click in the 'PAN' field and change the settings accordingly.

In the track view area the small squares represent recorded MIDI information. These are the binary codes which contain information on Note Number, Velocity, Timing & other sound control messages. By manipulating these you can re-arrange the song and even come up with completely new & different songs !
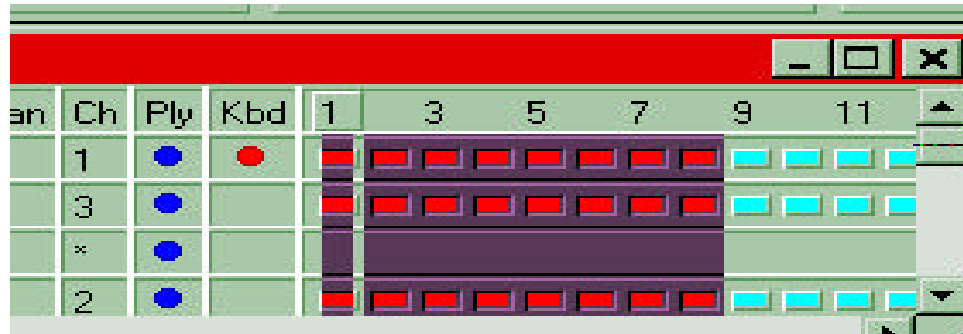
For example. Click the mouse at section '1' at the top left corner and then, while holding down the mouse button, highlight all the tracks from 1 through to 8 (these numbers represent the BAR numbers = so this equals 8 bars of music). Then go to Edit and choose Copy. Then scroll the screen to the end of the musical piece (where there are no more small squares) and click the mouse at the first bar after the end of the music (in the top left again). Then go to Edit and choose Paste. This will add a further 8 bars of music to this song.

Transpose it

Then highlight the section of music you've just pasted (but be careful NOT to highlight the DRUM track - If you have to highlight each section separately please do so). Then go to Edit and choose Adjust pitch... Here you can adjust the pitch (or 'Transpose') the section(s) of music up or down. Try adjusting it +3 up (one third up).

> **TIP / NOTE** : Since the DRUM KIT is comprised of several instruments sharing the same keyboard, DO NOT transpose the drum track as this will result in strange happenings such as a cymbal sounding where a bass drum was supposed to be !

Play the keyboard and enter you own notes

If you feel like adding you own tracks and music to the songs included here then go ahead.   First locate a spare track and choose an instrument. The choose a MIDI channel which is not used by another instrument.   Then go to Options and click on Metronome so that the metronome sounds when recording. Then click the record button and enter the notes using your mouse, QWERTY keyboard, or external MIDI keyboard.

MIDI letterbox ✎

You USE MIDI - Not the other way around

If you are serious about composing music using MIDI then you should make sure you use MIDI and not the other way around. MIDI sometimes can make everything TOO mechanical. On the other hand MIDI can also be a very powerful and time saving tool. By getting to understand MIDI and how to use it to your best advantage you will see that it can be very flexible & powerful.

MIDI Song Files

Many people produce MIDI Song files, and either release these royalty-free or sell them commercially. You can quite easily find 'virtual' MIDI Song Books on the internet where your favorite Rock & Rock, Pop, Classical, or for that matter, any type of music will be available.   Although we do not support any MIDI web site in particular, there are some excellent sites on the internet where you can learn about MIDI, share information and songs and download thousands of MIDI file songs.

Copyright Laws in relation to MIDI Songs

At the time of writing this section the copyright laws governing MIDI song files was a complicated and gray area. Copying, performance and actually downloading a MIDI file can be seen as an infringement of the Copyright law. However, from what we understand the Copyright office are having a hard time accepting a MIDI file as something tangible enough to write a legislation about (from all accounts they don't even have the necessary hardware and software to play a MIDI file - perhaps we/you could sell them something from this MMCD ?!).   So therefore we suggest you check our the current copyright situation before downloading, copying or performing other artists material on a MIDI song file.

Learn with MIDI

MIDI can also be a valuable training tool. As you will see when using the Presto Arranger software, you can view the music by each track & instrument - actually seeing in real-time what notes are being played. By adjusting the 'Tempo' (or speed) of the song you can listen to it at your pace, to fully understand what is being played.

Summary

We hope you enjoy the MIDI songs included on this MMCD and the Presto Arranger (and other) software's which help you play & understand MIDI.

Finally, if you on-line to the internet go to a search engine and just type 'MIDI' or 'MIDI Songs' and see what you come up with.....You'll be surprised !

Microsoft®

Internet Explorer

Useful E-Mail Addresses

If you find that the installation driver for your particular operating system is not included on this MMCD CD-ROM then please visit one of the following web sites for further information..

www.midi.com

MIDI Home Page

www.mmcd.com

MMCD Home Page

Thank you