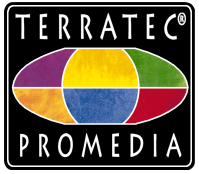
Music on your PC

The Wavetable- & MIDI manual



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Brief Introduction.

Dear Sir/Madam, Children.

Dear musicians (and aspiring musicians).

Hello to all computer freaks, trackers, gamers and so on.

Hello!

The purpose of this small book is to give a quick, informative and easy-to-understand insight into the world of music processing with the PC. You will find all the information you need on the different sounds, synthesizer functions and programming facilities of your new product. We have also summarised the most important information on the subject.

Many of the sections were written with those new to the world of music in mind and do not therefore go too deeply into the subject material. Advanced users, nevertheless, will find all the relevant information they require to use the products. It is difficult, of course, to cover the knowledge base of all readers at the same time, added to which readers are from different target groups - computers and music. We do therefore ask all beginners to reread a section where necessary and the professional to skip certain sections. Or maybe not, because any individual could learn so many things by looking at them from a diferent perspective.

We hope that while you browse through this book you find it both entertaining and informative.

.. *Your TerraTecTeam!*

AT THE BEGINNING ...

For the sake of simpliciity, this book refers to several of our company products. All TerraTec Wavetable sound cards and daughterboards that appeared until the book went to press refer essentially to the same, or a comparable technology in sound production. These include: all sound cards of the SoundSystem Maestro series, the SoundSystem Gold 32, all daughterboards of the WaveSystem series as well as products based on EWS technology.

Wavetables with fixed storage sounds in the ROM differ only in the storage size of 1, 2 or 4 MB ROM. The number of sounds varies between 343 and 393. You will find further details in the technical specification at the end of the next chapter.

The parameters specified in the “Sound and Data Tables” apply to all products. Devices that use EWS technology offer far greater options for sound impact. Values that apply only to this product range are colour coded. The same applies to the MIDI implementation chart. With the AudioSystem EWS64, a large part of the functionality is determined by the so-called “firmware” (the card’s internal “operating system”). You should therefore heed any additions to the README.TXT files supplied with the (update) software.

If a practical reference is made in this book to software, then menu items or buttons to be pressed are set in [square brackets].

We would like to take this opportunity to recommend, once again, that you register your product with us. We send out software updates, customer magazines or other treats at irregular intervals, so you can see that it is clearly worthwhile registering. You may also register online. The address is:

`http://www.terratec.net/register.htm`

and it is very quick.

The latest version of this manual can also be read on the Internet Online. The address is:

`http://www.terratec.net`

And last but not least: the term “keyboard” as used in this book does not refer to a computer keyboard, but a musical instrument or a MIDI control device.

Assembly and Installation.

Assembling a WaveSystem.

It should be possible to install the WaveSystem in your PC without any great difficulty. You should read the following instructions through carefully, however.

Briefly. All you need to do is to open your PC and place the board on your sound card (always heed the safety instructions in the manual for your sound card or your PC).

Or, to expand a little further. In order to operate the WaveSystem, you need a sound card with a so-called WaveBlaster connection (Fig.1). You will find this connector with 26 pins on all TerraTec sound cards or on the 5¼" front module ("digitalXtension 'F'") for the AudioSystem EWS64 (Fig. 2), as well as on some cards of other manufacturers, such as SoundBlaster 16 (not the ValueEdition), AWE32 (again, not with the ValueEdition). Your sound card's manual will provide further information.

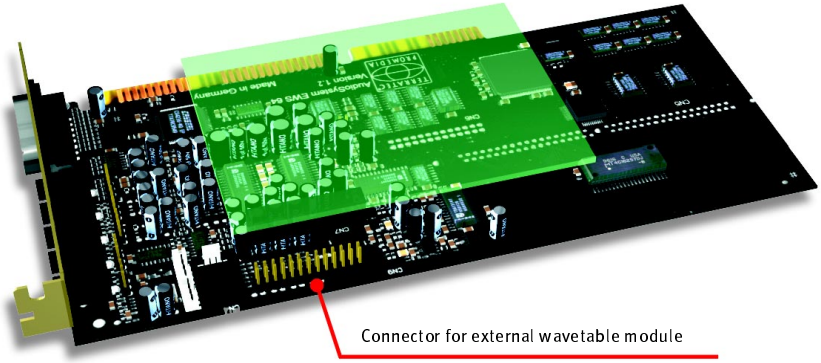

Fig. 1[1]

For perfect operation of the Wavetable when playing games under MS-DOS, you will also need a sound card with a hardware MPU401-MIDI interface (not "emulated by software"). You will also find this interface on all TerraTec models.

Carefully open your PC - as described in the accompanying manual - and remove your sound card. Now find out from the manual for your sound card whether any presettings are required to operate an external Wavetable (for our SoundSystem Maestro 16/96

1. Note: This is not an EWS soundcard

a jumper must be transferred in order to switch the MIDI interface). Look for the 26-pin board and carefully place the WaveSystem in position. If you have any doubts that some of the chips of both boards could be touching, place a thin piece of card (avoiding anything such as a coated pizza carton!) between the cards for protection. Small spacers are sometimes supplied, depending on the size of the Wavetable.

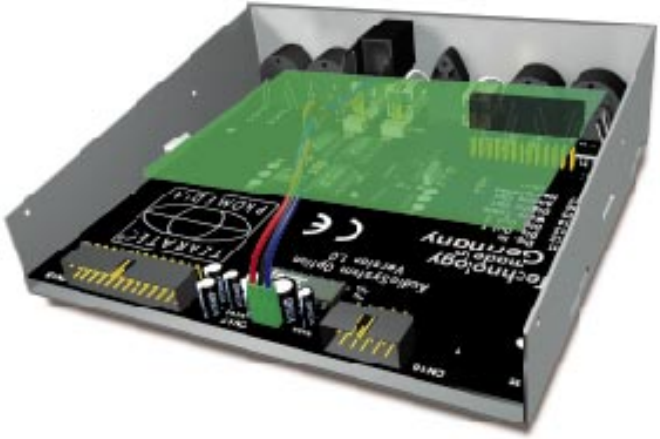

Fig. 2

Setting up the software / drivers.

If you have acquired one of our Wavetables separately, you may be wondering why there was no customary driver diskette in the package. These drivers are included with your sound card of course, and, in most cases, have “MPU” or “MIDI” in the name. Information on this can be found in the manual for your sound card. If you have a card for the sound system Maestro series with an integrated Wavetable, you will also find the drivers on the diskettes supplied.

Games supported by Wavetable.

Games running under MS-DOS always bring their own drivers. As a rule, two drivers have to be selected in the installation or setup program for the game - one for voice or sound effects output, and one for music playback. This is where the Wavteable comes in. You can specify, for example, MIDI, General MIDI, GM, GS, Roland, SoundCanvas, TerraTec MAESTRO, WaveBlaster, SCC-1, RAP-10 or Wavetable. The standard address for most sound cards is 330Hex. If you prefer music playback on a different address, for example because one of your PC’s other components is already on 330Hex, then you must make this change to your sound card (for owners of the SoundSystem Maestro or AudioSystem EWS64, this is in the installed setup program, or in Device Manager of Windows 95). A Wavetable mounted separately must not - and indeed cannot - be set differently because it is only addressed via the MPU401 MIDI interface of the sound card.

Second Wavetable.

One more thing - with the SoundSystem Maestro 32/96 and the AudioSystem EWS64 it is possible to operate a further Wavetable module via its own MIDI port in addition to the internal Wavetable / sampler. As this interface is hardware-dependent, of course, both Wavetables can also be addressed separately by a game. Cool! In the Games Setup, you simply specify the IRQ and the address of the second module - and the game now uses this module. But be careful, because there are programs, unfortunately, which allow for a setting in Setup, then re-check all resources during startup, but then may use the internal synthesizer because, as a rule, it is on standard settings.

The MIDI drivers of the AudioSystem EWS64.

From driver version 2.0, the AudioSystem EWS64 possesses various drivers that can address very flexibly the MIDI departments of the card. So the synthesizer / sampler (Wavetable element) is controlled via its own internal, extremely fast and extensive device driver which can be used by several programs simultaneously in both directions (up to 8 x IN, 8 x OUT). There is also an internal MIDI monitor function available with which it is possible for a program to re-record everything given out by the synthesizer.

On a more specific point of functionality - a conventional sound card, as a rule, offers a MIDI driver which supports 1 MIDI-IN (record) and 1 MIDI-OUT (playback on the internal Wavetable, or MIDI-OUT socket). This configuration allows each application use of the MIDI functions at the same time. The AudioSystem EWS allows up to 8 applications to record MIDI datastreams in parallel via MIDI-IN, although only one jack (MIDI IN-1) is physically available for it. The driver also allows up to 8 applications - Windows programs as well as (WIN95) DOS games - to address the synthesizer simultaneously (MIDI OUT-1 respectively). In addition, a MIDI monitor function has been implemented which again allows up to 8 applications to record simultaneously all data received by the synthesizer.

To enable the user to also exchange MIDI streams between individual applications without having to fall back on devices that are physically available, the driver provides up to 8 interswitchable “virtual MIDI devices” for the purpose. These “sub-drivers” have been called “V-MIDI #1-8”. One important point to note - the V-MIDI “drivers” have nothing to do with the actual hardware - they are purely a software solution for this (often requested) function. This driver “mayhem”, in fact, appears at first glance to be somewhat worse than it actually is because the number of drivers can be specified at any time.

Here are some examples of applications:

You would like to prompt your sequencer to synchronise a software synthesizer running in parallel via MIDI Clock (e.g. Cubase with ReBirth-338). The sequencer gives out a clock signal on “V-MIDI Play #1”. The synthesizer then receives this on “V-MIDI Record #1” and runs in the timing.

You are running a game in the DOS window of Windows which gives out its GM soundtrack on the synthesizer of the EWS (clear so far?). You like the sound so much that you want to keep it! Set your sequencer to record and use the MIDI monitor driver to record everything that had been specified only for the synthesizer. When doing this, note the feedback loop (see below) and heed any copyrights to the music ...

One musician is playing the piano and another the panpipe using their own keyboard. Each musician gives their best data (via Soft-MIDI-Thru) through their own sequencer on several MIDI channels. In parallel to this, a percussion/bass accompaniment is played back by Windows Mediaplayer. All programs give the data out on V-MIDI Play #5. This MIDI stream is recorded by a MIDI analyzer on V-MIDI Record #5, all the velocity information is filtered out and all the notes - except the percussion - are transposed by the program 3 semi-tones up. This application then leads the MIDI data to V-MIDI Play #1 to a further sequencer which records everything - on V-MIDI Record #1. Correct! In practice, this example makes no sense, but it does illustrate our aim of allowing you to conjure up whatever you like - whilst the EWS joins in and your creativity knows no bounds.

NOTE: FEEDBACK LOOP.

There is a conflict of interests, however, when the MIDI-OUTs are used simultaneously while using the MIDI monitor. If you give out data via MIDI-OUT, the monitor senses this in its function as a recording driver. When this monitor data again enters a MIDI-OUT, the result is an endless loop which will bring the system to a standstill. The same thing happens, moreover, when you use a program to record data on V-MIDI Record #1 and then put it out via MIDI-Thru on V-MIDI Play #1. The numbers must therefore always be different. Should one of these “deadlocks” occur, you can - with a little luck - prematurely terminate the corresponding application using the key combination [CTRL]+[Alt]+[Delete]. It would have been very time consuming to program a way around this particular set of circumstances and, because of software requests in the applications, would have meant a noticeable drop in performance. It is therefore best that you activate the monitor driver only if necessary (in the MIDI setup of your sequencer or in the extended driver settings of WIN95 Device Manager).

TECHNICAL SPECIFICATION (SYNTHESIZER SECTION).

	SoundSystem Maestro16/96 MiniWaveSystem SoundSystem Gold 32	SoundSystem Maestro16 WaveSystem	SoundSystem Maestro 32-Serie Professional WaveSystem Professional WaveSystem PCMCIA	EWS-Series
Chipset / DSP	9233	9233	9233 + 8905	9407 / 9503 with TerraTec OS
ROM	1 Mbyte (8 Mbit)	(16 Mbit)	4 Mbyte (32 Mbit)	-
RAM	-	-	-	2-64 Mbyte (16-512 Mbit) *1)
Polyphony (number of voices)	32	24	32	up to 64
Number of sounds	343	315	393	up to 16.384
Number of drumkits	8 (incl. SFX-Kit)	8	8 (inkl. SFX-Kit)	up to 16.384
Multi-Effekt processor	-	-	yes, 8 hall- and 8 chorus algorithm	yes, programable. Functions software controled

Table 1:

	SoundSystem Maestro16/96 MiniWaveSystem SoundSystem Gold 32	SoundSystem Maestro16 WaveSystem	SoundSystem Maestro 32-Serie Professional WaveSystem Professional WaveSystem PCMCIA	EWS-Series
Compatibility	GM, GS- and MT32*2)-instruments	GM, GS- and MT32*2)- instruments	GM, GS- and MT32*2)- instruments	GM / GS, MT32*2)-instruments after loading corresponding soundsets
Programable?	yes	yes	yes	yes!
Resolution / Samplerate	8/12 Bit / 44.1 kHz	8/12 Bit 44.1 kHz	8/12 Bit / 44.1 kHz	8/16 Bit 32, 44.1, 48 kHz
internal processing	16 Bit	16 Bit	16 Bit	20 Bit
D/A	18 Bit	18 Bit	18 Bit	18 Bit
Digital output	-	-	-	S/PDIF*3)

Table 1:

*1)For the AudioSystem EWS64 XL 6MB in the standard design, in the L version 2MB.

*2)via PatchMapping (see “What is Patch Mapping”).

*3)Included with the AudioSystem EWS64 XL, optional for other models.

Basic research.

This chapter describes - for the benefit of the newcomer - the development of all devices and technologies that are worth knowing when working with music on the PC.

Of synthesizers, samplers and virtual contemporaries. (Sound production).

Do you remember the fantastic sound collages of days gone by? Musical highlights in the style of Vangelis, Kraftwerk or Jean Michel Jarre? Milestones in the history of music, acoustic dreams condensed into reality, made possible through the technical flights of fancy of a Bob Moog or a Tom Oberheim? ...

Many songs by these artists had something strikingly in common at the time. They contained no - or very few - natural instruments such as strings, guitars or pianos. These presented the good old "synthesizers" with natural limitations. With an analog synthesizer, its basic sound is produced through what are mainly simple electrical waves (tooth of a saw, square, pulse) by means of a so-called oscillator. These waves then passes through other switched on elements such as filters and envelope generators, and then - still as an electrical vibration - to the audio output where it becomes audible via loudspeakers.

With the advent of so-called "sampling" technology, the early 80's witnessed the dawn of a new era in music electronics. "Sampling" is the term used to describe the conversion of a sound into digital information. It involves a sound event being recorded and stored up to 48,000 times a second. That's quite fast, so that sampling allows very natural playback of, for example, real musical instruments. If a simple wave is replaced by a so-called "sample" as the oscillator in a synthesizer, it becomes apparent that quite different sound options become possible than those associated with a conventional analog synthesizer. Devices that provide a fixed supply of wave forms (that is to say a stack of samples / natural recordings) are called ROM sample players, or simply "ROMplers". Your new Wavetable sound card / Wavetable upgrade board belongs to this "species".

If a device also offers the option to create digital recordings itself and then play them, for example via MIDI, (an important point because at last it is possible to digitise a sound with every sound card and store it on a hard disk, for example). then this is known as a "sampler". The AudioSystem EWS is such an example.

Incidentally, Wavetable technology was so called by the computer world because a) the term “Wavetable” sounds cool, and b) a sample is also referred to as a “wave”. Many hundreds of these waves are stored in a table in the chip and are read off and processed. Anyone delving more deeply into the subject will, however, come across wavetables at some stage. The music world refers to this technology - in the same breath as manufacturing - as waldorf (http://www.waldorf-gmbh.de) or PPG, but the background, or further processing in the synthesizer, is of a somewhat different nature. And while on the subject of other types of (digital) sound synthesis, frequency modulation (FM for short) was a significant contributory factor to the replacement of analog devices. With FM synthesis, in brief terms, several vibrations are produced simultaneously and modulated with each other, producing what at the time were considered (and still are considered) highly complex acoustic patterns. At the time, there was talk of a revolution in the industry, and FM synthesis was acknowledged as having a natural sound character that had never before been achieved. This FM technology is now found in every sound card, because very old computer games need this type of sound production - the first used in AdLib and Soundblaster cards. With the advent of samplers / (ROM) sample players, analog synthesizers were pushed ever further into the background. It was not until musical styles such as techno and its numerous variants and derivatives came onto the scene in recent years that many musicians were again able to enjoy the (unnatural, maybe “freaky”) sound produced by this old type of equipment. Second-hand prices went through the roof in some cases ... . A new “technology” has recently been enjoying - certainly for this very reason - ever increasing popularity: The pure software synthesizers, or so-called “virtual -analog” synthesizers, for the most part can offer options which, in many respects, are superior to their precedessors. Simple “analog” waveforms are calculated by a powerful DSP in the device - or by a fast processor in your PC in realtime - and can be afforded musical applications. The advantages are self-evident. Manufacture is considerably more cost effective, slider movements on the device (which contributed a great deal to the lively acoustic pattern of their precedessors) can be recorded simply and conveniently via MIDI and - banal though it may sound - component tolerances and other sensitivities (temperature, humidity) simply cease. Further developments can be expected on the PC in this direction in future. Results are already more or less usable in some areas.

Certainly the development of the program “ReBirth 338” (you will find a demo under http://www.propellerheads.se) can be regarded as a minor milestone. There are also attempts to replace pure wavetable sound cards with bits and bytes. Purely PC based synthesizers have one disadavantage when compared with their hardware colleagues, however. Firstly, they cannot be played via MIDI like a “real” device (due to the audible delays during key depressions, called “latency”), and secondly they gobble up enormous computing power which, at present, is severely restricting their use in combination with other programs (with software wavetables, such as games).

Yet in spite of all the numbers ‘mania’, one thing is always needed for a musical application of this type of technology - a good sound card. But you already have one of those, of course ...

What is the MIDI, and how did it come about.

Many years ago, musicians playing on stages around the world, surrounded by enormous ranges of keyboards, confronted the listener with veritable walls of sound. Bombastic synthesizer sounds were made up from many pieces of equipment, all of which had to be operated by one person, yet as simultaneously as possible. Using two hands, not to mention feet and many strips of sticky tape (to hold keys whilst at the same time playing an organ solo as well as a piano accompaniment) success, however, was often a difficult venture. The musician - perhaps not the most industrious of breeds by nature - very soon discovered something which would blaze a trail for the music industry in the years ahead. In 1983, the MIDI torch flickered in the USA - and it has been developed ever since.

With MIDI, it became possible for the first time to connect two pieces of equipment via cables, and to play the one from the other. Channels were later allocated on which a device could send and receive key information. So for example, if one had three keyboards, it became possible to play either three sounds from one keyboard (all devices on the same channel), or to choose between them (different channels).

Staying with the example of our none-too-industrious musician for the moment - surely there was a better way of doing things than all this endless lugging things about from one stage to the next?! And so it was that instruments were discovered which could produce several sounds at the same time. Why three keyboards if it was hard enough with one? Point taken. From now on, it was possible to arrange - and with considerably less effort - different sounds over each other using one keyboard via MIDI - and there are still 16 MIDI channels available today - with one sound per channel possible. So that the many buttons required to produce a change in sound from just one piece of equipment could now be remotely controlled, so-called MIDI controllers were soon defined. Commands, for example, to control the volume or stereo position (pan). But it went still further. If just one device alone could produce all the sounds ... why not this one device play everything by itself? A box was discovered which could record all the messages

generated by the musician on the keys. Note by note, button by button - and everything separately and consecutively for each channel - the sequencer.

We have now covered some of the more fundamental aspects of the subject in hand. And now to the technology. In MIDI language, there are no audible sounds - only data which, for example, describes a sound. If the key C3 on a keyboard is pressed very firmly and then released, precisely the following information will be sent via the cable: note number 60 was struck with a velocity of around 100 (out of 127, note “on”) and then released (note “off”). What sound emerges at the end is immaterial at first. It is actually produced by the device receiving this message. As ever.

One device can operate one MIDI channel - or indeed more than one. The differentiation here is between the MIDI omni-mode (where off or on, poly or mono status are still of no significance in principle) and multi-mode. A sound generator operating in multi-mode is known as a multi-timbral. It is now possible for virtually all “MIDIfied” devices to operate in 16-factor multi-mode, i.e. to play music back simultaneously on all channels. As well as the MIDI commands already mentioned such as note information and controllers, there is a multiplicity of other parameters available in the MIDI language. MIDI can be used to control virtually any function of a device nowadays. If the standard is insufficient, every manufacturer can control the individual properties of its sound generator via so-called “system exclusive commands”. The MIDI commands were defined over the years by the MMA (MIDI Manufacturers Association - an association of manufacturers within the musical instruments industry). These commands are not covered comprehensively in this manual, but just a few examples - such as commands to control tape recorders, song selection in sequencers, transmission of digitised sounds (samples) or the incorporation of accessories such as pedals, or so-called “breath controllers” - illustrate how almost everything has been thought of.

So what is the situation now. Well, the keyboard - or at least that which constitutes its sound - has since been shrunken to the size of a sound card, the task of the sequencer is now carried out by software running on your computer, and indeed offering far more opportunities for further editing - and the business about the “none-too-industrious” musician ... that was just a joke.

For the record, MIDI stands for Musical Instrument Digital Interface. Most important ...

The recording test. (After MIDI comes Audio, and what is the difference).

Long before the MIDI came on the scene, synthesizers were recorded on tape in the sound studio exactly like guitars, percussion instruments, vocalists, chickens or pianos. It was not until the synthesizer was developed that new paths were trodden, because the MIDI offers the arranger a far wider range of options for further editing than is possible with tapes. As has been described above, only sound information is transmitted in the MIDI language - not the sound itself. This means that every recorded “note”, or rather “event”, can be changed later - so that C3 beomes G#2, constantly loud slowly becomes quieter, hardcore comes from fast, and a waltz can emerge from a 4/4 beat - and all by post-editing. What is clear is that this task is being accomplished by the computer using software at the click of a mouse - quickly, clearly, simply and conveniently. As machines became more powerful, another application literally emerged. Why record only MIDI when operation can be so simple?

With so-called “hard disk recording”, live instruments (vocals, guitar etc.) is digitised and stored on the computer’s hard disk - consecutively on several tracks of the software used. Since the sound material - in contrast to analog recording tape - is stored in the computer fully digitally, i.e. in the form of numbers, many ideas suddenly appear in retrospect. As well as the obviously rudimentary things such as “cutting” and tuning-out, a great many more editing options have since emerged. It is now possible, for example, to use digital equalizers to change any frequencies or alter the pitch of a voice without influencing the length - and a lot more besides. There are also special programs for hard disk recording which offer many functions for their precise area of application.

”Audio/MIDI sequencer” is the simple and succinct term given to the combination of both program types under one surface - a development allowing for a very convenient mode of working. Note, however, that a clear understanding of the difference between (digital) Audio and MIDI will make your work that much easier. So once again:

MIDI data is information which can generate or change a sound or a function in a sound generator. Audible events are held in digital form as audio data. Audio data requires considerably more storage space and computing power than MIDI commands.

And finally, a very rough comparison for the benefit of all computer boffins. Audio data (.WAV) is better compared with scanned images (bitmaps, TIFF's, etc.), whilst MIDI data (.MID) would more closely correspond to a graph (Beziér), such as in CorelDRAW!. Is that clear?

Around the MIDI.

The right connection.

As already described, MIDI data is sent via a cable from one device to another. At the ends of the cable there are plugs - as they are perhaps known from older HiFi components: 5-pin DIN connections were selected for this purpose. The leads are not all through-connected, however, as the hobbyist will see from the graphics. For this reason, MIDI cables should only be obtained from a specialist music dealer, and the length is important too - 10m - otherwise data could go missing 'en route'.

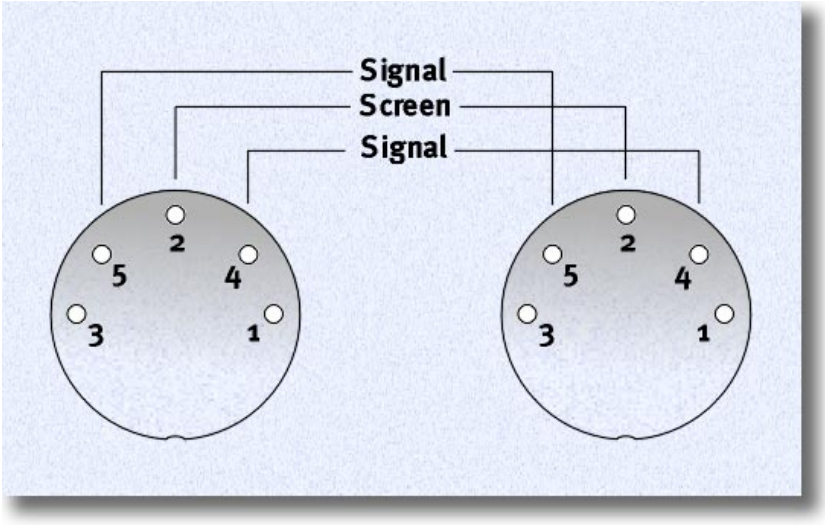

Fig. 3

As a rule, the devices themselves always offer two jacks: IN and OUT. Data is received via the MIDI IN jack. If you want to send information, it is emitted via the MIDI OUT jack. Devices are always cross-connected, i.e. an OUT always comes to an IN and vice versa.

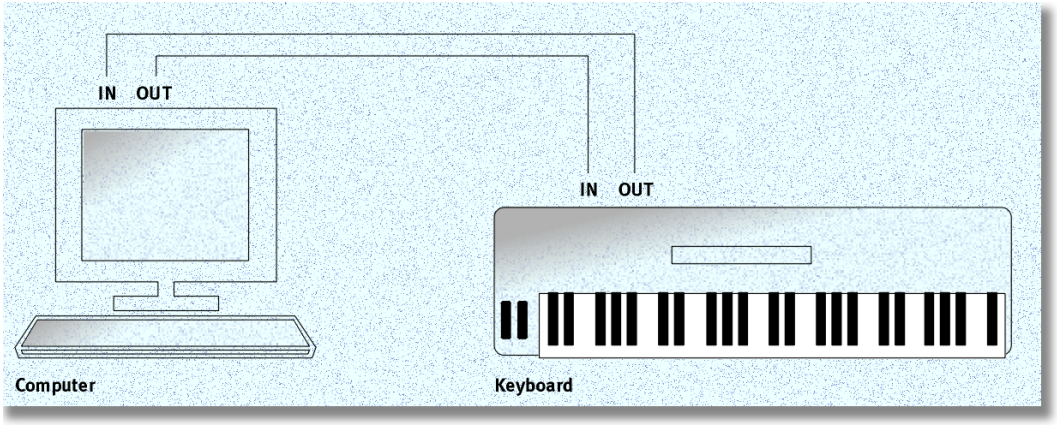

Fig. 4

Many devices also have another jack so that the data stream can be “looped through”. A MIDI IN signal enters a different device, unchanged, via MIDI TRHU, where it is again connected to the IN jack. Such interlinking is needed when several sound generators are to be played from one device. But note: with too many devices connected in series (>4-5), the result coud be clearly audible delays or data failures.

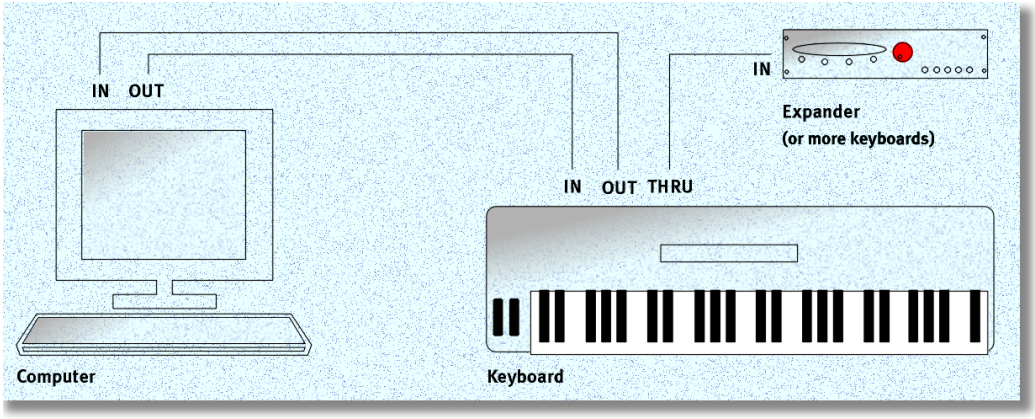

Fig. 5

GM, GS and XG Standards in the Standard.

At the start of the 90's, all of the leading manufacturers in the musical instrument industry got together and decided on a standard which would set out the minimum requirements for a MIDI instrument. The basic problem to that point was that each manufacturer had a vast array of sounds in their equipment. This was all very well, but they were in a state of disarray. If a musician wanted to swap songs with colleagues, the instrument configuration had to be revised each time. There was an even greater problem on top of this where percussion instruments were concerned. Each device had this instrument class scattered across other keys, perhaps on different MIDI channels - a recipe for true chaos, and nothing in it for the musician not industrious by nature.

The introduction of the General MIDI Standard (GM for short) brought about a minor revolution within the market. Ready-programmed pieces of music in so-called Standard MIDIfile format (SMF) mushroomed and the computer industry had a standard for use in games - the GM wavetable sound card was born! One thing should still be borne in mind in this respect, however. The GM logo on a device is in no way an indicator of the quality of the instrument. Finally, (and indeed fortunately) only key features are specified - and not sound aspects.

Here is a small extract from the General MIDI Specifications (1.0) of the MMA.

- Standard 128 instruments, playable on channels 1 - 9 and 11 - 16, sorted by groups:

Program number	Soundgroup	Program number	Soundgroup
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

Table 2:

- Plus a percussion set with 47 percussion instruments on MIDI channel 10. Standard keyboard configuration.
- Minimum 24-voice polyphony
- All voices react to velocity (impact intensity).
- Assistance of controllers 1, 7, 10, 11, 64, 121 and 123
- Assistance of RPN commands for tuning, fine tuning and pitch-bend range.

Further information can be found on the Internet - for example on MMA:
`http://www.midi.org;` you should not make any enquiries there, however, but instead use the links at the end of this book.

Most manufacturers now exceed this standard. The two largest, the Japanese firms Roland and Yamaha, therefore wished to include their own functionality in the standard to add still more nuances to the games. But as so often happens - each manufacturer had its own opinion about the functionality required (above all as far as a restriction in future developments was concerned) and so two new standards emerged from the common aim. Largely the manufacturer's own, of course ...

Roland's GS and Yamaha's XG both extend the GM standard by

- additional commands for sound selection (bank select for each of 128 Sounds in 128 banks),
- additional percussion sets,
- an effects processor with at least 1 reverb and 1 chorus effect,
- parameters for sound change using controllers (NRPN).

XG adds to this another, more flexible effects processor and control of an A/D transformer. It is used in karaoke systems, for example.

Many computer games support the GS standard but without explicit use of the effects processor. Most MIDI files were also created using GS instruments. You will find further informationen on XG on the Internet

`under http://www.xgyamaha.com`

or**`http://www.yamaha.co.uk/html/h_whatxg.htm.`**

The sound systems from TerraTec support many GS standard commands in addition to all the general MIDI functions. Furthermore, devices with EWS technology also offer extended access to the effects, as well as their external use. You will find all the parameters at the end of this book.

The MIDI mapper under Windows 3.1 / 3.11.

Windows 3.1/3.11 offers the user the MIDI mapper for the administration of various sound generators that can be addressed via the MIDI interface(s). It is possible to adapt the most important MIDI information in it, such as the output of program numbers or the octave position of a sound, to the user's own requirements. Still more important, however, is the mapping of MIDI information on different devices or drivers, i.e. which MIDI channel is to be output via which sound generator? We would like to expand briefly on this point.

The MIDI mapper is achieved via Windows' control system. As a rule, various [Setups] are available which can be selected in the menu [Name]:. If you now click on [Edit] you will be presented with a window in which a different channel from 1 to 16 can be allocated to each MIDI channel (SrcChan) (DestChan). Furthermore (and in fact most importantly), each channel can have its own output defined - provided that different MIDI drivers are available, of course.

But it is precisely this fact which can very often lead to confusion, too. If, for example, a MIDI file is played back by Windows via the media playback and the result sounds somewhat "cheap", it is most likely that a driver was selected - in the MIDI mapper as the output for all channels - which addresses the FM part of the sound card. In this case, a driver should be defined as the output which addresses the wavetable or the external sound generator. As a rule, the name of this driver will contain something with 'MIDI' or 'MPU' in it.

The basis for the function of the MIDI mapper is, of course, that it is also supported by a Windows application. In practice, the MIDI mapper is switched between the (music) program and the MIDI driver (and therefore the connection to the sound generator). There are also applications, however, which access the MIDI drivers directly - usually the more professional sequencers. Here, it is possible to specify the necessary drivers in internal program parts for MIDI input and output. These settings then completely bypass the MIDI mapper. The MIDI mapper, as a rule, is used by the smaller Windows applications, such as media playback, various ´HiFi racks´ (MediaRack, AudioStation) or MIDI auxiliary programs. It should further be noted that the MIDI mapper tends to “swallow” important data (such as SystemExclusive information). Under certain circumstances, therefore, the MIDI mapper may be the cause of faulty wavetable behaviour (suspended notes, incomplete program change, etc.).

The MIDI mapper under Windows 95 / NT 4.0x.

Under Windows 95 and Windows NT, too, there is a MIDI mapper which can be found in the control system\ Multimedia\MIDI. Here, too, it forms an interface between various Windows programs (not games in the DOS window). The 95/NT variant, however, has been clearly slimmed down from the range of functions - but that is no great tragedy. There is now the further facility to allocate different drivers to the individual MIDI channels. If one wants to play back MIDI files under Windows 3.x - all with just one instrument - then the driver must be set laboriously for each individual channel, a fact which has been taken into account in this case and simplified accordingly. Also, a new driver can now be installed directly in the new MIDI mapper (or more precisely, the “card file card MIDI”) by selecting the field [Add new instrument ...]. An online help facility has also been added.

”Old “ games in the DOS window, or MS-DOS mode, do not benefit from the MIDI settings, which still operate using their own drivers. On the contrary, an error message may sometimes appear stating that the current MIDI driver is already being used by another application.

The MIDI controllers.

The MIDI controllers are part of the so-called “channel messages”, and therefore change values on the MIDI channel on which they are sent (except for: #121-#127, see below). MIDI controllers are provided for live intervention in the acoustic pattern, and therefore offer real time control of the instrument. Many are available as constantly changeable values, and some as switch values (on/off). They are numbered consecutively from 0 to 127 and always require a further value (0-127) for data input. You should therefore send controller #7 for the volume of an instrument, for which you must specify a value which defines the volume - so for example 64 for a medium volume. The following chapter explains how to send MIDI controllers (and SystemExclusive commands, see below).

You will find a precise listing of the supported MIDI controllers in the chapter entitled “Sound and Data Tables”. Below are details of the most frequently used numbers:

Contoller #0 is the bank select command. It is used to gain access to the sound variations which you also have available for the GM soundset. The important point to note here is that you always have to send a program change *after* a bank select - never the other way round, otherwise nothing will happen. Nor is it possible to select a bank once and then just send program changes in order to listen to that bank’s sounds. The combination must always be given. Controller #32 is likewise a bank select, but is only used in some instruments.

Controllers #1-31 are normally used for handwheels, slider controls and other constantly changing values. These include, for example, the volume control, pan (stereo position), data entry (in connection with NRPNs, see below), expression (same effect as volume) and the modulation wheel of a keyboard (modulation).

Controllers #64-67 are switches for sustain (damper pedal), switching on the portamento (glide) effect, and the sostenuto and soft pedal - to use piano terminology.

Just as frequently used are controllers #80 and #81 to select effects algorithms *(See also "The effects processor." on page 62)* and #91 and #93 for the effects intensity of a MIDI channel. If you would like to delve further into the world of MIDI programming, you will not be able to avoid controllers #98 to #101. It would be possible to go into great detail - in combination with other controllers - on sound impact.

Controller #94 is provided for switching outputs 3+4 (OUT2) of the AudioSystem EWS64 on/off. It also controls the pan position of a signal between outputs 1+2 (OUT1) and 3+4 (OUT2).

Controllers #121-#127 are used more rarely, but they do send the "channel mode messages" which set general functions such as Controller Reset (resets to standard values), All Notes Off ("all quiet!") or the MIDI mode.

TIP: On tracks, channels and program switching.

Sequencer programs offer the facility to record MIDI data on different tracks. Like a multi-track tape recorder which some of you may know from the recording studio. So that more than one track can be played back simultaneously, a GM-compatible sound generator is able to put different instruments on up to 16 different MIDI channels. So, for example, a piano could be defined for channel 1, a bass for channel 2, ... for channel 3 and so on. However, you must not mix up sequencer tracks with MIDI channels - which it is easy for the novice to do - because many programs also normally have 16 tracks. For instance, it is always possible on track 5 to output data on MIDI channel 8 or to play back tracks 3 and 4 on the same MIDI channel.

When setting tracks and channels, care must also be exercised that only one (1) instrument can be allocated to any one MIDI channel at the same time. It is not possible to play a trombone on track 4 with a set MIDI channel 8, and at the same time select a harp on track 5 (likewise for channel 8). In such a case, a different channel would be required for the harp. If you do not want to play the instruments simultaneously, then that is no problem. It is always possible to swap an instrument during the piece that is running by means of program changes. For example, the trombone up to beat 20, then a harp, and later on a fluegel horn.

Too few channels? Muting parts.

Do you control your sound card through a keyboard with its own sound production, but want to use it alongside the wavetable sounds? If so, you will quickly discover that 16 MIDI channels may not be enough. So that you don't have to hear all the sounds simultaneously from the sound card and the keyboard, you should switch off (mute) some parts of the wavetable via SystemExclusive. You can find out more about how this works in the section headed "An Overview of the most important SysEx Commands". If you don't want to omit all the MIDI channels from keyboard and card, you should consider acquiring a second MIDI interface. If you buy another MPU interface, you will also need a special driver capable of operating more than one MPU port (Multi-MPU etc.). If you are fortunate enough to own a SoundSystem Maestro 32/96 or AudioSystem EWS64 from TerraTec, then you won't be faced with this problem - they both have 2 MPU interfaces on the card.

Closing time: local ON and local OFF.

Do you control your sound card through a keyboard with its own sound production? And have you also fed your MIDI cable back to the keyboard in order to use the keyboard's own sounds? Then you will doubtless have noticed at least once how all of your keyboard's sounds sound rather strange - as though they are somehow "doubled up". Or, when your device is operating in MIDI multi-mode, do you always hear a sound other than the one you are expecting (one which doesn't come from the sound card). If so, you haven't switched your device to 'LocalOff'. It is possible to separate the sound production of many keyboards from the keyboard, because the data which your keyboard sends to the computer is sent directly back to the keyboard, thereby producing largely undesired effects. Your keyboard's manual should explain how to carry out this setting.

What is patch mapping?

Patch mapping is the process of “diverting” a program change to another specific patch (sound) of the wavetable in order to attain limited compatibility with Roland’s MT-32. Since the GM/GS sound table does not concur with that of the (old) MT-32, program change information is sent to the wavetable during patch mapping. This information is then passed on by the synthesizer chip to the sounds that most closely approximate to the data. If you have a game which supports the MT-32, and perhaps sends special (SystemExclusive) data for this device, then this data is disregarded. The system may even crash on occasions. If this is the case, you should select the setting SoundBlaster (FM) or General MIDI (Wavetable) for music playback.

The standard MIDI file format (SMF).

The Standard MIDI File Format (SMF for short) is a standard on which most of the leading hardware and software manufacturers have agreed. This standard file format allows virtually problem free transfer of MIDI data between sequencers from different manufacturers.

There are several data formats. Two of the main ones are:

Format 0: In the first file type, all sequencer data - irrespective of the number of MIDI channels - is condensed onto one track. The sequencer receiving this format then splits the different channels back into individual tracks.

Format 1: In the second file type, the MIDI data (as usual) is stored as individual tracks. It should be noted in this case, however, that a track can also contain the data of various channels.

Nevertheless, as the SMF has since become established as a popular and much used facility for data interchange in the MIDI world, some “unofficial standards” should themselves be adhered to. They include, for example, the distinct naming of individual tracks - and indeed not with imaginative names such as “snow grouse” or “loudly blinking klingon mother ship with warp 8”, but rather with piano, strings and pan flute. Fortunately, a standard key configuration using percussion sounds has gained acceptance as a further standard. This drum configuration for which we can thank the so-called “GM standard” (See also “GM, GS and XG Standards in the Standard.” on page 31), should now certainly be adhered to during any interchange of data in order to avoid any irksome and time consuming transposing of individual sounds or tracks. This only applies, however, if you have have connected further MIDI devices to your computer. The wave system, of course, also operates to the GM standard.

Anyone intending to exchange songs with other MIDI musicians (and other systems) - which inded makes sense - should ensure that a standard disk format is agreed upon (beforehand!) to allow any possible exchange to take place. The most popular format at present is the MS-DOS format which can also be read by most keyboards. ATARI ST computers format diskettes from TOS 1.4 compatible with the DOS standard, Apple Macintosh computers read and write this format using additional software. The name extension for the SMF, incidentally, is “*.MID” (naturally). With Macintosh computers, this extension itself must be applied in some cases.

Structure of a standard MIDI file.

The composing and programming aspects of a song are not the only ones being learned today - attention is also being focused on the structural design of a (GM) MIDI file. There are therefore “regulations”, for example, that guarantee 100% perfect playback of MIDI files on GM/GS sound generators.

At the start of a “real General MIDI file”, at least one beat is released in which firstly a GM/GS reset is set (SysEx command: F0,41,10,42,12,40,00,7F,00,41,F7). One crotchet later, (about 200ms) all the settings follow for the piece of music, i.e. the bank number (controller #0), LSB bank number (controller #32, used by some devices), program number (program change), volume (controller #7), panorama (controller #10), expression (controller #11, same effect as #7, relative volume), as well as reverb and chorus section (controller #91 and #93). And all of this for each individual MIDI channel - those are the rules ...

If some parameters or channels are not used, the settings should be standard values. They are bank and program changes 0, volume 100, pan 64, expression 127, reverb section 40 and chorus section 0. This latter part is also known as “Setup Measure”, incidentally. Only then does the so-called “Song Body” follow, i.e. the music. Taking this literally, Setup Measure and Song Body must not overlap, that is to say if you wish to open a piece of music with an up beat, at least two beat pauses are announced. At the end of the piece, (last “NoteOff”), you should leave at least one beat pause so that any sounds still fading away are not curtailed. This feature, unfortunately, is not supported by some programs.

Have fun!

The depths of your sound card: programming via MIDI.

The hierarchy in the synthesizer chip.

The AudioSystem EWS64 that you have purchased is a dyed-in-the-wool synthesizer / sampler which supplies you with a whole host of facilities for sound production and editing. It is important, however, to understand the rudiments of how a sound is generated.

To create a sound in the oscillator (1 per voice), a wave (*.WAV) is used. Synthesizer functions can be assigned to this wave (i.e. filters, envelopes, LFO modulation etc.). Up to 64 waves can be combined into one instrument (*.TTi). This instrument can then be played via MIDI.

The EWS works always in MIDI multi-mode, and therefore receives on all 16 MIDI channels. Each instrument is assigned to one of 16 so-called 'parts'. This part determines on which MIDI channel - and with which parameters (volume, pan, OUT, effects section, etc.) - the instrument can be addressed.

All of these settings can be stored in a set (*.TTS) and are therefore available on request (loading into RAM).

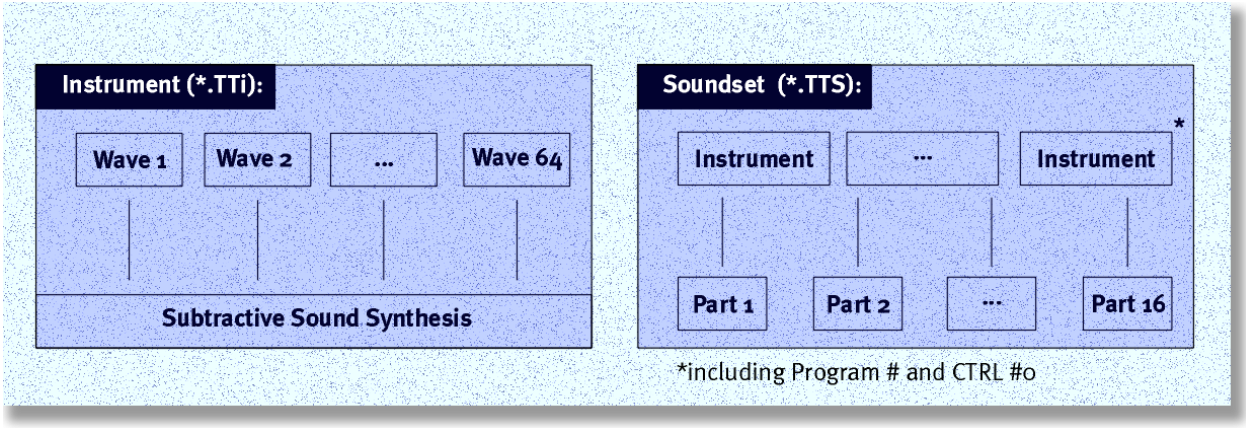

Fig. 6

The instrument: sound or drum set?

Within an instrument, there are again two different modes. The sound mode applies to almost all the card's sounds and contains the wave+parameter structure described above. If an instrument is specified as a drum instrument, then the functions available are those specific to drums. Individual waves can be mutually switched off (you play an open HiHat which is switched off by a closed HiHat before it fades out, [EXC] function). Moreover, individual waves can be changed later via the SysEx command in volume, pan, pitch and effects section.

Real time control of the sound parameters.

It is possible to use MIDI commands to control many sound-forming parameters (which you may already have come across in the EWS in Ed!son - the instruments editor), and effects in real time. MIDI controllers not only give you access to popular MIDI parameters such as volume or panorama. You can also change, for example, the envelopes, LFO speeds or the filter - including resonance - during playback. In the current firmware versions used in the printing of this manual, MIDI access is possible via so-called (N)RPN and / or SystemExclusive data. The following sections explain what it is, what it is meant to do, and how it works.

(N)RPN.

Registered and non-registered parameter numbers (RPN's and NRPN's for short) are extensions of conventional MIDI controllers, and can be edited and sent using virtually every known sequencer program. Whilst "normal" controllers (e.g. for volume) consist of just one number and the associated value, (N)RPN's have a combination of controllers sent consecutively to control a parameter in the synthesizer. (N)RPN's always consist of three controllers - each with its own value. The combination of the first two invokes the parameter to be influenced. The third carries out the change, where the latter can sometimes be sent - ingeniously using a different value - in order to describe dynamic sound changes. The important point is that all three controllers immediately follow each other - more on this later.

The registered parameter numbers are "standardised" details and have the same effect in almost all synthesizers. They currently influence the tonal keynote of a device and determine the intensity of the pitch bend wheel. Non-registered parameter numbers involve manufacturer-specific details and therefore offer access to functions which do not have to be the same in all devices (nor from a single manufacturer, in some cases). Incidentally, even with NRPN's, in the case of many manufacturers similar parameters with the same numbers are influenced such as filters and rudimentary settings in the effects processors - the very things which in any case have since become the (quasi) standard in many synthesizers. A definition is emerging as it was implemented by Roland in the GS standard; Yamaha's XG behaves similarly in many points.

As has already been pointed out, (N)RPN's also belong to the breed of MIDI controllers. They therefore have a number (#101 and #100 for RPN, #99 and #98 for NRPN) which identifies them in the MIDI language. They are always followed by controller #6 - the DataEntry command. The reason for this 3 combination is simple. There are only a maximum of 128 control numbers available, and almost all of them are occupied by some sort of standard functions. The combination of two controllers for the choice of parameter therefore opens up the door to a further 16,184 (128 x 128) functions - which should be enough to be going on with. It is the sequence that is important. Firstly controller #101 (or #99), then - a fraction later - #100 (or #98), and finally one or more controller #6.

So, if you want to address the filter of the EWS via NRPN, send

Controller #99 (so-called NRPN MSB) with the value 1, and

#98 (so-called NRPN LSB) with the value32, followed by

#6 (DataEntry) with a value between 0 and 127.

Later on you will read where and how this type of MIDI data is sent.

System Exclusive (SysEx).

It is also possible to influence some wavetable functions using so-called SysEx commands. However, programming dynamic changes is far more complicated than via (NRPN) controllers. Since SystemExclusive messages are purely manufacturer-specific data together with clear device identification via a number code, individual programming of a device can only be achieved as a rule, however, without a different instrument (which is on the same MIDI line) being influenced by it (at least in most cases ...). One important point to bear in mind is that SystemExclusive commands are independent of MIDI channel. If a quite specific channel is to be influenced, it will be specified explicitly in the command.

Like (N)RPN's, SysEx data also has a quite specific notation which must always be adhered to. Each SysEx command starts with "Fo" - like a signal to say "Look out - here comes SysEx!". A combination of numbers then follows (three in this case) identifying the manufacturer and its device. There is also a command identification which specifies, for example, that the parameter is from the "GS" range.

Now the all important data is entered. This chain can occasionally take quite a long time, depending on what is to happen. Some devices can code whole sound settings in this number combination - whilst settings may be for a single parameter only.

Below, you will find the so-called check sum - an addition of all the pre-positioned hex values to avoid transfer errors. Since most people cannot quickly calculate this check sum in their heads, we have omitted one specific detail. Any number can be specified in this case - the value is ignored (it must be in this position, however!).

Finally, the so-called "End Of Exclusive" (EOX for short, the end of the SysEx command) is sent. This end is described using the figure "F7".

Here is an example of a typical SysEx command (in this case: effects processor to delay).

F0H,00H,20H,00H,00H,00H,12H,40H,01H,30H,06H,00H,F7H

Hi! Manufacturer Device GS Parameter PS EOX

As can be seen, parameters are generally delimited by using commas (not in all programs). In addition, all values are specified in hexadecimal form. A letter “H” is therefore always written behind a value. This ‘H’ is generally not to be used when programming. It has been omitted in the following examples for the sake of clarity.

To reset all MIDI parameters to their initial values, you can switch off the computer or send the so-called GS Reset:

F0H,41H,00H,42H,12H,40H,00H,7FH,00H,41H,F7H

You will find a detailed listing of all the SysEx commands in the chapter entitled “Sound and Data Tables”. Later on you will read where and how this type of MIDI data can be sent.

One more thing. Programming a synthesizer via MIDI, whilst interesting, is nevertheless no easy matter - unfortunately. Anyone who has mastered it, however, soon discovers that far more can be got out of a device through skilful programming than may otherwise be assumed. There are often misunderstandings which are cleared up simply by re-reading the relevant section in the manual. If you have any questions on this matter, please do not use our technical support team but go back instead to the appropriate specialist reading material (see appendix), where it is possible to go into far greater detail on many subjects than is possible on the telephone.

Below are some more examples of SysEx programming.

Switching the effects processor to ...

Room 1	F0, 00, 20, 00, 00, 00, 12, 40, 01, 30, 00, 00, F7
Room 2:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 30, 01, 00, F7
Room 3:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 30, 02, 00, F7
Hall 1:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 30, 03, 00, F7
Hall 2:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 30, 04, 00, F7
Plate:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 30, 05, 00, F7
Delay:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 30, 06, 00, F7
Panning Delay:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 30, 07, 00, F7

Table 3:

It is also possible to set controller #80 for selection and #91 for intensity *(See also "The effects processor." on page 62)*.

Switching the second effects processor to ...

Chorus 1:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 38, 00, 00, F7
Chorus 2:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 38, 01, 00, F7
Chorus 3:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 38, 02, 00, F7
Chorus 4:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 38, 03, 00, F7
FeedbackChorus:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 38, 04, 00, F7
Flanger:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 38, 05, 00, F7
Short Delay:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 38, 06, 00, F7
FeedbackDelay:	F0, 00, 20, 00, 00, 00, 12, 40, 01, 38, 07, 00, F7

Table 4:

It is also possible to set controller #81 for selection and #93 for intensity *(See also "The effects processor." on page 62)*.

Muting parts.

(See also "Too few channels? Muting parts." on page 40)

Part 1:	F0, 00, 20, 00, 00, 00, 12, 40, 11, 02, 10, 00, F7
Part 2:	F0, 00, 20, 00, 00, 00, 12, 40, 12, 02, 10, 00, F7
Part 3:	F0, 00, 20, 00, 00, 00, 12, 40, 13, 02, 10, 00, F7
Part 4:	F0, 00, 20, 00, 00, 00, 12, 40, 14, 02, 10, 00, F7
Part 5:	F0, 00, 20, 00, 00, 00, 12, 40, 15, 02, 10, 00, F7
Part 6:	F0, 00, 20, 00, 00, 00, 12, 40, 16, 02, 10, 00, F7
Part 7:	F0, 00, 20, 00, 00, 00, 12, 40, 17, 02, 10, 00, F7
Part 8:	F0, 00, 20, 00, 00, 00, 12, 40, 18, 02, 10, 00, F7
Part 9:	F0, 00, 20, 00, 00, 00, 12, 40, 19, 02, 10, 00, F7
Part 10:	F0, 00, 20, 00, 00, 00, 12, 40, 10, 02, 10, 00, F7
Part 11:	F0, 00, 20, 00, 00, 00, 12, 40, 1A, 02, 10, 00, F7
Part 12:	F0, 00, 20, 00, 00, 00, 12, 40, 1B, 02, 10, 00, F7
Part 13:	F0, 00, 20, 00, 00, 00, 12, 40, 1C, 02, 10, 00, F7
Part 14:	F0, 00, 20, 00, 00, 00, 12, 40, 1D, 02, 10, 00, F7
Part 15:	F0, 00, 20, 00, 00, 00, 12, 40, 1E, 02, 10, 00, F7
Part 16:	F0, 00, 20, 00, 00, 00, 12, 40, 1F, 02, 10, 00, F7

Table 5:

Switching parts on again.

(MIDI channel to Part Assign).

Part 1:	F0, 00, 20, 00, 00, 00, 12, 40, 11, 02, 00, 00, F7
Part 2:	F0, 00, 20, 00, 00, 00, 12, 40, 12, 02, 01, 00, F7
Part 3:	F0, 00, 20, 00, 00, 00, 12, 40, 13, 02, 02, 00, F7
...	
Part 16:	F0, 00, 20, 00, 00, 00, 12, 40, 1F, 02, 0F, 00, F7

Table 6:

Stacking sounds.

It is also possible to assign a different MIDI channel to a part to create sound combinations of piano and strings, for example, or to make synth-instruments sound “fatter” through doubling, and much more besides. You will find details on the “MIDI channel to Part Assign” in the SysEx tables. Here is a brief example:

Part 2 (also) on channel **`F0,00,20,00,00,00,12,40,12,02,00,00,F7`**

Always ensure, however, that the various instruments and their settings (volume, reverb) are selected beforehand, i.e. send program change 1 (piano) via channel 1 and program change 49 (string section) via channel 2 and only then “merge” both parts. If you send a new program change later, (here on channel 1), then this will also apply to both parts.

Multiple drum kits.

In the base setting of every GM device, the drums are always on MIDI channel 10. Normally, only 1 drum set is available. As pointed out previously, it is not possible to define two drum sets on one MIDI channel by setting, for example, channel 10 and program 18, and also setting different drums (the 808 set with the number 26) on another track (which is also set on channel 10). This is because the program change that was last sent is valid for the relevant channel. If you want to use both drum kits at the same time, the wavetable must be programmed using the following SystemExclusive command.:

```
F0,00,20,00,00,00,12,40,1n,15,01,00,F7
```

where “n” stands for the part which is to become the drum kit (0 to F, i.e. 1-16 in hexadecimal notation). “01” defines the part as a drum part (00=sound part).

Where to program in the sequencer?

If you do not yet know where and how controller, SystemExclusive and program changes and other data (so-called “events”) are programmed in your MIDI program, you will find a brief explanation below of the Steinberg programs supplied with our sound cards. If the operating steps differ from those shown here due to new versions of the software, you should consult the manual or the online help facility / Adobe Acrobat Reader file for the relevant software. This also applies to software from other manufacturers which, regrettably, we cannot go into here for reasons of space.

Inserting events in the list editor of Steinberg programs (e.g. Cubasis Audio Lite, Cubasis AV, MusicStation or Cubase series).

Create a new part on a MIDI track (CTRL-P or Structure-menue/Create Part).

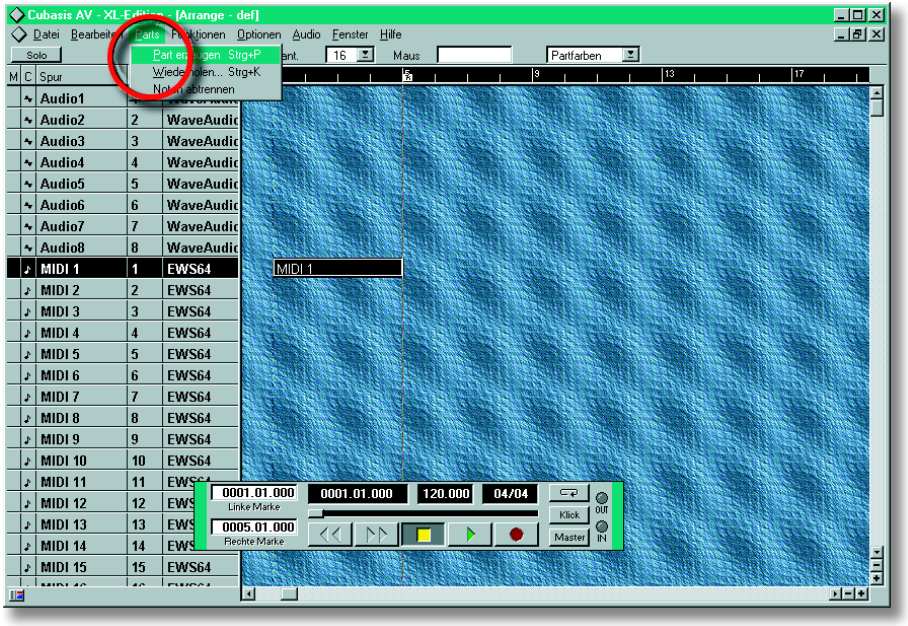

Fig. 7

Open the list editor (CTRL-G or Edit menue/List-Edit). Using the mouse, go to the insert menu and select the required event type (e.g. “CtrlChange” for controllers such as NRPN, DataEntry or Volume; “SysEx” for SystemExclusive data, “ProgChange” for program changes).

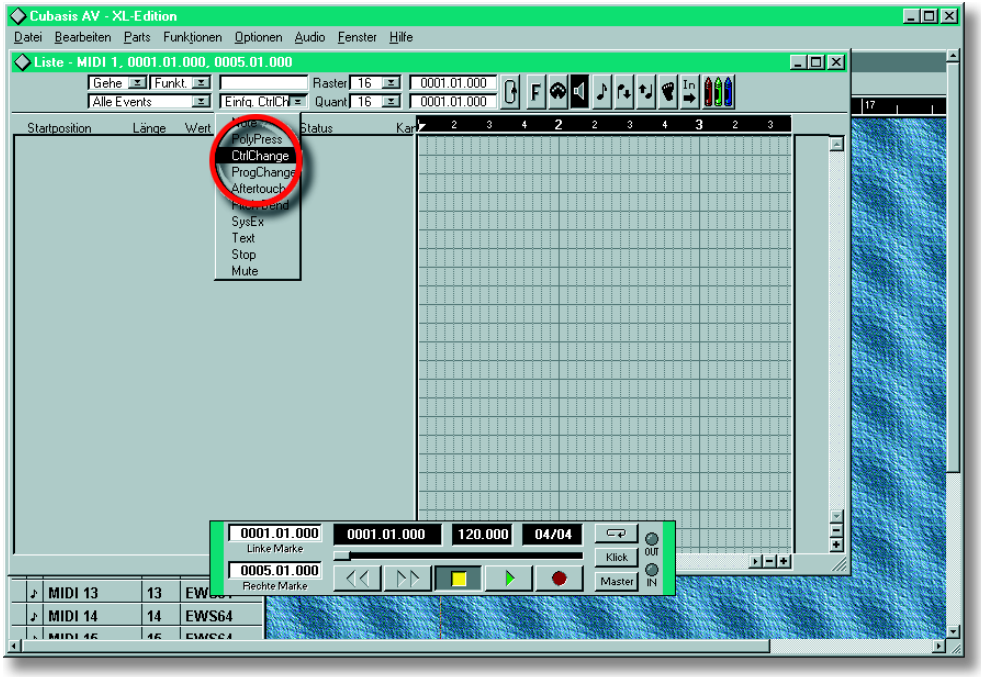

Fig. 8

Now keep the right mouse button pressed down - above the grid(!) - and select the pencil from the toolbox.

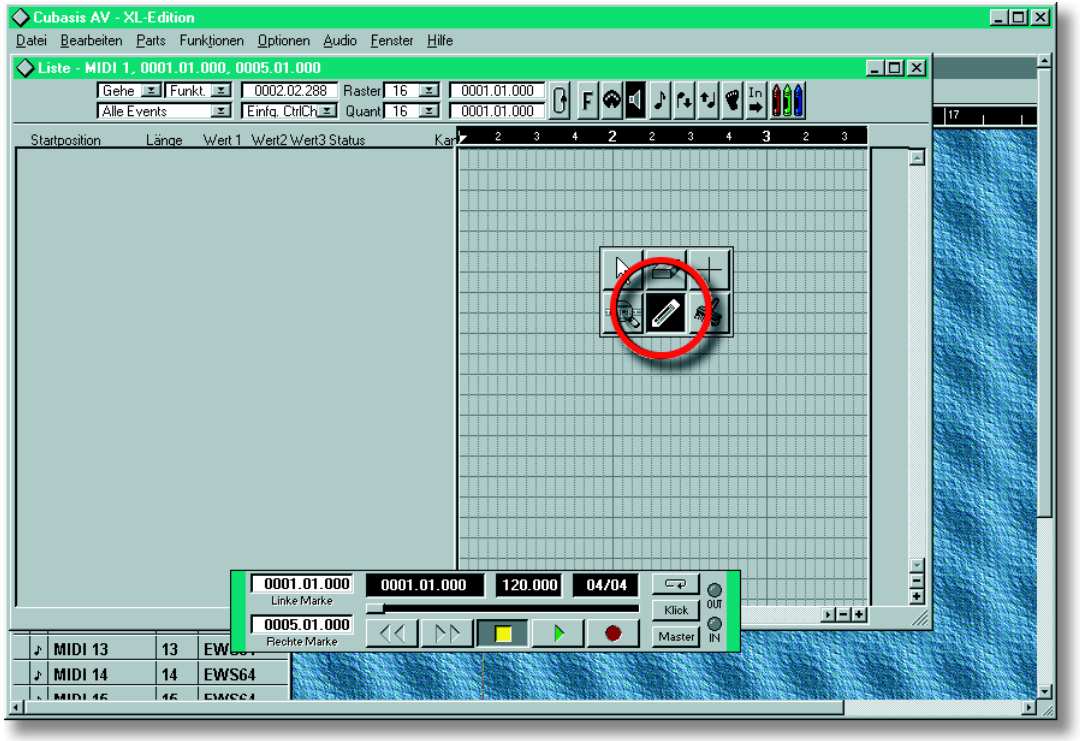

Fig. 9

Insert the required events one after another by clicking on the grid and then change “value 1” to define controllers (in the diagram), program changes or note pitches. If you have inserted a SysEx command, it can be edited by double clicking on “Comments”. Please note - when entering SysEx data, no space character may follow a comma.

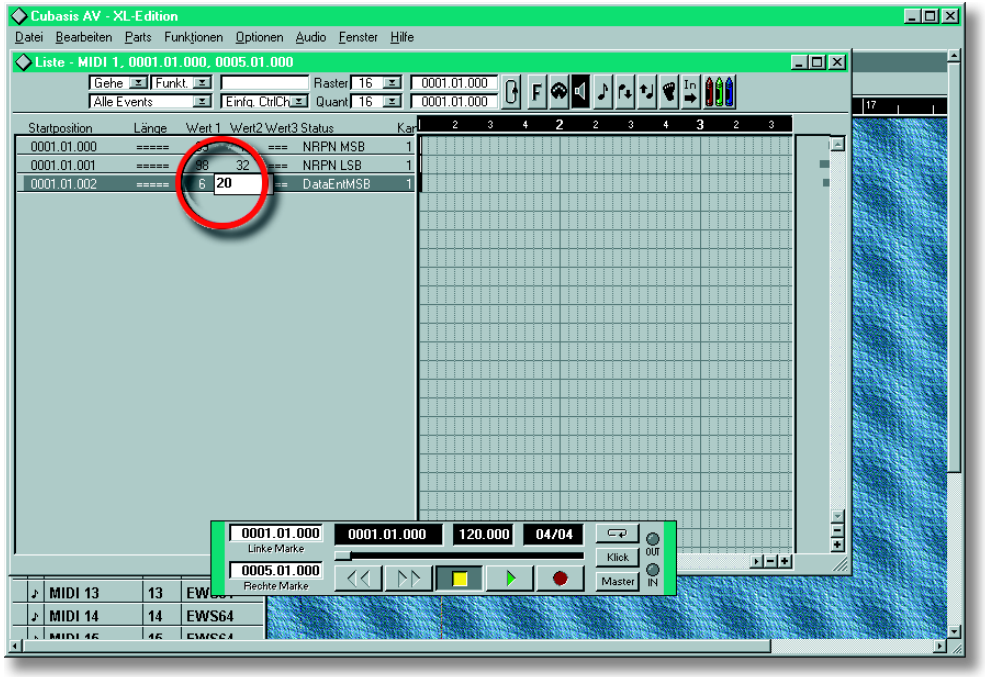

Fig. 10

Sounds from TerraTec and other suppliers.

A multiplicity of new sounds and soundsets for the AudioSystem is being planned - or is already available. You will find an up-to-date list of all known sounds - together with demos from other suppliers - at our website:

http://www.terratec.net.

We would also like to use this forum to provide you with the opportunity of entering into exchanges with other users. Many customers program sounds for the EWS product line and are always interested in new material. Why not join in by using and extending this offer!

Just a word at this point about the TerraTec newsmailer. Register with your e-mail address and you will receive - subject to availability - the latest inormation on your product, as well as details of new developments and offers.

The effects processor.

The effects processor of the SoundSystem Maestro series and the ProfessionalWaveSystem (PCMCIA) provides two effects simultaneously. This also applies to firmware version 1.0 onwards of the AudioSystem EWS64 where not described elsewhere in the accmpanying documentation.

One part of the DSP provides reverb and delay effects - the other provides chorus and flangers (modulation effects). MIDI controllers are used to select effects algorithms. Alternatively, SystemExclusive commands can also be used (see chapter entitled “Sound and Data Tables”).

MIDI controller #80 with a value between 0 and 7 selects the reverb effects as follows:

0: Room 11: Room 2

2: Room 33: Hall 1

4: Hall 2 (standard setting)5: Plate

6: Delay (Echo)7: Stereo Delay

The appropriate effects section of a MIDI channel (of a part) can be specified via controller #91. A value range from 0-127 is available, and the standard setting is a reverb section of 40.

MIDI controller #81 with a value between 0 and 7 selects the chorus effects as follows:

0: Chorus 11: Chorus 2

2: Chorus 33: Chorus 4

4: Feedback5: Flanger

6: Short Delay7: Feedback Delay

The appropriate effects section of a MIDI channel (of a part) can be specified via controller #93. A value range from 0-127 is available, and the standard setting is a chorus section of zero.

It is not possible - nor indeed usual at present - to assign each of the 16 parts with their own effects algorithm. This would far exceed the performance of the chips used. With the AudioSystem EWS, other parameters are available which can change the effects impact by using the software and SysEx commands supplied. As well as reverb and chorus, there is a 4-band total EQ the values of which can also be controlled via MIDI. The effects can also be used simultaneously by all audio sources and are even available for external devices. For this, consult the SysEx table and the help features of the corresponding program. It may also be that you receive a software update or upgrade of the effects processor from TerraTec - this is technically quite feasible. In this case you should also observe the info files supplied.

The individual outputs of the AudioSystem EWS64.

(The information that follows applies from driver version 2.0. onwards). The AudioSystem EWS64 is equipped with 2 stereo output pairs which - apart from the effects algorithms reverb and chorus - are available to you as separate, individual outputs for audio, MIDI and MOD playback. As you can see from the wiring diagram in the hardware manual, this even applies to analog as well as digital (S/PDIF). The software supplied can be used to determine whether an output is used, and if so how and which one. It is also possible - via MIDI controllers - to let a MIDI signal creep readily in real time from one output to the next! For this we have provided a combination of controller #7 (volume), #10 (pan) and #94 (pan between 1+2 and 3+4). The diagram below illustrates the concept.

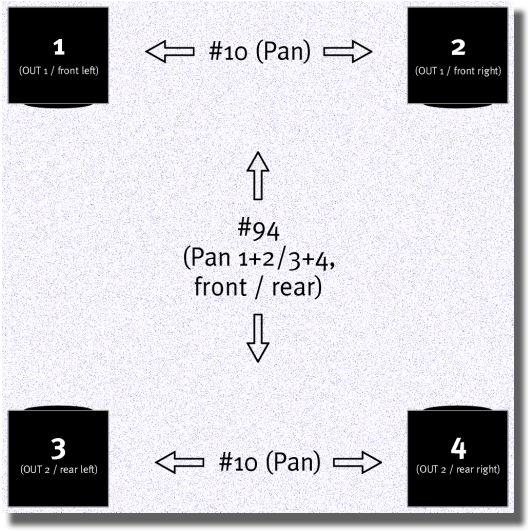

Fig. 11

Controller #7 controls - as usual - the volume of a MIDI channel, #10 a left/right movement (pan). Controller #94 allows positioning between OUT-1 and OUT-2 (or also individual output 1 + 2 or 3 +4). Note: This feature can be used only with reverb and chorus switched off.

As you may already be aware as a musician, a pan movement is possible with many samplers/synthesizers within the relevant output pair, but it has not proved possible to interconnect multiple outputs. In studio operation, this function is not necessary as a rule, but use of this feature in computer games or multimedia applications can be extremely exciting. With the EWS, this is very easily resolved with the help of controller #94.

Sound and Data Tables.

GM and variations sound table.

The wavetable sounds are generally selected by using MIDI program change commands. Every type of sequencer software, and many MIDI keyboards (including TerraTec's MIDI Master Pro), send these messages. In Steinberg programs there are several ways to send program changes. Where just sounds from the GM range are concerned, the most convenient method is to use the GM editor [CTRL]+Y. To select the banks, or if you also want to incorporate external devices, use the list editor [CTRL]+G. Program and bank changes are set as described in the chapter entitled "Where to program in the sequencer?". Bank switches involve normal controllers (#0) - a program change command is shown separately.

The short forms and colors used in the lists have the following meaning:

PC = Program change.

Co = Bank change.

blue = Only available in the SoundSystem Maestro 32/96, Professional WaveSystem (PCMCIA) and Standard 4MB SoundSet of the AudioSystem EWS.

red = Not available in the MiniWaveSystem, SoundSystem Maestro 16/96 and Standard 1MB SoundSet of the AudioSystem EWS.

In the blank fields, the drum sounds correspond to those of the standard set. [EXC] sounds switch off mutually. This is important with the HiHat, for example. By allocating this muting, an opened HiHat (open) is stopped by striking a closed HiHat (closed).

PC	GENERAL MIDI	Co	1st VAR	Co	2nd VAR	Co	3rd VAR	Co	4th VAR
1	(Grand) Piano 1	8	Piano 1	16	Piano 1				
2	(Bright) Piano 2	8	Piano 2						
3	(El. Grd) Piano 3	8	Piano 3						
4	Honky-tonk Piano	8	Honky-Tonk						
5	El. Piano 1	8	Detuned EP 1	16	El. Piano 1	24	60's El. Piano		
6	El. Piano 2	8	Detuned EP 2	16	El. Piano 2				
7	Harpsichord	8	Coupled Hps.	16	Harpsi	24	Harpsi		
8	Clavi								
9	Celesta								
10	Glockenspiel								
11	Music Box								
12	Vibraphone	8	Vibes						
13	Marimba	8	Marimba						
14	Xylophone								
15	Tubular Bells	8	Church Bell	9	Carillon				
16	Dulcimer (Santur)								
17	Drawbar Organ	8	Det. Organ 1	16	60's organ1	32	Organ 4		
18	Percussive Organ	8	Det. Organ 2			32	Organ 5		

Table 7:

PC	GENERAL MIDI	Co	1st VAR	Co	2nd VAR	Co	3rd VAR	Co	4th VAR
19	Rock Organ								
20	Church Organ	8	Ch. Organ 2	16	Ch. Organ 3				
21	Reed Organ								
22	Accordion (french)	8	Acc. (Italian)						
23	Harmonica								
24	Tango Accordion								
25	Ac. Guitar (Nylon)	1	SpanishGuitar	8	Ukulele	16	Nylon Gt.	32	Nylon Gt. 2
26	Ac. Guitar (Steel)	8	12-str. Guitar	16	Mandolin				
27	El. Guitar (jazz)	8	Hawaiian Gt.						
28	El. Guitar (clean)	8	Chorus Gt.	16	60's Guitar				
29	El. Guitar (muted)	8	Funk Gt.	16	Funk Gt. 2				
30	Overdriven Guitar								
31	Distortion Guitar	8	Feedback Gt.						
32	Guitar harmonics	8	Gt. Feedback						
33	Acoustic Bass								
34	Elec. Bass (finger)								
35	Elec. Bass (pick)								
36	Fretless Bass								

Table 7:

PC	GENERAL MIDI	Co	1st VAR	Co	2nd VAR	Co	3rd VAR	Co	4th VAR
37	Slap Bass 1								
38	Slap Bass 2								
39	Synth Bass 1	1	Syn Bass SH101	8	Synth. Bass 3				
40	Synth Bass 2	8	Synth. Bass 4	16	Rubber Bass				
41	Violin	8	Slow Violin						
42	Viola								
43	Cello								
44	Contrabass								
45	Tremolo Strings								
46	Pizzicato Strings								
47	Orchestral Harp								
48	Timpani								
49	String Ensemble 1	8	Orchestra						
50	String Ensemble 2								
51	Synth Strings 1	8	Syn Strings 3						
52	Synth Strings 2								
53	Choir Aahs	32	Choir Aahs 2						
54	Voice Oohs								

Table 7:

PC	GENERAL MIDI	Co	1st VAR	Co	2nd VAR	Co	3rd VAR	Co	4th VAR
55	Synth Voice								
56	Orchestra Hit								
57	Trumpet								
58	Trombone	1	Trombone 2						
59	Tuba								
60	Muted Trumpet								
61	French Horn	1	Fr. Horn 2						
62	Brass Section	8	Brass 2						
63	Synth Brass 1	8	Syn Brass 3	16	AnalogBrass 1				
64	Synth Brass 2	8	Syn Brass 4	16	AnalogBrass 2				
65	Soprano Sax								
66	Alto Sax								
67	Tenor Sax	8	Night Sax						
68	Baritone Sax								
69	Oboe								
70	English Horn								
71	Bassoon								
72	Clarinet								

Table 7:

PC	GENERAL MIDI	Co	1st VAR	Co	2nd VAR	Co	3rd VAR	Co	4th VAR
73	Piccolo								
74	Flute								
75	Recorder								
76	Pan Flute								
77	Blown Bottle								
78	Shakuhachi								
79	Whistle								
80	Ocarina								
81	Lead 1 (square)	1	Square 2	8	Sine Wave				
82	Lead 2 (sawtooth)	1	Saw 2	8	Doctor Solo				
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)								

Table 7:

PC	GENERAL MIDI	Co	1st VAR	Co	2nd VAR	Co	3rd VAR	Co	4th VAR
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	FX4 (atmosphere)								
101	FX 5 (brightness)								
102	FX 6 (goblins)								
103	FX 7 (echoes)	1	Echo Bell	2	Echo Pan				
104	FX 8 (sci-fi)								
105	Sitar								
106	Banjo								
107	Shamisen								

Table 7:

PC	GENERAL MIDI	Co	1st VAR	Co	2nd VAR	Co	3rd VAR	Co	4th VAR
108	Koto	8	Taisho Koto						
109	Kalimba								
110	Bag pipe								
111	Fiddle								
112	Shanai								
113	Tinkle Bell								
114	Agogo								
115	Steel Drums								
116	Woodblock	8	Castanets						
117	Taiko Drum	8	Concert BD						
118	Melodic Tom	8	Melo Tom 2						
119	Synth Drum	8	808 Tom	9	Elec Perc 1				
120	Reverse Cymbal								

Table 7:

SFX VARIATIONS.

All channels except 10, variations (bank switch 1-9) are not available in the WaveSystem.

PC	GM	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5	Bank 6	Bank 7	Bank 8	Bank 9
121	Gt. Fret Noise	Gt. Cut Noise	String Slap							
122	Breath Noise	Fl. Key Click								
123	Seashore	Rain	Thunder	Wind	Stream	Bubble				
124	Bird Tweet	Dog	Horse Galop	Bird 2						
125	Teleph. Ring	Teleph. Ring 2	Door Creaking	Door Clo-sing	Scratch	Wind chime				
126	Helcopter	Car Engine Start	Car Breaing	Car Pass	Car Crash	Police Siren	Train	Jet Take-off	Starship	Burst Noise
127	Applause	Laughing	Screa-ming	Punch	Heart Beat	Footstep				
128	Gunshot	Machine gun	Lasergun	Explosion						

Table 8:

SFX Drumset.

MIDI channel 10, program number 57, are not available in the WaveSystem.

MIDINote #	Prog 57: SFX SET	MIDINote #	Prog 57: SFX SET
39 - D#2	High Q	61 - C#4	Scratch
40 - E2	Slap	62 - D4	Wind Chime
41 - F2	Scratch Push	63 - D#4	Car Engine Start
42 - F#2	Scratch Pull	64 - E4	Car Breaking
43 - G2	Sticks	65 - F4	Car Pass
44 - G#2	Square Click	66 - F#4	Car Crash
45 - A2	Metronome Click	67 - G4	Police Siren
46 - A#2	Metronome Bell	68 - G#4	Train
47 - B2	Guitar Slide	69 - A4	Jet Take-off
48 - C3	Guitar Cut Noise (down)	70 - A#4	Helicopter
49 - C#3	Guitar Cut Noise (up)	71 - B4	Starship
50 - D3	Double Bass Slap	72 - C5	Gun Shot
51 - D#3	Key Click	73 - C#5	Machinegun
52 - E3	Laughing	74 - D5	Lasergun
53 - F3	Screaming	75 - D#5	Explosion
54 - F#3	Punch	76 - E5	Dog

Table 9:

MIDINote #	Prog 57: SFX SET	MIDINote #	Prog 57: SFX SET
55 - G3	Heart Beat	77 - F5	Horse Gallop
56 - G#3	Footsteps1	78 - F#5	Birds
57 - A3	Footsteps2	79 - G5	Rain
58 - A#3	Applause	80 - G#5	Thunder
59 - B3	Door Creaking	81 - A5	Wind
60 - C4	Door Closing	82 - A#5	Sea Shore

Table 9:

MT32 - Set.

Prog #	Instrument	Prog #	Instrument	Prog #	Instrument
1	Piano 1	44	Pan Flute	87	Bassoon
2	Piano 2	45	Saw Wave	88	Harmonica
3	Piano 3	46	Charang	89	Trumpet
4	Detuned Electric Piano 1	47	Tubular Bells	90	Muted Trumpet
5	Electric Piano 1	48	Square Wave	91	Trombone
6	Electric Piano 2	49	Strings	92	Trombone
7	Detuned Electric Piano 2	50	Tremolo Strings	93	French Horn
8	Honky Tonk Piano	51	Slow Strings	94	French Horn
9	Organ 1	52	Pizzicato Strings	95	Tuba
10	Organ 2	53	Violin	96	Brass
11	Organ 3	54	Viola	97	Brass 2
12	Detuned Organ 1	55	Cello	98	Vibraphone
13	Church Organ 2	56	Cello	99	Vibraphone
14	Church Organ	57	Contrabass	100	Kalimba
15	Church Organ	58	Harp	101	Tinklebell
16	Musette Accordion	59	Harp	102	Glockenspiel
17	Harpsichord	60	Nylon strung Guitar	103	Tubular Bells

Table 10:

Prog #	Instrument	Prog #	Instrument	Prog #	Instrument
18	Coupled Harpsichord	61	Steel strung Guitar	104	Xylophone
19	Coupled Harpsichord	62	Chorus Guitar	105	Marimba
20	Clav	63	Funk Guitar	106	Koto
21	Clav	64	Sitar	107	Taisho Koto
22	Clav	65	Acoustic Bass	108	Shakuhachi
23	Celesta	66	Fingered Bass	109	Whistle
24	Celesta	67	Pick Bass	110	Whistle
25	Synth Brass 1	68	Fretless Bass	111	Bottle Blow
26	Synth Brass 2	69	Slap Bass 1	112	Pan Flute
27	Synth Brass 3	70	Slap Bass 2	113	Timpani
28	Synth Brass 4	71	Fretless Bass	114	Melodic Tom
29	Synth Bass 1	72	Fretless Bass	115	Concert Bass Drum
30	Synth Bass 2	73	Flute	116	Synth Drum
31	Synth Bass 3	74	Flute	117	Melodic Tom
32	Synth Bass 4	75	Piccolo	118	Taiko
33	Fantasia	76	Piccolo	119	Taiko
34	Synth Calliope	77	Recorder	120	Reverse Cymbal
35	Choir Aahs	78	Pan Flute	121	Castanets

Table 10:

Prog #	Instrument	Prog #	Instrument	Prog #	Instrument
36	Bowed Glass	79	Soprano Sax	122	Tinklebell
37	Sound Track	80	Alto Sax	123	Orchestra Hit
38	Atmosphere	81	Tenor Sax	124	Telephone
39	Crystal	82	Baritone Sax	125	Birds
40	Bagpipe	83	Clarinet	126	Helicopter
41	Tinklebell	84	Clarinet	127	Bowed Glass
42	Ice Rain	85	Oboe	128	Ice Rain
43	Oboe	86	Cor Anglais		

Table 10:

The wavetable is transposed by sending bank switch #127 into MT32 mode.

PERCUSSION CONFIGURATION.

	PC 1 STANDARDSET	PC 9 ROOM SET	PC 17 POWERSET	PC 25 E-SET	PC 26 808 SET	PC 41 BRUSH	PC 49 ORCHESTRASET
27-D#0	High Q						Closed Hi Hat
28-E0	Slap						Pedal Hi Hat
29-F0	Scratch Push						Open Hi Hat
30-F#0	Scratch Pull						Ride Cymbal
31-G0	Sticks						
32-G#0	Square Click						
33-A0	Metronome Click						
34-A#0	Metronome Bell						
35-B0	Acoustic Bass Drum					Jazz BD2	Concert Bass Drum 2
36-C1	Rock Bass Drum		Power Kick	E-Bass Drum	808 Bass Drum	Jazz BD1	Concert Bass Drum 1
37-C#1	Side Stick				808 Rim Shot		
38-D1	Snare Drum 1		Gated Snare	E-Snare Drum	808 Snare Drum	Brush Tap	Concert Snare Drum
39-D#1	Hand Clap					Brush Slap	Castanets

Table 11:

40-E1	Snare Drum 2			Gated Snare		Brush Swirl	Concert SD
41-F1	Low Floor Tom Tom	Room Low Tom 2	Room Low Tom 2	E-Low Tom 2	808 Low Tom 2		Timpani F
42-F#1	Closed HiHat [EXC1]				808 Cl HH [EXC1]		Timpani F#
43-G1	High Floor Tom	Room Low Tom 1	Room Low Tom 1	E-Low Tom 1	808 Low Tom 2		Timpani G
44-G#1	Pedal HiHat [EXC1]				808 Cl HH [EXC1]		Timpani G#
45-A1	Low Tom	Room mid Tom 2	Room mid Tom 2	E-Mid Tom 2	808 Mid Tom 2		Timpani A
46-A#1	Open HiHat [EXC1]				808 OHH [EXC1]		Timpani A#
47-B1	Low-Mid Tom	Room Mid Tom 1	Room Mid Tom 1	E-Mid Tom 1	808 Mid Tom 1		Timpani B
48-C2	Hi Mid Tom	Room Hi Tom 2	Room Hi Tom 2	E-Hi Tom 2	808 Hi Tom 2		Timpani C
49-C#2	Crash Cymbal 1				808 Cymbal		Timpani C#
50-D2	High Tom	Room Hi Tom 1	Room Hi Tom 1	E-Hi Tom 1	808 Hi Tom 1		Timpani D

Table 11:

51-D#2	Ride Cymbal 1						Timpani D#
52-E2	Chinese Cymbal			Rev. Cymbal			Timpani E
53-F2	Ride Bll						Timpani F OCTAVE
54-F#2	Tambourine						
55-G2	Splash Cymbal						
56-G#2	Cowbell				808 Cowbell		
57-A2	Crash Cymbal 2						Concert Cymbal 2
58-A#2	Vibraslap						
59-B2	Ride Cymbal 2						Concert Cymbal 1
60-C3	Hi Bongo						
61-C#3	Low Bongo						
62-D3	Mute Hi Conga				808 Hi Conga		
63-D#3	Open Hi Conga				808 Mid Conga		
64-E3	Low Conga				808 Low Conga		
65-F3	High Timbale						
66-F#3	Low Timbale						
67-G3	High Agogo						
68-G#3	Low Agogo						
69-A3	Cabasa						
70-A#3	Maracas				808 Maracas		

Table 11:

71-B3	Short Whistle[EXC2]						
72-C4	Long Whistle [EXC2]						
73-C#4	Short Guiro [EXC3]						
74-D4	Long Guiro [EXC3]						
75-D#4	Claves				808 Claves		
76-E4	Hi Wood Block						
77-F4	Low Wood Block						
78-F#4	Mute Cuica [EXC4]						
79-G4	Open Cuica [EXC4]						
80-G#4	Mute 3angle [EXC5]						
81-A4	Open 3angle[EXC5]						
82-A#4	Shaker						

Table 11:

83-B4	Jingle Bell						
84-C5	BellTree						
85-C#5	Castanets						
86-D5	Mute Surdo [EXC6]						
87-D#5	Open Surdo [EXC6]						
88-E5							Applause!

Table 11:

List of available MIDI controllers.

Number	Control Value	Default Value	Function / Remarks
CTRL 00	0-127	0	Bank Select: Refer to sounds list. No action on drumset. Cc=64 reserved for Sound-Editor
CTRL 01	0-127	0	Modulation Wheel. Rate and maximum depth can be set using SysEx
CTRL 05	0-127	-	Portamento Time.
CTRL 06	0-127	-	Data Entry: provides data to RPN and NRPN
CTRL 07	0-127	100	Volume
CTRL 10	0-127 (0-64-127)	64 (center)	Pan
CTRL 11	0-127	127	Expression
CTRL 64	0+127	-	Sustain (Damper) pedal
CTRL 65	0+127	-	Portamento ON/OFF
CTRL 66	0+127	-	Sostenuto pedal
CTRL 67	0+127	-	Soft pedal
CTRL 71	0-127	-	Resonance (Harmonic Control)
CTRL 74	0-127	-	Cutoff Frequency (Brightness)

Table 12:

Number	Control Value	Default Value	Function / Remarks
CTRL 80	0-7	4 (Hall 2)	Reverb Program 0:Room 1 — 1: Room 2 2: Room 3 — 3: Hall 1 4: Hall 2 — 5: Plate 6: Delay (Echo) — 7: Stereo Delay
CTRL 81	0-7	2 (Chorus 3)	Chorus Program 0: Chorus 1 — 1: Chorus 2 2: Chorus 3 — 3: Chorus 4 4: Feedback — 5: Flanger 6: Short Delay — 7: Feedback Delay
CTRL 91	0-127	40	Reverb Send Level
CTRL 93	0-127	0	Chorus Send Level
CTRL 94	0-127	-	Pan-Control between OUT1 and OUT2
CTRL 120	0+127	-	All sound off **(abrupt stop of sound on MIDI channel, 0=Off)**
CTRL 121	0	-	Reset all controllers (0=Reset)
CTRL 123	0	-	All notes off (0=Off)

Table 12:

Number	Control Value	Default Value	Function / Remarks
CTRL 126	0, 1-16	-	Mono on
CTRL 127	0+127	(127)	Poly on (default power-up)
CTRL CC I (0-95)	0-127	-	Assignable Controller 1. cc=Controller number (0-95). Control number (ccH) can be set on CC1 CONTROLLER NUMBER (Sys. Ex 40 1x 1F). The resulting effect is determined by CC1 controller function (SysEx 40 2x 40-4A)
CTRL CC II (0-95)	0-127	-	Assignable Controller 2. cc=Controller number (0-95). Control number can be set on CC2 CONTROLLER NUMBER (Sys.Ex. 40 1x 20). The resulting effect is determined by CC2 controller function (Sys.Ex.40 2x 50-5A).

Table 12:

RPN (Registered Parameter Numbers).

B=CTRL 101, LSB=CTRL 100, Data Entry = CTRL 6

MSB/LSB Hex (Dec)	Control Value (=CTRL 6)	Default Value	Function / Remarks
RPN 00/00H (00/00)	0-12	2	Pitch Bend sensitivity in semitones
RPN 00/01H (00/01)	0-127	-	Fine Tuning in cents (00H= -100, 40H= +/-0, 7FH= +100)
RPN 00/02H (00/02)	0-127	-	Coarse Tuning in half-tones (00H= -64, 40H= +/-0, 7FH= +64)

Table 13:

NRPN (Non Registered Parameter Numbers).

MSB=CTRL 101, LSB=CTRL 100, Data Entry = CTRL 6

MSB/LSB Hex (Dec)	Control Value (=CTRL 6), Dec	Default Value	Function / Remarks
NRPN 01/08H (01/08)	0-127	-	Vibrate Rate modify (40H = no modif)*
NRPN 01/09H (01/09)	0-127	-	Vibrate Depth modify (40H = no modif)*
NRPN 01/0AH (01/10)	0-127	-	Vibrate Delay modify (40H = no modif)*
NRPN 01/20H (01/32)	0-127	-	TVF Cutoff Frequency modify (40H = no modif)*
NRPN 01/21H (01/33)	0-127	-	TVF Resonance modify (40H = no modif)*
NRPN 01/63H (01/99)	0-127	-	AMP-Envelope Attack Time modify (40H = no modif)*
NRPN 01/64H (01/100)	0-127	-	AMP-Envelope Decay Time modify (40H = no modif)*
NRPN 01/66H (01/102)	0-127	-	AMP-Envelope Release Time modif (40H = no modif)*
NRPN 18/rrH (24/rr)	0-127	-	Pitch Coarse of Drum Instrument in semitones. rr = Note (40H = no modif)*
NRPN 1A/rrH (26/rr)	0-127	-	Level of Drum Instrument. rr = Note
NRPN 1C/rrH (28/rr)	0-127 (0-64-127)	-	Pan of drum instrument note rr (40H = center)
NRPN 1D/rrH (29/rr)	0-127	-	Reverb Send Level of Drum Instrument. rr = Note
NRPN 1E/rrH (30/rr)	0-127	-	Chorus Send Level of Drum Instrument. rr = Note
NRPN 37/00H (55/0)	see Remarks	60H (+6dB)	Equalizer Low band (bass), 0=-12dB, 40H=0dB, 7FH=+12dB

Table 14:

MSB/LSB Hex (Dec)	Control Value (=CTRL 6), Dec	Default Value	Function / Remarks
NRPN 37/01H (55/01)	see Remarks	40H (0dB)	Equalizer Med Low band, 0=-12dB, 40H=0dB, 7FH=+12dB
NRPN 37/02H (55/02)	see Remarks	40H (0dB)	Equalizer Med High band, 0=-12dB, 40H=0dB, 7FH=+12dB
NRPN 37/03H (55/03)	see Remarks	60H (+6dB)	Equalizer High band (treble), 0=-12dB, 40H=0dB, 7FH=+12dB
NRPN 37/08H (55/08)	see Remarks	0CH	Equalizer Low cutoff freq, 0=0Hz, 7FH=4.7 kHz
NRPN 37/09H (55/09)	see Remarks	1BH	Equalizer Med Low cutoff freq, 0=0Hz, 7FH=4.2 kHz
NRPN 37/0AH (55/10)	see Remarks	72H	Equalizer Med High cutoff freq, 0=0Hz, 7FH=4.2 kHz
NRPN 37/0BH (55/11)	see Remarks	40H	Equalizer High cutoff freq, 0=0Hz, 7FH=18.75 kHz
NRPN 37/20H (55/32)	0-127	0	V-SPACE Effect Volume, 0= no effect, 7FH= maximum effect
NRPN 37/2CH (55/44)		2	V-SPACE Effect Delay, 0 to 7FH
NRPN 37/2DH (55/45)	0+127	0	V-SPACE Effect Input, 0=mono Input (left+right), 7Fh=stereo Input (left-right)
NRPN 37/2EH (55/46)	0+127	0	V-SPACE Effect Output mode, 0=2 speaker mode, 7Fh=4 speaker mode

Table 14:

* The value for 40H (Dec=64) is defined in Instrument's parameters. 0-3F and 41-7F causes an offset to this value (-/+).

blue= only EWS technology, red= not SoundSystem Maestro 16/96, MiniWaveSystem and WaveSystem

SysEx-table.

String	Control Value	Default Value	Funcion / Remarks
F0H 7EH 7FH 09H 01H F7H	-	-	General MIDI reset
F0H 41H 00H 42H 12H 40H 00H 7FH 00H 00H F7H	-	-	GS Reset
F0H 7FH 7FH 04H 01H 00H var F7H	00H-7FH	7FH	GM-Master Volume
F0H 41H 00H 42H 12H 40H 00H 04H var 00H F7H	00H-7FH	7FH	GS-Master Volume
F0H 41H 00H 42H 12H 40H 00H 00H dd dd dd dd 00H F7H	see Remarks	see Remarks	Master Tune (default dd= 00H 04H 00H 00H) - 100.0 to +100.0 cents. Nibblized data should be used (always four bytes). For example, to tune to +100.0 cents, sent data should be 00H 07H 0EH 08H
F0H 41H 00H 42H 12H 40H 00H 05H var 00H F7H	00H-7F (00H-40H-7FH)	40H (no Transpose)	Master Key-Shift
F0H 41H 00H 42H 12H 40H 00H 06H var 00H F7H	00H-7F (00H-40H-7FH)	40H (center)	Master Pan

Table 15:

String	Control Value	Default Value	Funcion / Remarks
F0H 41H 00H 42H 12H 40H 01H 30H var 00H F7H	00H-07H	04H (Hall 2)	Reverb Program 00H: Room 1 01H: Room 2 02H: Room 3 03H: Hall 1 04H: Hall 2 05H: Plate 06H: Delay (Echo) 07H: Stereo Delay
F0H 41H 00H 42H 12H 40H 01H 31H var 00H F7H	00H-07H	04H	Reverb Character
F0H 41H 00H 42H 12H 40H 01H 33H var 00H F7H	00H-7FH	64H	Reverb Master Level
F0H 41H 00H 42H 12H 40H 01H 34H var 00H F7H	00H-7FH	-	Reverb Time
F0H 41H 00H 42H 12H 40H 01H 35H var 00H F7H	00H-7FH	-	Reverb delay feedback. Only if reverb number=6 or 7 (Delay or Stereo Delay)

Table 15:

String	Control Value	Default Value	Funcion / Remarks
F0H 41H 00H 42H 12H 40H 01H 38H var 00H F7H	00H-07H	02H (Chorus 3)	Chorus Program 00H: Chorus 1 01H: Chorus 2 02H: Chorus 3 03H: Chorus 4 04H: Feedback 05H: Flanger 06H: Short Delay 07H: Feedback Delay
F0H 41H 00H 42H 12H 40H 01H 3AH var 00 F7H	00H-7FH	64H	Chorus Master Level
F0H 41H 00H 42H 12H 40H 01H 3BH var 00 F7H	00H-7FH	-	Chorus Feedback
F0H 41H 00H 42H 12H 40H 01H 3CH var 00 F7H	00H-7FH	-	Chorus Delay
F0H 41H 00H 42H 12H 40H 01H 3DH var 00 F7H	00H-7FH	-	Chorus Rate
F0H 41H 00H 42H 12H 40H 01H 3EH var 00 F7H	00H-7FH	-	Chorus Depth

Table 15:

String	Control Value	Default Value	Funcion / Remarks
F0H 41H 00H 42H 12H 40H 1pH 02H var 00 F7H	11H-1FH+00H-0FH or10H	... 40H 11 02 00 ... ... 40H 12 02 01 ... ... 40H 13 02 02... ... ... 40H 10 02 09 ... ... 40H 1E 02 0E ... ... 40H 1F 02 0F ...	MIDI channel to part assign (read carefully!). This SysEx allows to assign several parts to a single MIDI channel or to mute a part. p is part (1-16 is 11H-1FH), var is channel (1-16 is 00H-0FH) var=10H is mute (means channel Off).
F0H 41H 00H 42H 12H 40H 1pH 15H var 00 F7H	11H-1FH+00 or 01	part 10 plays drums (... 40H 10H 15H 01 ...) all other parts play sound.	Part to rhythm allocation. This SysEx allows a part to play sound or drumset. p is part (1-16 is 11H-1FH), var can be 00 (means sound part) or 01 (rhythm part). There is no limitation of the number of parts playing drumset.

Table 15:

String	Control Value	Default Value	Funcion / Remarks
F0H 41H 00H 42H 12H 40H 1cH 40H var1 v2 ... v12 00 F7H	00H-0FH+00H-7F (00H-40H-7FH)	var1, var2, ..., var12 = 40H, 40H, ..., 40H (chromatic tuning).	Scale Tuning. This SYSEX allows non chromatic tuning of the musical scale on a given MIDI channel. c is MIDI channel (1-16 is 00H-0FH), v1 to v12 are 12 semi-tones tuning values (C, C#, D, ... A#, B), in the range -64 (00H), 0 (40H) and +63 (7FH) cents. Default var1, var2, ...,var12 = 40H, 40H,...,40H (chromatic tuning). Scale Tuning has no effect if the part is assigned to a rhythm channel or if the sound played is not of chromatic type.
F0H 41H 00H 42H 12H 40H 1cH 1AH var 00 F7H	00H-7FH	40H	Velocity Slope. c is MIDI channel (1-16 is 00H-0FH)
F0H 41H 00H 42H 12H 40H 1cH 1BH var 00 F7H	00H-7FH	40H	Velocity Offset. c is MIDI channel (1-16 is 00H-0FH)
F0H 41H 00H 42H 12H 40H 1cH 1FH var 00 F7H	00-5FH	10H	CC1 Controller Number

Table 15:

String	Control Value	Default Value	Funcion / Remarks
FoH 41H ooH 42H 12H 40H 1cH 20H var oo F7H	oo-5FH	11H	CC2 Controller Number
FoH 41H ooH 42H 12H 40H 2cH ooH var oo F7H	ooH-7F (ooH-40H-7FH)	40H	Mod pitch control (-24,+24 semitones)
FoH 41H ooH 42H 12H 40H 2cH 01H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	Mod Cutoff Control (Filter)
FoH 41H ooH 42H 12H 40H 2cH 02H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	Mod Amplitude Control (-100%-+100%)
FoH 41H ooH 42H 12H 40H 2cH 03H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	Mod LFO1 rate control. c is don't care. Rate is common on all channels
FoH 41H ooH 42H 12H 40H 2cH 04H var oo F7H	ooH-7F	oAH	Mod LFO1 Pitch Depth (o-6oo cents)
FoH 41H ooH 42H 12H 40H 2cH 05H var oo F7H	ooH-7F	ooH	Mod LFO1 Filter Depth
FoH 41H ooH 42H 12H 40H 2cH 06H var oo F7H	ooH-7F	ooH	Mod LFO1 TVA Depth (o-100%)
FoH 41H ooH 42H 12H 40H 2cH 10H var oo F7H	ooH-7F (ooH-42H-7FH)	42H	Bend Pitch Control (-24,+24 semitones)
FoH 41H ooH 42H 12H 40H 2cH 11H var oo F7H	ooH-7F	40H	Bend Cutoff Control

Table 15:

String	Control Value	Default Value	Funcion / Remarks
FoH 41H ooH 42H 12H 40H 2cH 12H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	Bend Amplitude Control (-100%-+100%)
FoH 41H ooH 42H 12H 40H 2cH 14H var oo F7H	ooH-7F	oAH	Bend LFO1 Pitch Depth (o-600 cents)
FoH 41H ooH 42H 12H 40H 2cH 15H var oo F7H	ooH-7F	ooH	Bend LFO1 Filter Depth
FoH 41H ooH 42H 12H 40H 2cH 16H var oo F7H	ooH-7F	ooH	Bend LFO1 TVA Depth (o-100%)
FoH 41H ooH 42H 12H 40H 2cH 20H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	CAF Pitch Control (-24,+24 semitones)
FoH 41H ooH 42H 12H 40H 2cH 21H var oo F7H	ooH-7F	40H	CAF Cutoff Control
FoH 41H ooH 42H 12H 40H 2cH 22H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	CAF Amplitude Control (-100%-+100%)
FoH 41H ooH 42H 12H 40H 2cH 24H var oo F7H	ooH-7F	oAH	CAF LFO1 Pitch Depth (o-600 cents)
FoH 41H ooH 42H 12H 40H 2cH 25H var oo F7H	ooH-7F	ooH	CAF LFO1 Filter Depth
FoH 41H ooH 42H 12H 40H 2cH 26H var oo F7H	ooH-7F	ooH	CAF LFO1 TVA Depth (o-100%)

Table 15:

String	Control Value	Default Value	Funcion / Remarks
FoH 41H ooH 42H 12H 40H 2cH 40H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	CC1 Pitch Control (-24,+24 semitones)
FoH 41H ooH 42H 12H 40H 2cH 41H var oo F7H	ooH-7F	40H	CC1 Filter Cutoff Control
FoH 41H ooH 42H 12H 40H 2cH 42H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	CC1 Amplitude control (-100%-+100%)
FoH 41H ooH 42H 12H 40H 2cH 44H var oo F7H	ooH-7F	0AH	CC1 LFO1 Pitch Depth (o-600 cents)
FoH 41H ooH 42H 12H 40H 2cH 45H var oo F7H	ooH-7F	ooH	CC1 LFO1 Filter Depth
FoH 41H ooH 42H 12H 40H 2cH 46H var oo F7H	ooH-7F	ooH	CC1 LFO1 TVA Depth (o-100%)
FoH 41H ooH 42H 12H 40H 2cH 50H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	CC2 Pitch Control (-24,+24 semitone)
FoH 41H ooH 42H 12H 40H 2cH 51H var oo F7H	ooH-7F	40H	CC2 Filter Cutoff Control
FoH 41H ooH 42H 12H 40H 2cH 52H var oo F7H	ooH-7F (ooH-40H-7FH)	40H	CC2 Amplitude Control (-100%-+100%)
FoH 41H ooH 42H 12H 40H 2cH 54H var oo F7H	ooH-7F	0AH	CC2 LFO1 Pitch Depth o-600 cents)

Table 15:

String	Control Value	Default Value	Funcion / Remarks
FoH 41H ooH 42H 12H 40H 2cH 55H var oo F7H	ooH-7F	ooH	CC2 LFO1 Filter Depth
FoH 41H ooH 42H 12H 40H 2cH 56H var oo F7H	ooH-7F	ooH	CC2 LFO1 TVA Depth (o-100%)

Table 15:

CAF = Channel's Aftertouch, blue = only EWS technology

red = not SoundSystem Maestro 16/96, MiniWaveSystem and WaveSystem

var = Control Value

MIDI Implementation Chart.

Model: Synthesizerchips in SoundSystem Maestro-Series, WaveSystem Series, AudioSystem EWS64, Firmware 1.0. Date: July, 22th 1997

FUNCTION		TRANSMITTED	RECOGNIZED	REMARKS
Basic Channel	Default Changed	X X	1-16 1-16, Off	always in Multimode
Mode	Default Message Altered	X X **********	Mode 3 Mode 3, 4	
Note Number	 True Voice	X **********	0-127 0-12	
Velocity	Note ON Note OFF	X X	O O	
After Touch	Key's Channel's	X X	X O	Destination must be set manually
PitchBend		X	O	

Table 16:

FUNCTION		TRANSMITTED	RECOGNIZED	REMARKS
Control Change	1, 5, 7, 10, 11	X	O	Sound Controler
	71, 74	X	O	Cutoff, Resonance
	94	X	O	OUT1-OUT2 PanControl
	6	X	O	DataEntry (MSB)
	80, 81	X	O	Effect Select
	91, 93	X	O	Effect Depth
	64, 65, 66, 67	X	O	
	0	X	O	
	98, 99	X	O	BankSelect
	100, 101	X	O	NRPN; LSB, MSB
	120, 121, 123			RPN; LSB, MSB
	126, 127	X	O	System Messages
	CC I, CC II	X	O	User Definable Controler (0-95)
Program Change		X	O	
	True #	**********	0-127	
System Exlusive		X	O	
System Common	SongPosition	X	X	
	SongSelect	X	X	
	Tune	X	O	

Table 16:

FUNCTION		TRANSMITTED	RECOGNIZED	REMARKS
System Realtime	Clock Commands	X X	X X	
Aux Messages	Local On/Off All Notes Off Active Sens Reset	X X X X	X O O O	
Notes		Blue: Only EWS technology. Red: Not SoundSystem Maestro 16/96, WaveSystem, MiniWaveSystem		

Table 16:

Mode 1: OMNI ON, POLYMode 2: OMNI ON, MONOO=YES

Mode 3: OMNI OFF, POLYMode 4: OMNI OFF, MONOX=NO

Appendix.

(What previously didn't fit and other useful information).

A computer for hard disk recording.

In the past, many customers have enquired time and again about an ideal computer configuration for creating music. There is no simple answer, however, because the claims of each individual computer are too diverse. One thing that may be said, however, is that for pure (!) MIDI editing it is possible to manage even with a relatively small computer. As soon as Audio is involved however - and that would be the case as soon as songs are mastered on hard disk - a computer can no longer be fast enough. The table below is provided only as a rough overview, particularly bearing in mind that computer performance does not just depend on the hard disk and main storage. The correct choice of graphics card, controllers and additional components can also be a considerable factor in increasing speed.

Editing MIDI files	486/66, 8MB
Dual channel hard disk recording and simple post-editing	486/66, 16MB
Four channel hard disk recording and simple post-editing	Pentium 75, 16-20MB, fast hard disk
Hard disk recording of 8 channels or more and complex post-editing	Pentium 133, 24-32MB, fast hard disk
Real time effects (PlugIns for Windows software)	Pentium 166, 32MB
Hard disk recording with over 8 channels, real time EQ's, effects, automation, etc.	Pentium 166, 64MB, lightning fast hard disk, backup device (CD-writer, removable hard disk, etc.).

Table 17:

”Simple post-editing” means cutting, normalising, turning etc. of relatively small (< 30MB) files.

It should also be noted that the size of the hard disk(s) is calculated sufficient for 1 min Audio in “CD quality” (16-bit, 44.1kHz, stereo) - about 11MB alone is required for recording. To take an extreme example - if one were to record a flute concert on 4 stereo tracks and also create music using a guitar and three choir members, an average song 3:30 minutes long (11 x 8 x 3.5) would occupy at least 300MB. Do you want to do any cutting, copying or editing elsewhere (of course you do!)? Simply double the space requirement to be on the safe side. And finally, don’t forget to take a backup - it would be a pity to see so much hard work wasted. Incidentally, hard disk recording should always be carried out on a separate hard disk - i.e. store the operating system, program files and other data on a different disk.

"Mastering" and the personal music CD.

One particular property of TerraTec sound cards is that everything played via the cards can be recorded straight onto the hard disk. In the case of the AudioSystem EWS, this can even be on a digital level without any loss of quality (but avoiding the equalizer). This definitive mixing of (mostly) MIDI and Audio is called mastering. It generally includes post-editing, however, using effects for sum editing such as so-called compressors, loudness maximisers and stereo enhancers. Even this can now be done completely in the computer, and there is a wide range of software available. Examples are programs such as WaveLab (Steinberg), SoundForge (SonicFoundry) and Samplitude (SEK'D).

Your work can then be burned directly onto a blank CD. There are now very good CD burners available for SCSI and IDE interfaces, and the software is usually supplied. After mastering, the file resides as a normal wave (.WAV) file on the hard disk and can be converted by most programs into CD Audio format - and your own CD is now complete!

(Author's note: please forgive me for not mentioning the mastering studios that are available - with their special analog equipment etc. - for many thousands of marks ...)

A NOTE TO FINISH.

We hope that we have been able to provide an insight into the subject, and perhaps answer many of your questions. If you feel that you would like to offer some suggestions on individual chapters, constructive criticism, comments on any incorrect information or simply offer the authors your moral support, then please do so by e-mailing us at **midimann@terratec.de**. Have you composed your own musical pieces using TerraTec hardware? If so, we would be happy to listen to your material because there can be (almost) nothing better for a developer than the fruits of his/her labour.

Finally, may we once again thank the many customers who have contributed both their attention and suggestions to the production of this third edition of the MIDI book.

Good luck and best wishes from

... *your TerraTecTeam!*