



waveterm

OWNERS MANUAL

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As the owner of a WAVETERM you have a top instrument at your finger-tips which together with the WAVE 2.2 provides you with the most abundant possibilities of working creatively in music today. The WAVETERM System is a PPG concept with the aim of providing today's musicians with a complex music computer system, which can be adjusted to the most diverse needs. Every part of the PPG System can not only be used with dramatic results in the studio, but are equally flexible in a live situation.

The WAVETERM System is an additional programming unit for the PPG WAVE 2.2 Synthesizer. This monitor-oriented system allows the composer to make his compositions audible even when he may not be in the position of otherwise realising his instrumental ideas. Complete productions may thus be realised. The WAVETERM also provides the composer with the possibility of creating his own sounds, of becoming his own "instrument maker". All kinds of natural sounds can be manipulated (e.g. musical instruments, the human voice, animal and environmental sounds), frequency spectrums can be determined using Resonance Curves, and sequences of unimaginable length can be created. Using direct numerical commands unusual rhythms can be produced.

In this sense the WAVETERM is a complete 8-track digital recording system with one great advantage - every single note (or sound) can be changed in regard to its pitch, colour loudness etc. Without having to re-record the track as in conventional recording. Or it is possible to play polyphonically on the WAVE 2.2, have the stored information displayed on the monitor screen and only then sit down to work of actually getting the composition on to paper.

Technical development never stops and so the PPG System will also undergo further development, alongside new hardware developments, such as the Touch-Sensitive Keyboard, PRK, and the Expansion Voice Unit, EVU. PPG's main area of development lies in the production of new software. By the use of new system floppy disks (inserted in the disk drive nearest to the monitor screen) every WAVETERM System can be updated in line with the latest developments.

The WAVETERM System is provided as in 19" unit in line with today's trend of integrating electronic systems in standard units and can thus be simply screwed into an available rack.

Please read the operating instructions carefully since operating mistakes can, at the beginning, easily lead to misunderstanding. A demo floppy disk is included to provide examples.

IMPORTANT INSTRUCTIONS

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The floppy disks must always be inserted into the disk drives with the printed side to the LEFT, that is next to the monitor screen side. A right-handed person should hold his thumb over the small label so that the PPG sticker is in a vertical position. The WAVETERM can not operate when the disks are inserted incorrectly. Avoid touching the disk on its operating surface.

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Two floppy disks are included with the WAVETERM. The system disk "SYS" for the drive on the left (the one nearest the monitor screen) and the demo-disk "DEMO" for the drive on the right. The demo disk provides data for the various PAGES of the WAVETERM. The chapter HELP describes how the data can be obtained from the demo disk. Storing individual information (e.g. sounds or sequences) is described in the chapter STORE.

RESTART - Loading the WAVETERM program from the PPG SYSTEM disk.

Whenever you have entered a series of commands, or have developed a new sound, or manipulated a natural sound, or created a Resonance Curve or sequence, you should store the information using the HELP key in order to secure the sound. A breakdown, or fluctuation in the main voltage can interrupt the normal working of the system and thus data which has not been stored will be lost. Similarly it could happen that through operating mistakes the WAVETERM would block thus hindering the working of the function or command keys. Should this ever happen it will not (necessarily) mean that your WAVETERM is defective, but only that the "mathematics" have become somewhat muddled (either through external interference or possibly through an operational mistake). PPG has gone to great pains to ensure that the operation of the System is so simple and obvious that operational mistakes seldom occur. Blocking of the System can thus be resolved by loading the SYSTEM DISK anew. This is achieved by pressing the red button at the front of the WAVETERM (found to the left of the canon mic/line input). This automatically erases the work memory.

3. WORKING WITH THE COMMAND KEYS

Directly under the monitor screen, you will find two rows of 10 keys. The upper row is directly under the monitor screen and has 10 soft-keys (programmed keys) whose function is always displayed directly above them on the monitor. The keys have been so programmed that you will always find the same keys in the same place e.g. GET is always Key 6, STORE always Key 7, PAGE is always Key 9, and HELP is always to be found on Key 0, that is on the extreme right. Key 1 is called ESCAPE and can be therefore used to eradicate a wrong command (or Key) or return to a basic PAGE following a selected (perhaps wrong) function.

Key above 1	-	ESCAPE
Key above 6	-	GET
Key above 7	-	STORE
Key above 9	-	PAGE
Key above 0	-	HELP

The second row of Keys are purely numerical (0-9), which, following selection of a command function, can be used to select values (codes). If a certain command requires a two-figured number, you wish to select a value (code) under 10, then the first figure of the two must always be a "0". For example: selected value "5", command give "05".

Following selection of a command, by pressing a function and help key, the upper row of command keys will be blocked (apart from ESCAPE, Key 1 on the extreme left) until a command with the second, numerical row of keys has been completed. Should you have selected a wrong command you can eradicate this with the ESCAPE key, and then select the correct one.

4. The HELP Key

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The HELP key has two functions. They are -

- 1) to call up (GET), store (STORE), delete (DELETE), new disk formatting (NEWDISK) and copying (COPY), and
- 2) to call up explanatory notes on the SYSTEM (following selection of HELP in this function requires a further selection of HELP and then the function key for which explanation is required).

Sounds, sequences, or data etc., which have not been stored on disk, can be lost through operational mistakes (see RESTART in the Introduction). Data which, is called up from the disk, is copied in the working storage so that it will not be lost during a possible breakdown of the System or through operational mistakes.

1. Working With The Floppy Disk

To reach the floppy disk first, press HELP once. Along the base of the monitor screen there appear works which refer directly to the upper row of soft keys.

ESCAPE COPY NEWDISK YES NO GET STORE DELETE FILES HELP

The keys have the following meanings:

- ESCAPE** : To leave the HELP function and to correct wrong commands.
- NEWDISK** : To format new disks. The question which appears on the monitor must be answered with YES or NO.
(See the chapter on STORE).
- COPY** : To copy (transfer) data from one floppy to another.
- YES** : To affirm questions appearing on the monitor screen.
- NO** : To negate questions appearing on the monitor screen.
- GET** : To call up data from the disk (that is to load the working storage from the stored data on the disk).
- STORE** : To store data on the floppy disk.
- DELETE** : To erase data on the floppy disk.
- FILES** : To call up the catalogue of the disk in the user-drive.
The symbols W, T, M, E, R, S, L, P, D, K, and the numbers belonging to them will be displayed.
- HELP** : To call up the HELP functions.

2. Explanatory Notes

If explanation is required for some area of working, press HELP. Press HELP a second time and the word will light up. There also appears on the monitor screen the words HELP FOR PAGE:3 SELECT FUNCTION. Then select the key for which explanation is required. For example if you need explanation for recording transient sounds press RECORD and the explanatory text will appear.

3. The DEMO Floppy Disk

The Demo Floppy Disk contains examples of all areas & functions of the WAVETERM. First you must select the correct PAGE (0-5) which can work with the data required (not necessary for D (data)).

e.g.

D (Data)	-	PAGES 1 - 5
W (Waves)	-	PAGES 1 & 2
T (Transient Sounds)	-	PAGE 3
R (Resonator Curves)	-	PAGE 4
S (Sequence)	-	PAGE 5
P (Play Command)	-	PAGE 5
E (Event Generator)	-	PAGE 5

For example, to call up a natural sound (Transient Sound) select first PAGE 3, and then press the HELP key. Then press, GET and the word will light up. Press GET again, and the words TRANSIENT SOUND (T) will appear. Then press YES. Now you must enter the number (cod) of the sound you require e.g. 006 for a flute. The data will then be loaded into the working storage. Then press ESCAPE and the sound waveform will be displayed on the monitor screen. The selected sound can then be played on the WAVE 2.2 keyboard.

5. STORE - Storing On To Floppy Disk

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1. Formatting The Disk

Every floppy disk must be formatted before data can be first stored on it. Certain kinds of floppy disks (but not all kinds) have to be made "recordable" by closing the large slot with an aluminum sticker. Then the disk to be formatted is inserted correctly into the drive on the right, as described in the IMPORTANT INSTRUCTION in the Introduction. Then the key NEWDISK is pressed and when it is certain that the disk in the right hand drive is to be formatted (everything will be erased!) the corresponding answers (YES or NO) are pressed. Formatting takes time, but following this data can be stored on the disk. The PPG System and the DEMO-disk have been secured against accidental erasing by removal of the aluminum sticker. A similar procedure can be followed with every disk.

2. Copying Disks

It is possible to copy (transfer) all the data from on floppy disk to another. Use the following procedure:

1. Format the new disk as described in 5.1. above.
2. Press COPY - "Insert ORIGINAL in SYSTEM Drive. COPY in USER drive.
READY ?" appears.
3. Depending on whatever is to be copied, insert this original disk into the left-hand SYSTEM drive; that means that if a disk other than the SYSTEM disk is to be copied, the SYSTEM disk must first be removed.
4. Press YES. (Copying can take time, depending on what is to be copied.)

3. Storing Procedure

Every Waveform (**W**), Wavetable (**W**), Transient (Natural) Sounds (**T**), Lower Wavetables (**L**), Resonators (**R**), Sequences (**S**), Play commands (combination of sequences) (**P**), Event Tables (**E**) and Programs (**D**) for WAVE 2.2, EVU and PRK can be stored on Floppy disks. For all storing procedures first press:

1. HELP (not necessary when already on the HELP Page)
2. STORE - continues to successively press STORE until the code letters (**W**), (**T**), (**M**), (**E**), (**R**), (**S**), (**L**), (**P**), (**D**), or (**K**) with the corresponding terms appear, under which storing is to take place. (Further code letters are being developed for updates and hardware expansion units).
3. YES

4. A three-numbered code (000-999) now has to be typed in after the code letter. However with Single Sequences, the first number must be a "0".

During the storing procedure (that is after the code number (S) have been typed in) the red light on the right hand drive must be lit. Storage is completed when the word STORE is no longer illuminated.

5. Should, following the typing-in of the three-numbered code, the following question appear on the monitor;

"MAY THE EXISTING FILE BE DELETED?"

this means that data is already stored under this number. Should it be wished to erase this data because it is either no longer needed or because it will be updated with the new number the answer YES should be pressed. There then appears the second question:

"ARE YOU SURE?" as an added precaution against accidental erasure. If YES is now again pressed, the previous data will be erased. If it is required to retain the old data, the answer must be NO. Then begin the procedure again, this time with a new code number.

PAGE 1

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1.1. EXPLANATION

1.1.1. GENERAL DETAILS

Every note played on a musical instrument is really a combination of sounds or harmonics. Mathematically that means whole-numbered multiples of fundamental vibrations, which are sometimes called partial tones, or harmonics, or even natural harmonics. The particular sound character of each (natural) instrument is very dependant on the amplitude of various harmonics. Thus the particular construction of an instrument may cause, for example, a doubling of the vibrations, and thus the octave sounds, or even a tripling, which brings forth the fifth. The following table of natural harmonics should make clear, which note sounds according to which multiple brackets or ignored. The assumed fundamental here is C

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
C	c	g	c	e	g	(a+)	c	d	e	(f+)	g	a	(a+)	b	c
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	d		e		(f+)		g		a		(a+)		b		c

1.1.2. PAGE 1 (The Monitor)

After switching on the WAVETERM and pressing ESCAPE, Page 1 appears together with a table of number n the right of the screen. The numbers 1 - 32 represent the harmonics (see the Harmonic Table above, "01" represents the fundamental). By entering a two-figured number (01 - 63) each harmonic can thus be assigned on amplitude. The value 00 would mean that the harmonic would not sound. The periodic axis (horizontal line) displays the waveform.

1.2. USING PAGE 1

Select Program 80 on the WAVE 2.2. (Wavetable 30). Should program 80 no longer be available in its original form, load the data into the wave 2.2 from the demo disk using code (D 099).

At the base of the monitor screen there appear the following words, which are directly associated with the upper row of soft-keys. They are:

HARMON NEXT LAST AMPLIT FUNDAM GET STORE COMPUTE PAGE HELP

Use of the Keys:

- HARMON** : Using this Key and then typing in a code (01 - 32) harmonics can be selected & given an amplitude (00 - 63).
- NEXT** : The following amplitude is selected.
- LAST** : The previous amplitude is selected.
- AMPLIT** : The amplitude of a complete waveform can be attenuated (reduced in loudness) (63 - 00). This has no influence on the colour of the sound.
- FUNDAM** : To select the required fundamental waveform (mathematical basis). 01 - 04 are presets. Following completion of each waveform further numbers can be entered in with the same number.
- GET** : To load completed waveforms from the volatile memory into the working memory (values 05 - 99)
- STORE** : To store completed waveforms into the volatile memory (values 05 - 99)
- COMPUTE** : To compute waveforms resulting from inserting amplitude values.
- PAGE** : To select another page (0 - 5).
- HELP** : To enter the HELP Page, that is either to GET waveforms or to STORE waveforms, or to obtain the explanatory notes.

1.2.2. Building a Waveform

1. Press HARMON (Key to the extreme left). By entering a two-figured code (01 - 32) harmonics can be selected.

2. Now enter a further two-figured number which will represent the size of the amplitude (00 - 63)

3. Press COMPUTE. The resulting waveform should appear.

This procedure - HARMON - Harmonic number (01 - 32) - amplitude size (00 - 63) - compute can be repeated as often as required. Corrections can also be carried out by selecting a harmonic already provided with an amplitude, and simply changing the value (however, COMPUTE must be pressed anew!).

1.2.3. Possible Mistakes

The WAVETERM can cope with a maximum amplitude of 63. If the first harmonic receives a high value, and the following harmonics too, then certain amplitudes can increase to values over 63 and distortion is the result. To avoid this, smaller amplitudes should be typed in, or a different fundamental chosen (Press key FUNDAM. 02 - 04 have smaller amplitudes than 01). If you call up a new basic waveform (press key GET: the cursor will appear at WAVE) the waveform you have been working on will be erased.

1.2.4. Storing

On Page 1 the commands GET and STORE appear on two different lines. They have different functions! The two lines are:

a) **HARMON NEXT LAST AMPLIT FUNDAM GET STORE COMPUTE PAGE HELP**

and after pressing the HELP key:

b) **ESCAPE COPY NEWDISK YES NO GET STORE DELETE FILES HELP**

By pressing the key STORE of line (a) your new waveform can get given a number between 05 - 99 and thus temporarily, stored in the working storage. If it is wished to permanently retain a waveform (that is even after the WAVETERM has been switched off), the waveform must be stored on to disk using line (b) (see also "S" - storing). This is done as follows:

HELP - STORE - YES - a number from 000 - 999.

To summarize, completed waveforms built in Page 1, can be temporarily stored (that is without, you switching the WAVETERM off!) using STORE (the cursor will appear at WAVE NUMBER) and selecting a number from 05 - 99, or permanently stored by pressing the keys HELP - STORE - YES - (W) 000 - 999.

1.2.5. Calling Up Waveforms

After switching on the WAVETERM, select Page 1. Then press key HELP. Line (b) - see above - will appear. Then press GET. The words SPECT. + WAVETB. (W)? will appear. Press YES, and enter in the number of the waveform you have previously stored and now wish to recall (000 - 999). Should the words NOT FOUND appear, after the number you have entered, press the key FILES and all the data number on the USER drive (The disk in the right-hand drive) will appear.

1.3. Extensions

So far, the basis of our examples was the Sine wave (fundamental waveform - key FUNDAM 01 - 04). However, every waveform can be used as a fundamental.

Example: When you have built two new waveforms, and stored them temporarily under numbers, 05 and 06, you can use waveform 05 as the fundamental for waveform 06. So press GET - 06 - FUNDAM - 05 - STORE 07. Waveform 06 has been completely modulated by the other fundamental. Thus you can see the tremendous possibilities in building waveforms.

1.4. Examples

A ramp (sawtooth) waveform can be built using the following table. We use fundamental 02 for this waveform.

Wave Amplit: 63 FUNDAM: 02

1	63	17	3
2	32	18	3
3	21	19	3
4	16	20	3
5	13	21	3
6	11	22	2
7	9	23	2
8	8	24	2
9	7	25	2
10	6	26	2
11	5	27	2
12	5	28	2
13	5	29	2
14	4	30	2
15	4	31	2
16	4	32	2

Build the waveform as follows: Press key FUNDAM and the cursor appears behind FUNDAMENTAL. Enter in the value 02 with the numerical keys. WAVE AMPLIT needs no number to be entered in since it already has the amplitude 63 (this appears automatically after switching on the WAVETERM). Press the key HARMON and the word illuminates. With the numerical keys, enter the number 01 for the first harmonic. The cursor appears after the number 1, immediately before the 0 of the table on the right of the monitor screen. Now enter the amplitude value 63. The illumination of HARMON will disappear and a Sine waveform with amplitude 63 will appear.

Press key HARMON and the word illuminates. Enter the number 02 for the second harmonic. The cursor appears behind the number 2 and immediately before the 0 in the table. Enter in the value 32. The illumination of HARMON disappears and a Sine waveform with amplitude 32 is represented additionally to the first harmonic.

Now you can press compute and see the result of adding the two Sine waveforms together. You can press compute after entering each harmonic amplitude, and so slowly watch how the ramp waveform is created.

Using the above table you can also create a square wave whereby only the odd numbered harmonics are used (1, 3, 5, 7...) however, using the same amplitudes as for the ramp waveform. You must enter amplitudes of 0 for all the even-numbered harmonics.

PAGE 2

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2.1. EXPLANATION

2.1.1. GENERAL DETAILS

A musical note sounds more natural when the harmonics vary during its transient period, that is when a different waveform sounds at the beginning, than at the end. You can do this already with the WAVE 2.2 using wave blending. The ADSR 1 pots on the WAVE 2.2 can influence the waveform development of every sound. The wavetables (00 - 29) are provided as presets. Using the WAVETERM you can create your own wavetables on Page 2.

(???) wavetables can be played normally on the WAVE 2.2 (???) all the different modulation devices available on the keyboard e.g. an envelope can produce dynamic waveform progressions of wavetables produced on Page 2.

2.1.2. THE MONITOR SCREEN

Select Page 2 by pressing the key PAGE and the number 2 on the numerical keys.

To the upper left of the monitor screen there appear the following words:

- | | |
|-------------------|--|
| WAVETABLE NUMBER | - here you can enter the number of a wavetable by pressing the key STORE, or |
| | - you can call up a wavetable by pressing the key GET. |
| HALF OF WAVETABLE | - to display the first or second part of a wavetable labeled UPPER or LOWER waves. Can be switched by pressing HALF. |

The vertical table on the right of the monitor screen displays the positions which can be provided with waves. The horizontal line represents the periodic axis of the waves selected and displayed here. Since the wavetables of the WAVETERM consist of 128 waveforms this display has been divided into UPPER and LOWER parts, each with 64 waves. You can provide every second stage of the 128 wavetable with a waveform.

Note, however, that the WAVE 2.2 envelope can run through, at the most, 64 waves for every musical event. Nonetheless, it is usually more useful to work with the 128 waves available in the WAVETERM since it is possible to stagger the range of the selected waveform area. This can be achieved by using parameters KW, SW, UW, WAVES-OSC and WAVES-SUB on the WAVE 2.2.

To select the position in the wavetable, press WAVE and write in an odd number between 01 - 63, thus selecting for this position one of the of the waveforms you have constructed on Page 1. You can enter up a different waveform for every second position in a wavetable (odd-numbers), or you can enter in a waveform for position 1 and position and position 127 (two halves - LOWER/UPPER). The computer will, when required, calculate all the intermediary waveforms providing a continual variance from position 1 to position 127.

2.2. USAGE

2.2.1. THE FUNCTION KEYS

Select Program 80 on the WAVE 2.2. Select Page 2 on the WAVETERM. The following terms appear at the bottom of the monitor screen immediately above the upper row of soft-keys.

WAVE NEXT LAST HALF DISPLAY GET STORE COMPUTE PAGE HELP

The Keys and their use:

- WAVE** : To select a position in the wavetable, to escape from an unwanted function and to hold the display function.
- NEXT** : To select the following position in the wavetable.
- LAST** : To select the previous position in the wavetable.
- HALF** : To change from one half of the wavetable to the other (LOWER/UPPER)
- DISPLAY:** To run through a wavetable (all intermediary values will be visable) and to hold the display function at any position.

GET : To call up a wavetable from the working storage (00 - 20).

STORE : To store a wavetable in the working storage (00 - 20).

COMPUTE: To compute the intermediary values.

PAGE : To select another Page (0, 1, 3 - 5).

HELP : To call up the explanatory notes. Working with the floppy disks.

2.2.2. BUILDING A WAVETABLE

After pressing the Key WAVE, enter an odd-number between 01 - 63 to select a wavetable position. If position 00 is not select, it will be automatically provided with the preset wave form 01 (Sine). Apart from the presets 01 - 04, every waveform selected for a wavetable, must first be built using Page 1. When a waveform has been selected, it will be graphically displayed.

To provide the next waveform press, WAVE. The word illuminates. Enter the position number required of the wavetable. The cursor appears. Enter in the waveform number you require at this position. After completing the waveform number, the illumination of WAVE and the cursor disappears. Press the key HALF to select the UPPER part of the wavetable. Using the key, COMPUTE, you can have the computer calculate the intermediary waveforms (i.e. the empty positions between the selected waveforms) thus completing the wavetable. Following completion of the calculation, the illumination of COMPUTE will disappear. Now press DISPLAY. The computer now displays graphically what you hear when playing an envelope in the WAVE 2.2. The wavetable is sampled, line for line, and the computer shows graphically the cursor position in the table. After all the 128 waveforms have been sampled, the computer stops and the illumination of DISPLAY disappears. Should you wish to hear a waveform singly, during the display function, press, DISPLAY a second time. The computer will stop, and you can hear the waveform selected singly: press = stop, release = run.

2.2.3. STORING

The completed wavetable can be stored by pressing STORE, and selecting a number between 00 - 20. Up to 20 wavetables can be built (don't forget the COMPUTE key!), and can then be stored together with the waves from page 1 (05 - 99) using a (W) number (using the storage procedure similar to Page 1).

2.2.4. CALLING UP WAVETABLES

If wavetables have been stored in the working storage, they can be selected by pressing GET, and entering a number between 00 - 20. When wavetables have been stored on disk using a (W) number, they can be accessed using the following procedure:

Press HELP

Press GET - WAVETABLES (W) ? appears.

Press YES - File Name?: W appears.

Enter in the number of the wavetable you require.

Press ESCAPE - the selected wavetable data will be loaded into the working storage.

With GET you can select the individual wavetable (00 - 20) you require. If you the select Program 80, on the WAVE 2.2. and then press DISPLAY on the WAVETERM, you can simultaneously hear, and see, the wavetable you have selected. If you press the key, DISPLAY, while the WAVETERM is running through the waveform, the process will be halted for as long as you hold the key down. The cursor remains at the waveform which is displayed on the monitor and which can be heard on the WAVE 2.2. The process can be completely aborted by pressing WAVE.

2.2.5. EXTENSIONS

Wavetables can also be represented on PAGE 3 on its time axis (see Chapter 3.3.4.).

PAGE 3

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3.1. EXPLANATION

3.1.1. GENERAL DETAILS

With the AUDIO SIGNAL PROCESSOR on Page 3, it is possible to record and modulate all manner of natural sounds, such as music instruments, the human voice, and animal sounds. Using a microphone or a line-input (such as a tape recorder), the sound to be recorded, and/or modulated, can be loaded into the WAVETERM and the waveform visualized on the monitor.

The AUDIO SIGNAL PROCESSOR is a part of the WAVTERM, with which a natural sound can be analyzed and converted to a digital word. This is achieved by SAMPLING the sound and changing every sample into an 8-bit word (analogue -> digital converter). Sampling means electronically chopping up the sound, and analyzing it digitally. The 8-bit words thus achieved are then temporarily stored and can be used (modulated) in the most diverse manner. This first temporary storing process works somewhat like a tape loop, in an echo machine, and records constantly, whereby the audio signals running through it would disappear at the end of the "loop". To stop the recording, you must press the button labeled RECORD in order to complete the recording process, and store the material required. The amount of available recording time lies in direct proportion to the SAMPLING RATE used. A higher sampling rate has a shorter recording time but provides a better frequency spectrum.

3.1.2. THE MONITOR SCREEN

After the selection of Page 3, there appears a horizontal line in the middle of the screen. This is the time axis, and here is where the Transient Sounds are visualized. The small vertical line is the THREAD, which can be moved horizontally with the keys RIGHT and LEFT. The THREAD provides a relative position for defining the commencement or completion of the waveform periods - carried out with the soft keys START, and END.

In the top left-hand corner of the screen, there are the following words:

SAMPLE RATE:	LOWPASS:
ZOOM MAGNITUDE:	THREAD POSITION:

The SAMPLE RATE defines the quality (frequency spectrum) and the length, in seconds of the storage time. 00 corresponds to the shortest storage time, and the best results in sound quality. 10 corresponds to the longest storage time, and thus provides the weakest quality in sound. 02 - 09 are values in between.

LOWPASS determines the filter function for recording. The value 99 mean that the filter is completely open, and 00 that it is closed to its maximum (the cutoff frequency is variable between 4Khz and 25KHz).

ZOOM MAGNITUDE has values between 1 - 6, and shows the enlargements of the waveform. This allows the number of periods of the Transient Sound, show on the time axis, to be varied (zoom factor).

THREAD POSITION has numbers showing the position of the cursor on the time axis.

A sound entering the AUDIO SIGNAL PROCESSOR by microphone or tape is displayed as a waveform running from left to right on the time axis (it is not a spectrum analyzer). It is possible to modulate the acoustic representation of this waveform in many ways.

3.2. USE

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3.2.1. THE FUNCTION KEYS

Select Page 3. At the base of the monitor screen appear words which refer directly to the upper row of soft-keys:

INCRS LEFT RIGHT DECRS START END LOOPS RECORD PAGE HELP

The keys have the following functions:

INCRS : To enlarge the waveform shown (up to ZOOM MAGNITUDE 6) and to escape from incorrect entries.

- LEFT** : To move the thread to the left on the time axis.
Pressing the key once, briefly, moves the thread one position (size according to ZOOM MAGNITUDE). Holding the key allows the thread to move continuously.
- RIGHT** : See LEFT above
- DECRS** : To reduce the size of the waveform shown (down to ZOOM MAGNITUDE 1, but only possible when INCRS is use first).
- START** : To determine the starting point (in time), of the waveform shown (not the starting point when recording!). When START is pressed, the whole recording is rotated to make the point, where the thread was, the starting point of the waveform. This means if errors are made in finding the starting point, the error can be corrected, since pressing START does not erase, but only rotates the sound. In case of such an error, move the thread, using keys LEFT and RIGHT again, to the point where the waveform actually begins (this point will usually be in the right-hand part of the monitor screen), and press START again. START is also used to determine the starting point of a LOOP.
- END** : To determine the end of a Transient Sound waveform show (not the end when recording!). The parts of the waveform to the right of the thread will be erased when END is pressed (different to START which only rotates the sound).
- END is also used to determine the end of a LOOP.
- LOOPS** : To create a LOOP from parts of a waveform, determed by using START and END.

RECORD : To record a sound in the Transient Memory, using a microphone or line input. This button is also used to finish recording into the WAVETERM.

ANALYSE: Appears at the same position as RECORD, after pressing LOOPS. ANALYSE allows the waveform, the beginning of which has been determined by the thread, to be analyzed according to fourrier. The resulting harmonic spectrum is then immediately displayed on page 1.

PAGE : To select other Pages or by selecting Page 3 anew, to reload a sound into the WAVE 2.2.

HELP : To call up the HELP functions.

3.2.2. RECORDING TRANSIENT SOUNDS

Connect a microphone or line input to the cannon socket at the rear of the WAVETERM. The red light under the disk drives, at the front of the WAVETERM, should light up at the loudest point of the sound to be recorded. The signal strength can be adjusted using the SENSITIVITY pot. Next, press RECORD. The cursor appears at SAMPLE RATE. Values between 00 - 10 can be entered (see 3.1.2. above SAMPLE RATE). 00 sample rate = 50KHz - the shortest storage time, with the best sound quality.

SAMPLE RATE	FREQUENCY		RECORDING TIME	

00	-	50 KHz	-	0.37s
01	-	30 KHz	-	0.5 s
02	-	21 KHz	-	0.75s
03	-	16.5 KHz	-	1 s
04	-	13 KHz	-	1.25s
05	-	11 KHz	-	1.5 s
06	-	9.5 KHz	-	1.75s
07	-	8.5 KHz	-	2 s
08	-	7.3 KHz	-	2.25s
09	-	6.8 KHz	-	2.5 s
10	-	4 KHz	-	2.75s

10 - weakest sound quality, longest recording time - frequency 4Khz.

After entering the SAMPLE RATE value, the cursor jumps to LOW PASS. Here a value can be entered determining the filter position.

A value of 99 opens the filter completely (25KHz), and 00 closes it down to 4Khz. 01 - 98 are values in between. When using a long SAMPLE RATE, the filter should be correspondingly close, to avoid unnecessary noise.

Immediately after the filter values have been entered, the AUDIO SIGNAL PROCESSOR starts recording continuously.

Should you know, from experience, where the frequency spectrum lies, of a sound you wish to record, you can choose an appropriate SAMPLE RATE in order to save storage space, allowing maximum storage time. You will thus achieve a better recording, with good sound quality. With a recording time of 1 second, you have a frequency range of 16KHz for the audio signal (determine by SAMPLE RATE). With a recording time of 2 seconds, you have a frequency range of 8KHz, and so on.

In order to get to know the various effects of different SAMPLE RATES and LOWPASS values, it is best to try out a few sounds with speech, using of course a microphone. After entering in the values for SAMPLE RATE and LOWPASS as described above, say "HELLO", and immediately press the RECORD soft-key. The word is now stored in the WAVETERM and the waveform is displayed on the time axis.

Using the WAVE 2.2 (GROUP A) you can immediately hear "HELLO" by pressing a key. The sound can be adjusted using the 3 pots, ENVELOPE 1 Waves, WAVES OSC, and WAVES SUB. The sound can also be influenced using the WAVE 2.2 filter.

Should Page 5 have been immediately in operation before recording a sound on Page 3, it can happen that the working storage will give a false image of the sound to the WAVE 2.2. In this case, recall T000 from the DEMO disk, to restore a neutral working program.

After a little practice, you will be accustomed to recording simple sounds, and want to try something more difficult. The sounds can be modulated by all the functions available on the WAVE 2.2 and WAVETERM (including the sequencer).

3.2.3. MODULATING NATURAL SOUNDS

After the RECORD button has been pressed, the waveform is displayed on the time axis. Move the thread to where the waveform begins, and press START. The waveform now appears at the extreme left (beginning) of the time axis. Make an approximate adjustment of the sound on the WAVE 2.2 and store it on disk as follows:

Press HELP

Press STORE twice - TRANSIENT SOUND (T)? appears.

Press YES - FILE NAME?: T appears.

Enter a number between 000 - 999.

Recall the Transient Sound:

Press GET twice - TRANSIENT SOUND (T)? appears.

Press YES - FILE NAME?: T appears.

Enter the number of the sound:

Press ESCAPE - the waveform appears on the time axis.

(It is always better to store sounds immediately on to disk. In this way, nothing is lost, even if mistakes are later made!)

Now you can move the thread with the key LEFT and erase everything after the waveform. Should you erase too much, you can always recall the waveform from the disk as described above.

Using the key INCRS, you can now enlarge the waveform to visualize single periods. The following values appear after ZOOM MAGNITUDE:

- | | | |
|---|---|--|
| 1 | - | The whole contents of the Transient Storage
128 periods are visualized. (16Kbyte) |
| 2 | - | 64 periods are visualized. (8Kbytes) |
| 3 | - | 32 periods are visualized. (4Kbytes) |
| 4 | - | 16 periods are visualized. (2Kbytes) |
| 5 | - | 8 periods are visualized. (1Kbytes) |
| 6 | - | 4 periods are visualized. (512Bytes) |

The various representations are reached by pressing the function keys INCRS or DECRS (DECRS can only work if ZOOM MAGNITUDE is larger than 1). The thread can be moved on the time axis, using the function keys LEFT and RIGHT. The position of the thread is shown at THREAD POSITION.

If the thread moves, the parameter "EVENLOPE 1-WAVES" on the WAVE 2.2 moves too, so that the position of Loops can be heard (see 3.3.1.).

If you have moved the thread and pressed INCRS or DECRS, the last position of the thread (and the waveform) is represented in the middle of the screen. If the thread is made to run over, and past the time axis, the thread and the time axis will once again be represented in the centre of the screen. Using the thread, you can determine the start and end of a Transient Sound, make loops, or present a waveform for Fourier analysis (see 3.3.3.).

There are two lots of figures after THREAD POSITION. The first number shows the number of periods, the second the step number in the period.

The following table shows which notes, on the WAVE 2.2, represent the approximate original pitch of Transient Sounds with the equivalent SAMPLE RATE.

SAMPLE RATE	OCTAVE	NOTE
-----	-----	----
00	4	G sharp
01	3	B
02	3	F
03	2	C sharp
04	2	A
05	2	F sharp
06	2	E

(Penciled in notes: Sample rates 00, 04 & 06 have been written on the pages as D sharp 3, G 2, and D 1, respectively)

Should the sound recorded be musical, rather than percussive, possible differings in pitch between the original sound and the pitch reproduced on the Wave 2.2, can later be adjusted using the LOOPS procedure (see 3.3.1. below)

The Waveform flow, of a Transient Sound, can be quite easily adjusted. Using the pot "WAVES-OSC", the starting point of the waveform can be shifted. For instance, "HELLO" can be made into "LO".

3.2.4. Storing a TRS

A Transient Sound can be stored on to disk, using the method described above in 3.2.3. The data from the WAVE 2.2 will be automatically stored with the equivalent TRS. On the other hand, getting a TRS from disk is simple (See 3.2.3.). After pressing ESCAPE, the sound can be immediately played on the WAVE 2.2.

3.3. Additional Manipulations

3.3.1. Working With Loops

A sound can be lengthened, by making a loop at an appropriate point in the waveform. Basically, there are two kinds of loops in the WAVETERM. There is first the small loop, which exactly corresponds to a waveform stored in the WAVE 2.2's wavetables. If such a small loop is determined on Page 3, then it is either identical in length of the period of the waveform, from one or another wavetable in the WAVE 2.2, or two waveforms stored in the WAVETERM on Page 1. The pitch corresponds to the normal pitch of the WAVE 2.2.

The second kind is a large loop, sixteen times longer than the small loop. This loop is particularly suitable for sounds, which are very irregular, such as the panflute, in which breath noise also plays a big part. If such a small loop were used, the typical sound of the panflute would be lost.

However, the computer decides automatically whether a small, or large, loop is built. It depends on the Zoom Magnitude as to whether it is a small or large loop. When Zoom Magnitude is at 6, that is the biggest enlargement possible, the a small loop will always be made. If you now used START and END, so that one, two or four periods were confined on the monitor screen, the resulting pitch of the loop will be exactly the same as the pitch on the WAVE 2.2.

The Loop should always be defined, so that the START and END points are at zero crossings (where the waveform crosses the time axis), so to avoid glitching. The same applies to large loops.

3.3.2. Combining Two Transient Sounds On One Time Axis.

In order to combine two Transient Sounds on one time axis, you must have already recorded the sounds on to disk. Two sounds have already been combined on the demo disk. T009 (strings) and T004 (trombone). They are both heard on T021.

When the waveform of a natural sound takes up less than half the memory space available (measured from the edge of the monitor screen, to the thread in the middle), then it can be combined with another sound, so long as it fulfills the same conditions. They then can both be simultaneously played on the WAVE 2.2 keyboard. The second sound is first stored under LOWER WAVETABLE, and combined with the first sound. Then both can be stored under a T number. Use the following procedure:

Select Page 3.

Press HELP

Press GET twice - TRANSIENT SOUND (T)? appears.

Press YES - FILE NAME? : T appears.

Enter the number of the sound.

Press ESCAPE - Transient Sound waveform appears.

If this sound is to be combined with another sound it must be shorter than half of the storage space available. If not then it must be shortened using the key END.

This TRS will now be renamed under an L (LOWER WAVETABLE) number. Proceed as follows:

Press HELP.

Press STORE seven times. LOWEVER WAVETABLE (L)? appears.

Press YES - FILENAME? : L appears.

Enter a number between 000-999.

Now repeat the whole process calling up first a second TRS (the waveform of which takes up less than half of the storage space available!).

Using the key START shift the sound to the second half (right hand side) of the time axis. (If the thread is in the middle all you have to do is press START thus rotating the sound to this point. See 3.2.1. "START".)

Now press HELP.

Press GET seven times - LOWER WAVETABLE (L)? appears.

Press YES - FILE NAME ? : L appears.

Enter in the number of the waveform you stored under L (see above).

Press ESCAPE.

The LOWER WAVETABLE sound will now appear in the first half (left hand side) of the monitor screen while the second sound is in the second half (right hand side).

On the WAVE 2.2 press DIGITAL under DISPLAY SELECT. In one Group enter in "1" behind UW so that the UPPER WAVETABLE is activated. Now enter in a number between 4-8 behind KEYB: and also enter in a number behind KEYB-SPLIT:. Now you can play the two Transient Sounds on the two halves of the WAVE 2.2 keyboard. It may be necessary to adjust both sounds using ENVELOPE 1-WAVES and WAVES-OSC and WAVES-SUB on the WAVE 2.2.

Following this you can store the dual sounds normally on the disk under a T number. The WAVE 2.2 data (Keyboard Split etc. will also be automatically stored under the T number.

3.3.3. Fourier Analysis

Fourier Analysis more or less does the same thing backwards that you can do on Page 1 - namely additive synthesis. Using an existing sounds (normally a Transient Sound) Fourier Analysis calculates its row of harmonics that is the whole-number multiples of fundamentals. Noise content will be ignored. This means that using the WAVETERM a sound stored for example using a microphone can be examined in its harmonic structure in order to possibly imitate it synthetically (that means to "construct" it additively).

Proceed as follows:

Select first a Transient Sound which has been properly looped. Then using the thread and keys LEFT/RIGHT determine the approximate position of the starting point in the waveform you wish to examine.

Now press INCRS until you reach ZOOM MAGNITUDE: 6.

Move the thread to a positive zero-crossing of a period (positive means that the waveform crosses the time axis going from the bottom to the top).

Now press LOOPS - ANALYSE appears in place of RECORD. With ANALYSE you can now examine a period of the transient sound according to Fourier and have the harmonic construction displayed in Page 1.

So now press ANALYSE. When the computer has completed the calculation, the harmonic construction will automatically appear on Page 1.

Now press COMPUTE on Page 1 - the waveform will be displayed on the time axis.

The periods which you have selected for analysis can now be acoustically and separately realised on the WAVE 2.2.
Proceed as follows:

Select Program 80 on the WAVE 2.2 (if necessary load the original sounds from the DEMO disk "D 099").

The waveform will appear at Position 0 of the Wavetable.

3.3.4. Working With Wavetables On Page 3

3.3.4.1 Integrating A TRS Into A Wavetable

A single waveform can be analysed according to Fourier and visualised on Page 1. This waveform can then be stored under a number and then integrated into a wavetable on Page 2.

3.3.4.2. Representing Wavetables From Page 2 On Page 3

After you have built a wavetable in Page 2 from waveforms developed in Page 1 press the COMPUTE found on Page 2.

Return to Page 3

The wavetable from Page 2 will be represented on the time axis of Page 3. This will result in a different playback mode on the WAVE 2.2. The acoustic result is possibly more organic than on Pages 1 and 2 since the sound memory is heard in its entirety and not in segments on Pages 1 and 2. The only disadvantage is that the pitch on the WAVE 2.2 determines the length of the notes. This sound can be worked with and modulated as described above. If you wish to store this sound it must of course then be filed under a T number.

3.4. Examples

Select Page 3. Call up Transient Sound T002 from the disk (see 3.2.3. above).

Do not forget to press ESCAPE. The sound will now be shown on the time axis.

Now press key LEFT and move the thread until approx. in the first quarter of the monitor screen.

Now press INCRS five times until ZOOM MAGNITUDE 6 is reached (the biggest enlargement).

Move the thread to a zero-crossing of the waveform that is to the zero-crossing which can be best seen. In this case that is the zero-crossing which goes from above the time axis to below. Move the thread to this exact position and stop.

Press START - the thread will stop and a second thread will appear which can again be moved.

Press RIGHT moving the thread to a zero-crossing two periods further on.

Press END - and so you have formed a loop from one or two periods of a natural sound. It takes a moment for the computer to calculate the new waveform after you have pressed END. When you now play a note on the WAVE 2.2 you will hear how the sound runs through linearly and then "circles" on the loop at the end. Should the loop not have the correct pitch, or have a different sound colour, define the end position of the loop anew by using the keys LEFT/RIGHT finding a new zero-crossing and pressing END again. You can repeat this process as often as you like until the sound is correct. You can make the loop four periods long but then it will be an octave higher in register. However, a loop should always have a period number representing a unison or octave unison that is either with two, four or eight periods. Using the same process you can also build larger loops.

PAGE 4 - BUILD UP A RESONATOR

=====

4.1. Explanation

4.1.1. General Details

All natural sounds are influenced by the resonance of the instruments which make them. This the sounds of a note C played on a trumped will sound different to this sound recorded on tape and played at double speed, that is an octave higher. The number of harmonics present is different and that means that the difference between a high note and a low note lies not only in their differing frequencies. And it means too, that acoustic instruments amplify certain frequencies with their sounding bodies (whole-numbered multiples of the wavelengths correspond to the measurements of the sounding body - that is resonance). These physical laws can be imitated with a resonator.

Using Page 4 you can draw a resonance curve which determines which frequencies should be emphasised and which ones should be attenuated. A waveform built in Page 1 will be calculated on the resonance curve of the frequency spectrum. Thus the waveform will not sound the same over its entire frequency band. The resonance curve will attenuate certain harmonics.

The acoustic effect is comparable to a filter with EMPHASIS (resonance) whereby the CUTOFF point is constant (that is, does not run parallel to pitch). That means that differing output waveforms occur depending on the pitch of a constant input waveform the range of a filter curve.

4.1.2. The Monitor Screen

The horizontal line represents a frequency spectrum ranging from 16 Hz to 16 kHz (16,128 Hz exactly). The vertical line represents a unit of amplification, that is amplification from the base upwards of the harmonics in the various frequencies. The horizontal line represents therefore the area of greatest attenuation, that means that in the area around this line no harmonics can be heard. At the top of the vertical line, on the other hand, the attenuation is zero - that means that here input loudness equals output loudness.

The nearer the resonance curve is to the horizontal line the more the harmonics in the area will be attenuated (softer) and the nearer the curve comes to the upper limit the lesser the harmonics will be attenuated (louder). The curve can have any form even vertically, changing between attenuation 0 (Gain 126) and attenuation MAX (Gain 00 = -45dB) - (the "ideal filter").

At the base of the monitor there appears the following words which refer directly to the upper row of softkeys:

UP LEFT RIGHT DOWN SET ERASE COMPUTE PAGE HELP

They have the following use:

- UP** : To move the illuminated dot upwards, and to escape from incorrect entries.
- LEFT** : To move the illuminated dot to the left.
- RIGHT** : See LEFT.
- DOWN** : To move the illuminated dot downwards.
- SET** : Draws the curve determined by the dot which following this commands can no longer be moved to the left.
- ERASE** : To erase the curve shown.
- COMPUTE** : To calculate a wavetable according to a resonance curve.
- PAGE** : To call up other Pages 0-3 and Page 5.
- HELP** : To call up HELP functions.

4.2. Use

Using the movable illuminated dot you can draw a RESONATOR curve on the monitor screen. The line of the frequency spectrum is logarithmically realised in 512 dots (positions), the line of attenuation linearly realised in 128 dots (positions). Every one of the 512 x 128 dots or positions, of this area can be reached with the illuminated dot, which can be moved up and down, to the left, and to the right. Four keys are used to move the dot - UP, LEFT, RIGHT and DOWN (see above 4.1.2.). The position of the illuminated dot is given the line:

POINT POSITION : Frequency: Hz ; Gain:

Move the dot with the keys described above and then press SET. The starting position will be joined to the position reached with a line.

Move the dot again and then press SET again. Now this position will be joined to the previous position and so on.

In this way you can construct many RESONATOR curves and have various waveforms calculated over them.

When you have finished constructing a curve press COMPUTE this word illuminates and on the monitor screen appears the following:

This operation will use the waves 50 to 81 for creating the RESONATOR wavetable.

RESONATOR INPUT WAVE:

Following RESONATOR INPUT WAVE you can enter in which waveform the resonance curve should be calculated.

The required waveform must have been previously built on Page 1, or be called up from disk using a W number.

Following entry of the two-figured number, the computer calculates the resulting wavetable. This operation requires a little time. When illumination of COMPUTE goes out you can immediately hear the result on the WAVE 2.2. For this use Program 81 (wavetable 30 and in the DIGITAL DISPLAY KW4) whereby the waveform are evenly distributed over the keyboard.

The resulting wavtable occupies the wavepositions 50 to 81 (on Page 2) and can be treated like any other wavetable. These numbers should be kept free in the working storage of Page 2. Should you have already occupied these numbers on Page 2 give them other numbers or store them seperately on to disk.

A RESONATOR can only be stored completely by using disk. If it is stored on to disk, only the data of the curve will be stored, not the resulting calculation on to a waveform. If therefore a RESONATOR curve is called up from disk the calculation on to a waveform must be carried out anew.

Press COMPUTE

Enter in the number of the input waveform

However, a wavetable calculated using the RESONATOR curve can be stored under a new W number and called up without having to calculate it anew.

Press ERASE to erase a curve. Then you can start building a new curve.

4.3. Storing a Resonator Curve

The RESONATOR curve can be stored on to disk. Use the following procedure:

Press HELP

Press Store several times until "RESONATOR (R)" appears.

Press YES - FILE NAME?: R appears.

Enter in a number 000-999

4.4. Extensions

The wavetable resulting from the above mentioned calculations can be visualised on Page 2. By pressing DISPLAY you can access the waveforms singly. These single waveforms can of course be heard on Page 1 and made further use of.

That part of a wavetable or TRS seen on the screen can also be used for a RESONATOR curve. Use the following procedure:

Call up wavetables (using a W number) from the disk.

Select Page 2 and call up one of the wavetables in to the working storage using GET.

Now press DISPLAY and shortly afterwards WAVE. The waveform displayed is interrupted.

Now select Page 3. The wavetable from Page 2 is displayed.

Press INCRS to reach ZOOM MAGNITUDE 6.

Now select Page 4. You will see the waveform segment constructed on Page 3.

Now press COMPUTE and a wavetable will be calculated on this RESONATOR curve.

5. PAGE 5

=====

5.1. Explanation

On pages 1, 2, 3 and 4, the WAVE TERM can create single sounds and periodic sounds. Now with Page 5, whole compositions can be created. Any pitch or any rhythm can be realised and dynamic sound combinations can be combined and then fed in to the WAVE 2.2's eight channels. There are various ways of composing a piece and then storing it on disk, for example a sequence can be played on SEQM:00 on the WAVE 2.2, and then stored in the WAVE TERM as a single SEQUENCE (S).

Stored SINGLE SEQUENCES can then be combined together in so-called PLAY COMMANDS to form whole pieces.

The EVENT GENERATOR provides the most comprehensive facilities for composing. Every note is registered as an EVENT. Using the WAVE TERM keypad, EVENTS can be directly entered in to the computer determining every parameter such as pitch, rhythm, amplitude and colour. Entering data with the WAVE TERM keypad supercedes by far the method of entering data with the WAVE 2.2. keyboard. It is also possible to call up a SINGLE SEQUENCE from the disk and have every note visualised as an EVENT on the monitor. This SINGLE SEQUENCE can then be varied or altered as required using the WAVE TERM keypad. All the sequences composed with the EVENT GENERATOR can then be combined as SINGLE SEQUENCES to form whole, completed musical pieces (PLAY COMMAND).

5.2. Using the EVENT GENERATOR

Select Page 5 by pressing PAGE number 5 on the WAVE TERM's numerical keys. There then appear at the base of the monitor the following words which refer directly to the upper row of keys on the WAVE TERM keypad.

TEST PLAY STOP STEP EDIT COPY DELETED UPDATE PAGE HELP

TEST:

Used for working with the EVENT GENERATOR (E). Following updates on a sequences press TEST and then play (or RUN 1 on the WAVE 2.2) to hear (test) the sequence in the changed form. By pressing TEST a selected or updated sequence will be loaded in to the WAVE 2.2.

PLAY:

Used to lay a selected or updated sequence. Press also to select the PLAY COMMAND mode.

STOP: To stop a selected or updated sequence.

STEP: In preparation.

EDIT:

Used with the EVENT GENERATOR. By entering the required number the data of a corresponding BAR will be visualised.

COPY:

Used to copy several BARS or parts of a sequence such as rhythm, register, pitch and channel.

DELETE:

Used to erase several BARS or even whole parts of a sequence.

UPDATE:

Used to determine the Program No, the tempo (speed) and the update parameters for every channel.

PAGE: Used to select another page 0-4.

HELP: Used to call up the HELP functions.

5.3. Working With The Event Generator

5.3.1. Starting with a SINGLE SEQUENCE

Only sequence mode SEQM:00 on the WAVE 2.2. can be used for working with the WAVE TERM EVENT GENERATOR. (SEQM: 01-09 can, however, be stored in the WAVETERM using (D) together with other WAVE 2.2. data.)

Using SEQM:00 play a sequence on the WAVE 2.2. using all eight channels if you wish. Do not at this point make any corrections which might be necessary, but store the sequence immediately as a SINGLE SEQUENCE on to Disk as follows:

Press HELP

Press STORE - word illuminates. Press STORE FIVE more times until SINGLE SEQUENCE (S)? appears.

Press YES - FILE NAME?: S appears.
Select a number between 000 and 099.

Then call up the same sequence again from the disk as follows:

Press GET - word illuminates. Press GET five more times until SINGLE SEQUENCE (S)? appears.

Press YES - FILE NAME? S appears. Enter the sequence number.

Now press ESCAPE and then EDIT. You may now type in the number of any bar you wish to visualise and all the notes (EVENTS) played on that bar will appear. For the purposes of working with the EVENT GENERATOR a BAR has the normal musical meaning of one measure of say 4/4 or 3/4 but represents the value of one WAVE 2.2.

(metronome beat!) Thus if you have played the sequence on the WAVE 2.2. with TIMCOR: 1 (that is one note per one metronome beat) then there will on be one row per voice (channel) to be seen on the monitor. However on the WAVE 2.2. you can also play with TIMCOR: 2, 3, 4 and 8, that is up to 2, 3, 4 or 8 notes per metronome beat. Correspondingly there can be up to 8 notes per voice (channel) visualised under any BAR number.

After pressing EDIT and selecting a BAR number there appears the data for this BAR arranged under code names:

EDIT:

BAR No:

0001. In music a bar is normally one measure of say 4/4, or 3/4. When working with the EVENT GENERATOR one BAR has the value of one metronome beat. However, you can decide for yourself what value one metronome beat has. For the purposes of this explanation a BAR has the value of a crotchet (quarter note). All the notes (EVENTS) played on the first metronome beat appear under BAR 0001.

TIME:

TIME determines where a note rhythmically begins! If the note is to begin directly on the metronome beat the number on the left of the sloping line has to be on a 0. The second number, that is the one after the sloping line shows how the first number is to be divided, and normally this number is a 16. Every BAR, that is every metronome beat, can be divided in to as many 16 different parts, every on of which can be programmed. The way in which the BAR is divided is determined by the second number.

Under TIME the notes are listed in their rhythmic order, that means the notes which sound or a played first are also listed first. Triplets are usually shown as semi-quavers (16th notes). More about this later.

GATE:

Here the two numbers indicate the length of a note. The number in front of the comma indicates whole BARS, that is whole beats. The second number indicates eighths of a BAR. The comma is therefore not to be mistaken as a decimal point. Gate lengths ranging from 0,1 to 15,7 are possible.

OCT:

This number indicates the octave register of the notes. The range is from 0-7.

SEM:

The names of the notes can be entered in using the numerical keys. 1=C, 2=D, 3=E, 4=F, 5=G, 6=A, 7=B. To enter up or change the name of a note, first set the cursor over the note-name, then press INPUT and then the corresponding number. The name of the note will illuminate. It is only possible to raise (sharpen) notes and not flatten them, therefore the sign is available next to the 8 on the numerical key 8. Escape from this function is made by pressing 0.

GROUP: Still in development.

UPDAT:

Here the update parameters (00-63) can be written in. The manner of update, corresponding to the update on the WAVE 2.2., can only be written in under UPDATE (to be found in the row of commands after selecting Page 5).

CH:

Used to select one of the 8 sequencer channels for the corresponding EVENT.

0 1 2 3 4 5 6 7 8 9 A B C D E F (Numbers 0, 1, 2 and 3) are still being developed. (16 trigger for EVU (Expansion Voice Unit) or for external devices, such as light effects using an additional interface.)

At the base of the monitor screen there are words which are directly related to the upper row of soft keys.

ESCAPE: To leave this particular program area

LEFT: To move the cursor to the left.

RIGHT: To move the cursor to the right.

NEXT: To move to the next BAR.

LAST: To return to the previous BAR.

INPUT: Is illuminated when making inserts.

COPY: To copy a line move the cursor to this line and press COPY

DELETE: To delete a line move the cursor to this line and press
DELETE

DOWN: To move the cursor downwards.

UP: To move the cursor upwards.

Using the EVENT GENERATOR notes can be added, deleted, mistakes corrected, the length of sequences changed and ... and ... and. Musical ideas can be now realised which were previously only dreams. Sequences can be created which are simply not physically possible to play on a normal keyboard.

5.3.2.1. The BAR - when an EVENT sounds

As already mentioned, in the first BAR all EVENTS are visualised which occur on this BAR (metronome beat). If for example you wish to have rests at the beginning of a sequence you can either give the BARS new numbers (e.g. change BAR 0005 and so on) or you can simply erase the BARS where you require the rests by using the DELETE key. Rests can be made anywhere by simply altering or erasing the BAR numbers correction used. Following the final BAR the end of the sequence is shown by +++++END+++++ which also has its own BAR number. Therefore if a sequence is 16 BARS long, then +++++END+++++ has the number 0017. Should you wish to increase the length of the sequence from 16 BARS to 20 BARS, alter the number at +++++END+++++ to 0021. Then press LAST to return to BAR 0017. Erase this BAR by pressing DELETE. If nothing else is entered in to these BARS, there will be a rest between BAR 0016 and BAR 0020. After completing alterations, press ESCAPE.

Then press TEST. Word will illuminate. Now by pressing PLAY (or RUN:1 on the WAVE 2.2) you can hear the sequence with the changes made. Of course if there is to be a rest at the end of the sequence (as described above) this can only be heard by entering LOOPS on the WAVE 2.2. The sequence will loop exactly four BARS (beats) later. If you wish there to be notes in BARS 0017-0020 it is possible to change an existing BAR number to 0017 then another to 0018 another to 0019 and so on. By doing this the single EVENTS will be automatically under the BAR number of the EVENT you wish to copy. Alter the BAR number to the number where the EVENT is desired. The EVENT will be automatically copied in to the new position. Of course the values of the new (or old) EVENT can be altered as required. If for example you have copied BAR 0005 to BAR 0012 you can either leave bar 0005 as it is or erase it, or change it. To reach BAR 0005 press LAST several times. If you wish to erase BAR 005 (the one you copied to BAR 0012) set the cursor under the BAR number and press DELETE. By using the BAR numbers you can move around a sequence which is long (say 120 BARS) very quickly. To do this, press ESCAPE. Then press EDIT and write in the number of the BAR you wish to access (say 0115).

5.3.1.2. TIME - Determining the Rhythm

With TIME you can determine the exact moment when a note begins but not its length. Values from 0/1 up to 15/16 can be used. When working solely with the WAVE 2.2 either 1, 2, 3, 4 or 8 notes per metronome beat can be played. However, with the EVENT GENERATOR up to 16 notes per BAR (metronome beat) can be used.

The following table can be used as a guide when working with the TIME parameters. The numbers from 1 to 16, set in a vertical line on the right hand side of the table, should be imagined as the possible equal divisions of one BAR. These numbers correspond to the second number shown under TIME.

45

To sum up;

The first number under TIME (the number before the sloping line) shows whether the note is the first, second or third one etc. and the second number (the one after the sloping line) shows in what manner of equal division (rhythmical division) is being used for these notes. One voice in one BAR can be divided in various ways e.g.

0/16 = the first note

2/11 = the third note when dividing by 11

4/8 = the fifth note when dividing by 8

2/3 = the third note when dividing by 3

Do not forget that 0 represents the first note!

5.3.1.3. GATE - Length of Notes

With GATE you can determine how long a note has to be. It must be obvious that the Envelope adjusted on the WAVE 2.2. also plays a big part in this case. For example if you enter in a long GATE on the WAVE TERM and the sound on the WAVE 2.2 has a short percussive GATE, then the sound can not be long. If we assume a BAR (one metronome beat) to be a crotchet (quarter note) a possible BAR division of 16 would result in hemi-demi-semi-quavers (64th notes). However, the GATE length only has a division of 8 corresponding to demi-semi-quavers (32nd notes). On the WAVE 2.2 it is possible to adjust the envelope generators so as to hear notes single or as a kind of glissando.

The number before the sloping line shows the note lengths in whole BARS (metronome beats). 15 is the highest number possible so when one BAR = one crotchet (quarter note) 15 would be equivalent to a length of five 3/4 measures, or three and three quarters of 4/4 measures. The number after the sloping line represents eighths of a BAR (metronome beat).

If we imagine one BAR = one crotchet (quarter note) then we have the following values;

GATE

0,1 = 1/32 note (demi-semi-quaver)

0,2 = 2/32 = 1/16 note (semi-quaver)

0,3 = 3/32 notes (three demi-semi-quavers)

0,4 = 4/32 = 1/8 note (quaver)

etc.

0,7 = 7/32 notes (seven demi-semi-quavers)

7 is the largest number possible after the sloping line because 0,8 would represent eight eights, and would therefore mean the down-beat of the next note.

GATE

1,0 = 1/4 note (crotchet)
 1,4 = 3/8 notes (three quavers)
 2,0 = 2/4 notes (two crotchets)
 etc.

15,7 is the largest number possible, because 15,8 would be the down-beat of the next note.

5.3.1.4. OCT and SEM - Determining Pitch

Pitch and register are determined by SEM (semitone) and OCT (octave).

The values for OCT are from 0-7. The value OCT:7 ranges from the lowest C, to B natural seven notes above. After this follow OCT:1, OCT:2 etc. Of course register is a relative thing dependant on how the WAVE 2.2 is tuned.

SEM is used to enter in the names of the notes. Using the LEFT/RIGHT keys move the cursor under SEM. Then press INPUT. The words at the base of the monitor will disappear. To change or enter in a note name use the numerical keys. 1=C, 2=D, 3=E 4=F, 5=G, 6=A, 7=B. Accidentals that is for these purposes notes are played on black keys (B or E are not possible!) can be entered in with the sign which is available on the 0 numerical key. In other words accidentals can only be shown as raised notes. Flattened notes are not possible! After the corresponding numerical key has been pressed the note names and the sign appear on the monitor screen directly above the soft keys. Should the sign not be required you must press the numerical key twice. However, when entering in note names do not forget to first move the cursor to SEM!

5.3.1.5. UPDATE - Determining Dynamics and Colour

If you have stored a sequence in the WAVE TERM without using the WAVE 2.2's sound update, you will see on the monitor that UPDAT has the value 0. Values can be entered for certain updates on the WAVETERM from 00 - 63, although simply entering these values in the EDIT mode will first have no influence on the colour. Assuming that you are in the EDIT mode, the procedure should be as follows;

Press ESCAPE

Press UPDATE - on the left of the monitor screen will appear the 8 Channel Commands below this those for SPEED, BASETUNE and PROGRAM. Each of the Channel Commands can be given a different parameter. They are;

- 0 = recorded channel
- 3 = off (This means that this channel is playable as an independent voice on the WAVE 2.2. This update is important if it is wished to play live with a sequence used in a PLAY COMMAND.)
- 5 = pitch - positive
- 6 = loudness attenuator (00 is off, 63 is the loudest)
- 7 = filter (32 represents flat response)
- 8 = waves (0 represents flat response)
- 9 = filter attenuation (32 represents flat response)

5.3.1.6. CH - Channel -Channel Commands for the EVENTS

Using the numbers 1 to 8 every EVENT can be directed to any channel of the sequencer. Channels 1, 3, 5 and 7 are controlled by the sound from Group A, and channels 2, 4, 6 and 8 from Group B.

5.3.2. Storing The Updated Sequence

Before finally storing a sequence it would be wise to complete the update parameters on all 8 channels, and also enter in the speed 00-63. (See 5.3.1.5. UPDAT above.) It would also be appropriate to enter in the correct program number at PROGRAM if it is intended to use the sequence in a PLAY COMMAND. Before storing a SINGLE SEQUENCE it is vital that the key TEST be pressed. Storing the completed sequence under an (S) number changes the shown values by recall, however, not the rhythm. (Due to technical reasons the quantisation of the Time Events are expressed differently with (S) than with (E).)

If it is intended to change the sequence in the future, it can be stored using the following procedure;

Press HELP

Press STORE

If it is wished to later work further on the sequence it can be stored under (E) using the following procedure (assuming that you are in UPDATE mode);

Press ESCAPE

Press HELP

Press STORE 4 times - EVENT TABLES (E)

Press YES - FIRE NAME ?: E appears
Enter a number between 000 and 999

A completed sequence should always be stored under (S) and (E). The (S) sequences can be used in PLAY commands. Sequences stored under (S) need less storage space than those stored under (E).

5.3.3. Giving Commands Directly Into The WAVE TERM

It is possible to enter a sequence directly from the WAVE TERM's softkeys, that is without using the WAVE 2.2's keyboard. Enter the correct mode using the following procedure;

Select PAGE 5

Press EDIT

Enter BAR 0001 - BAR 0001 appears with the words and terms
Described in 5.3.1. above.

Enter BAR 0001 again - values appear which can be changed as
required.

When BAR 0001 is complete;

Press ESCAPE

Press EDIT.

Enter BAR 0002 - and so on.

If the sequence is to be 12 BARs (metronome beats) long then +++++END+++++ is selected at BAR 0013 by moving the cursor under TIME and pressing 99 on the numerical keys.

If you wish to hear your sequence with LOOPS (on the WAVE 2.2) then you must be careful that the GATE length in the BAR immediately before +++++END+++++ (in the example BAR 0012) is not longer than the BAR itself. If TIME shows 1/2 then the GATE length may be no longer than 0,4 if LOOPS are required.

If the sequence is to be incorporated into a PLAY COMMAND then it must be completion be transferred first to the WAVE 2.2. Use the following procedure;

Press ESCAPE

Press TEST

Press PLAY (or RUN:1 on the WAVE 2.2.)

Then select UPDATE and enter in values required as described above

Then press ESCAPE

Press TEST

Press PLAY (or RUN:1 on the WAVE 2.2.)

Then the sequence can be stored under (E) and (S) via key HELP.

5.4. SINGLE SEQUENCES

Every sequence stored in the WAVE 2.2. under SEQM:00 can be transferred to the WAVE TERM irrespective of length and number of channels. If it is not intended to work on the sequence with the EVENT GENERATOR it is worth while supplying the sequence with the required number of LOOPS while still in the WAVE 2.2. If the end of the sequence has not been programmed exactly (that is if the soft key RUN/STOP in DISPLAY SELECT on the WAVE 2.2. has not been pressed rhythmically in time) then the sequence will not loop rhythmically.

Tempo (speed) programmed under RECM:0 and SOUND UPDATE will also be stored in the WAVE TERM. When the sequence has been completed on the WAVE 2.2 use the following procedure to store it in the WAVE TERM:

Select Page 5.

Press HELP.

Press STORE four times for (E), six times for (S)

Press YES.

Enter a three-figured number, the first of which must be a 0. (if the sequence is not required for a PLAY COMMAND then any three-figured number is suitable). The sequence is now stored. In this manner up to 100 sequences can be stored on one floppy disk (000-099). If just one SINGLE SEQUENCE is required use the following procedure;

Press HELP

Press GET six times - SINGLE SEQUENCE:(S) appears

Press YES - FILE NAME?:S appears

Enter the number of the sequence.

Press TEST - the sequence will now be transferred to the WAVE 2.2.

Press PLAY (or RUN:1 on the WAVE 2.2.)

5.5. PLAY COMMAND

As described above in 5.4. SINGLE SEQUENCES stored under numbers with 0 as the first figure can be combined with other sequences to form longer pieces as PLAY COMMANDs.

WARNING: If the SINGLE SEQUENCES of a PLAY COMMAND have different programs, these programs must all have the same WAVETABLE number on the WAVE 2.2 if they are to function in a PLAY COMMAND! Select the PLAY COMMAND mode using the following procedure;

Select Page 5 (this must always be done even if in Page 5 otherwise PLAY has simply a run function similar to SINGLE SEQUENCE)

Press PLAY - the following words will appear at the base of the Monitor screen. They refer directly to the upper row of softkeys:

ESCAPE LEFT RIGHT () INPUT SEQUENCE EXECUTE

ESCAPE: To enter other modes and escape from wrong entries.

LEFT: To move the cursor to the left (is only possible when INPUT is not illuminated. Escape by pressing numerical keys)

RIGHT: See LEFT above.

() Used for constructing PLAY COMMANDS. The numbers of the required sequences are entered in the ().

INPUT: Is illuminated when commands are being made.

SEQUENCE: Still in development

EXECUTE: The PLAY COMMAND is loaded into the working storage to Be played via SEQM:00 on the WAVE 2.2.

After pressing PLAY the cursor appears at the top left hand corner of the monitor screen. Give the commands using the following procedure;

Using the numerical keys enter how often the first sequence should repeat. This number must always have two digits. Number range from 01-99.

Then press key () - (appears.

Press SEQUENCE - S appears.

Now enter the number of the required sequence, however, this time leaving off the first 0. If, for example, Sequence 003 is required to repeat four times enter in 04(S 03).

EXAMPLE:

In a PLAY COMMAND you wish to hear Sequence 000 four times, Sequence 001 twice and Sequence 000 twice. The PLAY COMMAND will look like this;

04(S 00) 02(S 01) 02(S 00)

Using this procedure, it is possible to connect many sequences together, and so store them. If a sequence is altered after the PLAY COMMAND has been entered then the altered sequence will be played, therefore altered sequences should possibly be given new numbers.

If you make a mistake when entering up a PLAY COMMAND the cursor can be moved to the left with the LEFT key. When correcting a mistake all the data for the particular sequence must be repeated - even if it was not all incorrect! If, for example, you enter 01(S 04) but decide it should have been S 05, move the cursor back and repeat the whole sequence details: 01(S 05). After this the PLAY COMMAND can be stored as usual;

Press ESCAPE

Press HELP

Press STORE eight times - PLAY COMMAND (P)? appears

Press YES - FILE NUMBER ?: P appears

Enter a number 000-999

When recalling the PLAY COMMAND

Press HELP

Press GET eight times - PLAY COMMAND (P) ? appears

Press YES - FILE NUMBER ?: P appears

Enter the number of the PLAY COMMAND

Press ESCAPE

Press PLAY - the PLAY COMMAND appears

Press EXECUTE - the WAVE TERM loads the PLAY COMMAND into the WAVE 2.2 and then "Ready For Start" illuminates above the PLAY COMMAND.

Select the program for the first sequence in the PLAY COMMAND on the WAVE 2.2. If the various sequences have different programs, they will then be automatically selected by the PLAY COMMAND. However, as mentioned above, it must not be forgotten that different programs must have the same WAVETABLE number on the WAVE 2.2. if they are to function in a PLAY COMMAND!

Press RUN: 1 on the WAVE 2.2.

If you wish to hear the PLAY COMMAND again press EXECUTE again, then RUN:1.

The tempo (speed) of the PLAY COMMANDS will be determined by the stored tempos of the individual SINGLE SEQUENCES, or of course can be adjusted directly on Panel 2 and SEQM: on the WAVE 2.2.

If it is required to hear the PLAY COMMAND either without the stored Programs being selected, or to hear the PLAY COMMAND with a Transient Sound (TRS) press RUN: 5 on the WAVE 2.2.

5.6. EXTENSIONS

5.6.1. COPY

5.6.1.1. The Monitor Screen

With the EDIT key the individual EVENTS described above can be copied to other BARS possibly extending the sequence. Using the COPY key whole parts of a sequence can be copied (duplicated).

After pressing COPY there appears;

```

SOURCE                : FROM BAR No. : 0001
                      TO   BAR No. : 0001

SELECTION             : TIME           : X
                      OCTAVE          : X
                      SEMITONE        : C
                      GROUP           : X
                      CHANNEL          : X
                      TRIGGER          : X

DESTINATION           : FROM BAR No. : 0001
                      TO   BAR No. : 0001

MODIFICATION          : TIME           : X
                      OCTAVE          : X
                      SEMITONE        : C
                      GROUP           : X
                      CHANNEL          : X
                      TRIGGER          : X

```

At the base of the monitor screen appear the following words which refer directly to the upper row of softkeys;

ESCAPE TIME OCTAVE SEMITON BAR No. GROUP TRIGGER EXECUTE HELP

They have the following use:

```

ESCAPE      : To escape from the COPY mode.

TIME        : To enter in when a note should start.

OCTAVE      : To determine the register.

SEMITONE    : To determine the pitch.

```

BAR No. : To enter in the BAR number (DESTINATION OR SOURCE)
GROUP : Still in development.
TRIGGER : Still in development.
EXECUTE : To carry out commands.
HELP : To call up the HELP page.

5.6.1.2. USE - AN EXAMPLE

When for example you have a sequence 4 BARS long and wish to extend it to 16 BARS proceed as follows:

Select Page 5

Press HELP

SELECT the sequence you need using GET.

Press ESCAPE.

Using the key EDIT change the BAR number at +++++END+++++ (in our example 0005) to 0016. Using the last key return to bar 0005 and erase it with DELETE.

Press ESCAPE

Press COPY

Press BAR No. - the cursor appears in the area DESTINATION. Enter here the numbers from BAR No. 0005 to BAR No. 0016. The source for these BARS are BARS 0001-0004. So proceed further:

Press BAR no. cursor now appears at SOURCE.

Enter in from BAR No. 0001 to BAR No. 0004

Press EXECUTE.

The sequence is now 16 BARS long.

5.6.1.3. SELECTION

In a similar way also parts of bars can be copied. Using SELECTION and MODIFICATION parts of BARS can be transferred to other parts of a sequence.

Example:

You must have an 8 channel sequence (BARS 0001 - 0016) from which the notes from Channel 2 (which always start directly on the down beat) have to be copied to BARS 0017-0032

(1) DESTINATION

Press BAR No. - the cursor appears at DESTINATION.

Enter the numbers 0017 and 0032.

Press CHANNEL - enter in 2.

Press TIME - enter in e.g. 00/02

(2) SOURCE

Press BAR No. - cursor appears at SOURCE.

Enter in BAR Nos. 0001 and 0016.

Press CHANNEL - enter in 2.

Press TIME - enter in e.g. 00/02, 04, 08

(the second number must be identical to the one in the sequence)

5.6.2. DELETE

Similar to the COPY procedure at 5.6.1.2. passages can also be erased using DELETE.

EXCITING NEW SOFTWARE FOR PAGE 3 ON THE PPG WAVE-TERM !

- 1) Using Page 3 it is now possible to reverse Transient Sounds and also to store them in this manner under new T numbers.
- 2) A further exciting addition also provides the possibility of merging two Transient Sounds together, not only laying one directly on top of the other, but joining them in such a way that they form a complete unbroken acoustic event.
- 3) Using Page 4 the Transient Sounds required to be manipulated on Page 3 can be provided with all manner of loudness envelopes resulting in rich and abundant new acoustical experiences.

Explanation of Use
-----Notes to No.(1) above

The function key MERGE has two uses:

- a) To merge two Transient Sounds together. To fulfill this function, one Transient Sound must already be on Page 3 and the second Transient Sound must then be called up from disk. The result of merging two Transient Sounds can be seen on Page 3 and immediately heard on the WAVE 2.2. The two Transient Sounds used can, however, be previously treated on Page 4 providing them with different loudness values and/or contours which obviously creatively enhance the resulting sound mixture.
- b) To load a Transient Sound in reverse. This sound must however be first available on floppy disk.

Use the following procedure:

Enter the HELP page by pressing HELP.

Press MERGE - "Merge second Transient Sound from Disk with sound on Page 3?" appears.

Press YES - TRANSIENT SOUND (T)? appears.

Press YES - Enter in the number of the Transient Sound you require

Press ESCAPE to see the result

Do not forget that in order to fulfill this function the first Transient Sound must already be on Page 3!

Notes To No.(2) above

Use the following procedure:

Enter the HELP page by pressing HELP.

Press MERGE - "Merge second Transient Sound from disk with sound on Page 3?" appears.

Press MERGE a second time - "Load Transient Sound reversed into Page 3 memory?" appears

Press YES - TRANSIENT SOUND (T)? appears

Press YES - Enter in the number of the Transient Sound you require

Press ESCAPE to see the result Press a key on the WAVE 2.2. to hear the result!

It is, however, possible to also use half Transient Sounds (stored under LOWEVER WAVETABLE (L) number) combining them with full Transient Sounds for both functions described above (for assistance see the WAVE-TERM Owners Manual 3.3.2.)

Notes to (3) above

Use the following procedure:

Call up the Transient Sound you wish to manipulate on Page 3.

Enter Page 4.

The representation seen on Page 3 is displayed on Page 4. It is possible to display enlarged representations of the Transient Sound waveform on Page 4 which can be used as a source for the modulation. Should the not be required press ERASE.

Draw the curve you require as described in the WAVE-TERM Owners Manual at 4.4. This curve then functions as a loudness envelope to the Transient Sound on Page 3.

Press SHAPE - the resulting shape appears on PAGE 3.