04 MIDI CHANNEL

Related Functions

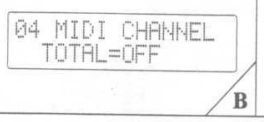
Parameters	O/S	EDIT—PAGE—CURSOR—VALUE

CHANNEL = 1 ~ 16
TOTAL = ON / OFF

Domain

Mode	Normal	Combination 4 mix/split 8 mix	Operation memory	Multi channel
K	GLOBAL			
G				
W				

A



B

The MIDI CHANNEL parameter is used to specify the MIDI channel on which the VZ will receive and transmit MIDI messages.

It is possible to program separate MIDI channels for each operational mode (NORMAL, COMBI, OP MEM and MULTI CH). This is accomplished by first selecting the desired mode, and then setting this parameter.

Notice that there are two parameters the "CHANNEL" parameter and the "TOTAL" parameter.

When the TOTAL parameter is set to "ON", the MIDI receive channel in all modes are affected by the channel set in the "CHANNEL" parameter, with the exception of the MULTI CH mode or operation memories using the MULTI CH mode.
To switch between the two parameters, use the cursor keys. The value keys can be used to raise or lower the CHANNEL number and change the TOTAL parameter setting.

05 MIDI DATA

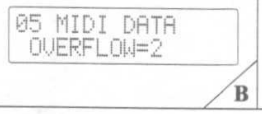
Related Functions

Parameters	O/S	EDIT—PAGE—CURSOR—VALUE

PROGRAM = 0 – 127 / 0 – 63 / DIS
EXCLUSIVE = ENA / DIS
DEF CONTROL = OFF / 12 ~ 31
VOLUME = ENA / DIS
OVERFLOW = NORMAL 1 ~ 8

Domain

Mode	Normal	Combination 4 mix/split	Combination 8 mix	Operation memory	Multi channel
K	GLOBAL				
G					
W					



The parameters in this function are used to specify a variety of MIDI-related data (with the exception of the MIDI Channel).

The PROGRAM NO parameter lets you choose the MIDI PROGRAM CHANGE message number. Note that messages are distributed as shown in the chart below. You can choose from DIS, 0 ~ 63, and 0 ~ 127 settings with the VALUE controls.

0 ~ 63: The unit receives messages 0 ~ 63 in the selected memory area (PRESET 1, PRESET 2, INTERNAL, CARD 1 or CARD 2).

0 ~ 127: The unit receives messages 0 ~ 63 in INTERNAL areas A1 through H8. 64 ~ 127 are received as CARD 1. However, if INTERNAL is selected on the receiving unit, 64 ~ 127 are received in the memory area which is selected in MIDI EXCLUSIVE function.
When power is turned ON, memory area is set to CARD 1 (set to "INTERNAL" when no card is inserted).

DIS: Program data is not received.

The EXCLUSIVE parameter lets you choose whether or not sound or operation data or multi-channel mode data is transmitted / received according to MIDI System Exclusive messages. When it is set to ENA (enable), MIDI communication can be controlled through these messages.

The DEF CONTROL (control number) parameter is used to specify the Control Change number of messages controlled by MIDI Control change No. 12 ~ 31 messages (see EFFECT-05 "DEF CONTROL"). When set to OFF, MIDI OUT / IN messages are not transmitted.

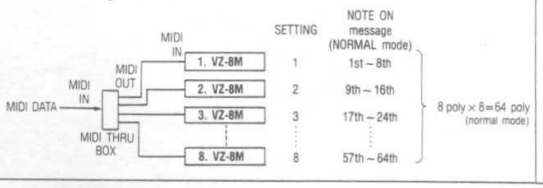
The VOLUME parameter can be used to specify whether or not the unit will transmit and receive MIDI Volume messages (control change 07). When set to ENA (enable), the Master volume level can be controlled by MIDI messages from an external device. When set to DIS (disable), the Master volume is independent of external control.
In addition, MIDI Volume messages are not output when set to DIS.

A Channel on which Master volume data is received in respective performance modes is shown below.

performance mode	channel received
K/W mode	Channel which receives NOTE ON.
G mode	Primary channel which receives NOTE ON.
MULTI CH mode (including Operation memory with MULTI CH)	Channel set in TOTAL-04 "MIDI CH" function.

Overflow Mode — NORMAL 1 ~ 8

The overflow mode allows programming so that no sound is produced until a specific MIDI IN NOTE ON message number is received. When set to NORMAL, sound is produced from the reception of the first NOTE ON message, with the last note played having priority.
When the OVERFLOW MODE is set to "1", sound is also produced from the reception of the first NOTE ON message, with the note previously played having priority.
When set to "2", sound is produced only from the reception of the first NOTE ON message which exceeds the polyphonic limit of the device presently sounding.
When set to "3", sound is produced only from the reception of the first NOTE ON message which exceeds a value which is twice the polyphonic limit of the device presently sounding.
In this way, multiple VZ-8M's can be linked to create up to 64-note polyphony, with the first VZ-8M covering NOTE ON messages 1 through 8, the second covering messages 9 through 16, etc., as shown below.
NOTE: The settings (MODE, operation data and voice data etc.) must be the same for all VZ-8M units when used in this configuration.

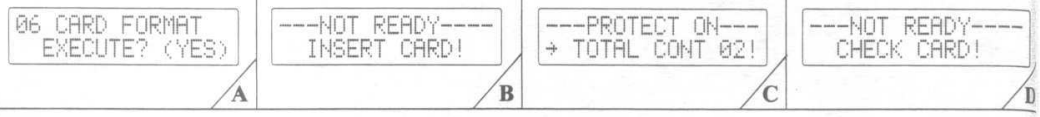


06 CARD FORMAT

Related Functions
TOTAL—01

Parameters	O/S	EDIT—PAGE—CURSOR—VALUE

	Domain				
	Mode	Normal	Combination 4 mix/split 8 mix	Operation memory	Multi channel
EXECUTE? (YES) PUSH YES KEY	K	GLOBAL			
	G				
	W				



This is a utility function which is used to "FORMAT" the accessory RAM card. Before you can store information in RAM cards, you must "initialize" them into a format that the VZ understands.

By executing the FORMAT command, all former contents are erased from the card, and it is prepared to receive fresh sound data. When the RAM card is formatted, it is automatically programmed with the 64 preset (1) patches and 64 preset (1) operation memories.

After inserting the card you want to format in to the card slot, you simply access this function's EXECUTE parameter. A "YES?" prompt will appear on the display (FIG-A). To execute formatting, press the YES key.

If you try to execute formatting without first inserting a RAM card, the display will appear as in FIG-B. First insert the card and try again!

If you try to execute formatting when the memory protect function (TOTAL-02) is ON, the display will appear as in FIG-C. First turn this function OFF, and try again!

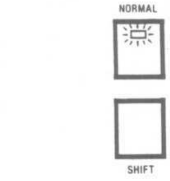
If you try to execute formatting when an optional ROM (not "RAM" but "ROM") card is inserted in the card slot, the display will appear as in FIG-D. There is no need to format ROM cards.

To abort execution of this function, press the MODE key or PAGE key.

Performance/Editing in the Normal Mode

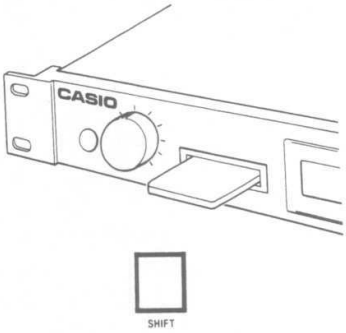
To select sounds for performance in the normal mode

①Press the NORMAL mode key.



②If you want to choose a **PRESET** or an **INTERNAL** patch, select by using the SHIFT key.

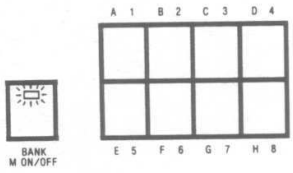
If you want to choose a **CARD** patch, first insert the RAM or ROM card in the card slot and then select by using the SHIFT key.



Each bank holds up to 64 patches and 64 operation memories.

When using a new RAM card, you must first format it (see TOTAL-06). A formatted RAM card is capable of storing up to 64 patches and 64 operation memories.

③Select the patch you want to play.
In order to change the BANK, first press the BANK key (indicator lights). Next press the PROG NO key corresponding to the BANK "letter" you want to choose. (For example, the "B2" key corresponds to the "B" bank.) Notice that the BANK key indicator goes out as soon as you select a bank.
Finally, select the voice number by pressing a PROG NO key once again. In this case, the keys correspond to the numbers digit. (For example, the "B2" key would now correspond to voice number "2".)



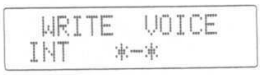
④Select the performance mode (Keyboard, Guitar or Wind) by pressing the value keys.

To write a single patch to memory

①Select the patch you want to write to memory (preset, internal or card patch or Compare/Recall ON/OFF) and select one of the performance modes (K, G, W).

②Hold down the WRITE key.

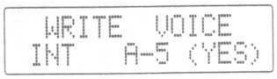
The LCD appears as shown at the right, and the INTERNAL/CARD indicators go out. If you release the WRITE key, the LCD will return to its normal status.



If you've used the COMPARE/RECALL function when editing a patch using VOICE PARAMETER menu functions, be sure that the COMPARE/RECALL indicator is ON. If it is OFF, press the COMPARE/RECALL key.

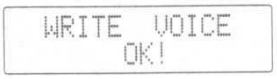
If the COMPARE/RECALL key is pressed in the NORMAL play sub-mode, the EDIT key indicator also comes ON. If you want to enter the play sub-mode once again to write sounds to memory, you must first press either the NORMAL key or EDIT key so that the EDIT key indicator goes out.

③ While still holding down the WRITE key, select the memory to which you want to write the patch. This is accomplished by pressing the SHIFT key and PROG NO keys. Next, press the YES key.



When using the PROG NO keys, first press a key corresponding to the bank (A1 key for "A" bank, for example) and then press a key corresponding to the voice number (F6 key for "6", for example).

When writing is completed successfully, an "OK!" message appears on the display.

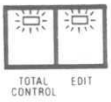


If the memory protect function (TOTAL-02) is ON, writing will be impossible. In this case, you must first turn the protect function OFF by accessing TOTAL-02, reenter the PLAY mode and perform write operations again.

For information on writing patch data to the OPERATION MEMORY, see "Performance/Editing in the Operation Memory Mode."

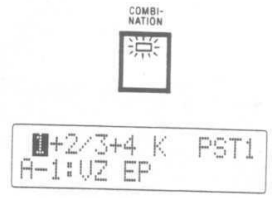
To edit a single patch

To edit a single patch in the NORMAL mode, simply press the MENU selector (EDIT/PAGE key or TOTAL CONTROL key) corresponding to the function which you want to edit, and access the function. For further data on MENUs, FUNCTIONs and PARAMETERs, refer to " Operating System Controls".



To specify KEY ASSIGN configurations

①After entering the Combination PLAY sub-mode, you can select from one of 8 different "KEY ASSIGN" configurations by pressing the VALUE keys. When the VALUE keys are pressed, key assign configurations change cyclically.



KEY ASSIGN CONFIGURATIONS

( ) .... polyphonic

DISPLAY \ OUT	MIX OUTPUT	LINE OUT***	
		1	2
1+2 *	1+2	1 (4)	2 (4)
3+4 *	3+4	3 (4)	4 (4)
1+2+3+4 **	1+2+3+4	1+2 (2)	3+4 (2)
1/3	1/3	1 (4)	3 (4)
1/3+4	1/3+4	1 (4)	3+4 (2)
1+2/3	1+2/3	1+2 (2)	3 (4)
1+2/3+4	1+2/3+4	1+2 (2)	3+4 (2)
1/2/3/4	1/2/3/4	1/2 (2/2)	3/4 (2/2)
12345678	1+2+3+4+5+6+7+8	1+2+3+4 (1)	5+6+7+8 (1)

* Note that when cross-fade is used, each sound features 4-note polyphony and you can use as many as 8 notes simultaneously.

** Note that when cross-fade is used, each sound features 2-note polyphony and you can use as many as 8 notes simultaneously.

*** LINE OUT 1/2 is set for the time being according to EFFECT-09 setting.

To select patches in a combined sound

①After entering the Combination PLAY sub-mode, move the CURSOR to any patch position.

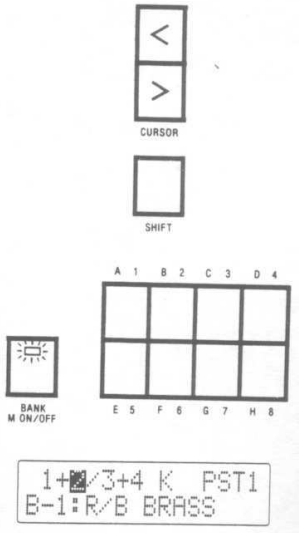
②In order to choose a PRESET or INTERNAL patch, you must first press the SHIFT key.

If you want to choose a **CARD** patch, first insert the RAM or ROM card in the card slot and then select by using the SHIFT key.

③Select the patch you want to play.

In order to change the BANK, first press the BANK key (indicator lights). Next press the PROG NO key corresponding to the BANK "letter" you want to choose. (For example, the "B2" key corresponds to the "B" bank.) Notice that the BANK key indicator goes out as soon as you select a bank.
Finally, select the voice number by pressing a PROG NO key once again. In this case, the keys correspond to the numbers digit. (For example, the "A1" key would now correspond to voice number "1".)

You can view the patch name by moving the KEY ASSIGN position using the cursor keys.

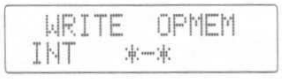


④Move the cursor to the right to select the performance mode (Keyboard, Guitar or Wind). Performance mode can be selected by pressing the VALUE keys.

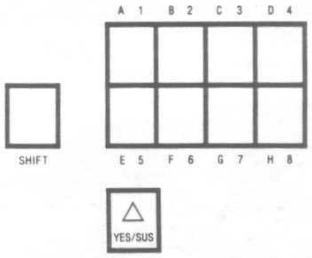
To write Combination data to the OPERATION MEMORY

①Select the COMBINATION mode and edit your combined sound until you are satisfied. Then press the COMBINATION key to enter the PLAY sub-mode and select one of the performance modes (K, G, W).

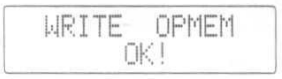
②Hold down the WRITE key.



③While still holding down the WRITE key, select the memory to which you want to write the patch (the SHIFT key, followed by PROG NO keys), then, press the YES key.

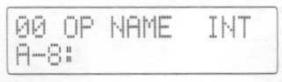


When writing is completed successfully, an "OK!" message appears on the display.



If the memory protect function (TOTAL-02) is ON, writing will be impossible. In this case, you must first turn the protect function OFF by accessing TOTAL-02, reenter the PLAY mode and perform write operations again. Also, it is impossible to write to the Operation Memory when the COMPARE/RECALL function is ON, regardless of the selected key assign setting. For example, if COMPARE/RECALL function is set to ON for key assignment "3+4", it will be impossible to write when 1+2 is selected as well. If "C/R ON CHECK VOICE NO.!" messages are displayed, be sure to turn the COMPARE/RECALL function OFF for all patches.
Note that writing to the operation memory must be performed in the PLAY sub-mode.

④Once you've completed writing combined sound data to the operation memory, you can give it a name by using the OPERATION NAME function in OPE EFFECT-00. (After assigning a name, you must rewrite the sound again to the Operation Memory.)



Performance/Editing in the Operation Memory Mode

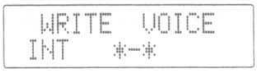
The OPERATION MEMORY mode can be used to store effect and sound data from up to 64 sounds (patches or combined sounds) from the VZ-8M internal memory or card memory.

To copy data from the Normal Mode memory into the Operation Memory

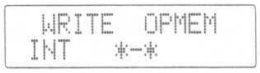
①After entering the Normal Mode, select the Play sub-mode by pressing the NORMAL key.

②Select the patch you want to use, as well as the desired performance mode (K, G, or W).

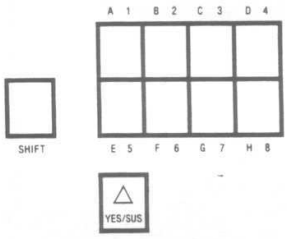
③Hold down the WRITE key. The display appears as shown on the right.



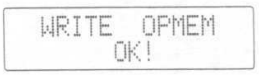
④Press the OPERATION MEMORY key.



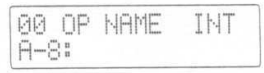
⑤While still holding down the WRITE key, select the patch you want to WRITE by first pressing the SHIFT key, and then pressing the PROG NO key. Finally, press the YES key.



When writing is completed successfully, an "OK !" message appears on the display.

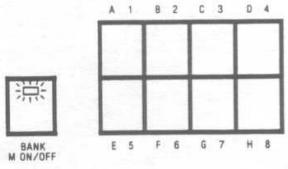


⑥Once you've completed writing combined sound data to the operation memory, you can give it a name by using the OPERATION NAME function in OPE EFFECT-00. (After assigning a name, you must re-write the sound again to the Operation Memory. The OPERATION NAME function can only be set while in the OPERATION MEMORY mode.)



To write operation memory data from one operation memory to another

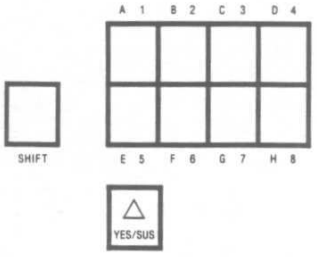
①After entering the Operation Memory Mode, select the operation you want to transfer by pressing the BANK key and a PROG NO key.



②Hold down the WRITE key.

③Select the operation memory you want to transfer the selected operation memory to by pressing the PROG NO keys, then, press the YES key.

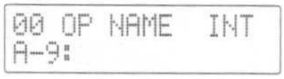
When writing is completed successfully, an "OK !" message appears on the display.



④Once you've completed transferring the operation memory data, you can give it another name by using the OPERATION NAME function in OPE EFFECT-00. (After assigning a name, you must re-write the sound again to the Operation Memory).

If the memory protect function (TOTAL-02) is ON, writing will be impossible. In this case, you must first turn the protect function OFF by accessing TOTAL-02, reenter the PLAY mode and perform write operations again.

Note that writing to the operation memory must be performed in the PLAY sub-mode.

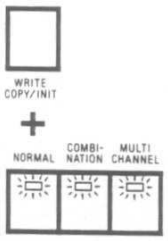


To edit sound, effect data and MIDI setting data you've already written, preset sounds or sounds from RAM or ROM cards

You must first move the sounds of the selected Operation Memory back to the COMBINATION, NORMAL or MULTI CH MODE memory.

①While in the Operation Memory mode, select the patch that you wish to edit.

②Hold down the WRITE key and press the COMBINATION key, NORMAL key or MULTI CH key (whichever indicator is lit).



This will write the Operation back into the combination buffer so you can access all of the functions (except for OPE EFFECT-00 and 01) to re-edit your combination or normal sound — months or even years after you originally created it!

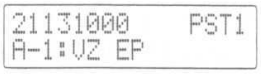
③When you've finished editing the sound, re-write it using normal write operations.

Performance/Editing in the Multi Channel Mode

The Multi channel mode can be used to receive or send through up to 8 MIDI channels.
This MULTI CHANNEL mode differs from the normal MIDI Performance MODEs (MIDI mode 4 (OMNI/OFF, MONO), etc.).

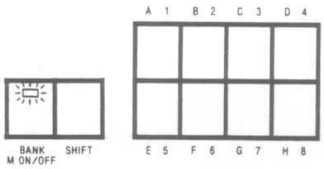
To assign a patch to a specific AREA

①After entering the Multi Channel mode by pressing the Multi Channel key, specify the AREA in which you want to assign a patch by pressing the cursor and VALUE keys.



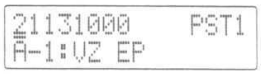
Note there are 8 digits at the top left-hand corner of the display. These digits correspond to memory AREAs 1 through 8, from left to right. The value of each digit indicates the polyphony of the corresponding area. Note that as the VZ-8M features 8-note polyphonic performance, the sum of these digits can be no higher than 8.

②Specify the patch to be assigned by pressing the SHIFT key, the BANK key and the PROG NO key.

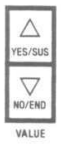


To specify polyphony for a specific AREA

①After entering the Multi Channel mode by pressing the Multi Channel key, specify the AREA in which you want to specify polyphony by pressing the cursor keys.



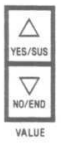
②Specify polyphony for the selected AREA with the value controls. (Note that if this value does not change, you may have to lower the polyphony level for another area, as the maximum sum polyphony totals 8 notes for AREA 1~8.)



To alter volume level for a specific AREA

①After entering the Multi Channel mode by pressing the Multi Channel key, specify the AREA for which you want to alter the output volume level by accessing EFFECT-10.

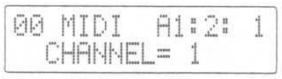
②Lower or raise the relative volume level with the value controls. (Note that at a maximum level of "99," the volume is equal to that as controlled with the master volume on the front panel.)



To specify a MIDI channel for a specific AREA

①After entering the Multi Channel mode by pressing the Multi Channel key, specify the AREA for which you want to set the MIDI channel number by accessing EFFECT-00.

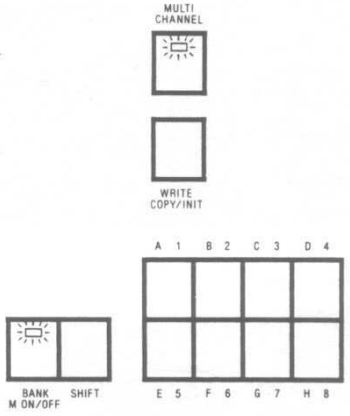
②Specify the MIDI channel with the value controls.



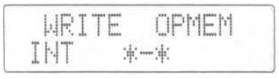
Note that these settings are made for each AREA individually. You can change the selected AREA number at any point in editing by pressing the Multi Area keys.

To write MULTI CH data to the OPERATION MEMORY

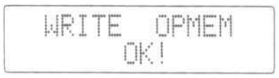
①Select the MULTI CH mode and edit multi-channel data until you are satisfied. When you're finished editing, press the MULTI CH mode key to enter the PLAY mode.



②Hold down the WRITE key.

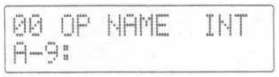


③While holding down the WRITE key, select the memory to which you want to write the patch (SHIFT key, followed by PROG NO keys A1 ~ H8). Then, press the YES key.
When writing is completed successfully, an "OK!" message appears on the display.



If the memory protect function (TOTAL-02) is ON, writing will be impossible. In this case, you must first turn the protect function OFF by accessing TOTAL-02, reenter the PLAY mode and perform write operations again.

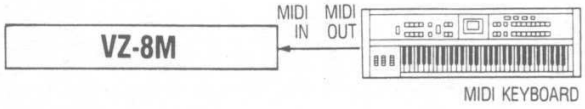
④Once you've completed writing the MULTI CH data to the operation memory, you can give it a name by using the OPERATION NAME function (OPE EFFECT-00). After assigning a name you must re-write the data again to the Operation Memory.



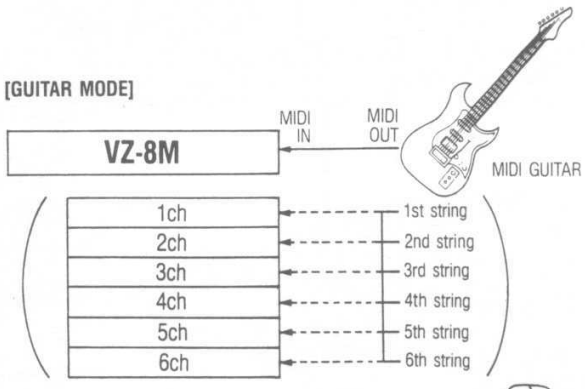
MIDI — Musical Instrument Digital Interface

This Digital Synthesizer module is equipped with MIDI — the Musical Instrument Digital Interface. To play using the module's sounds, you must connect the unit to other MIDI-equipped electronic musical instruments, drum, rhythm machines, sequencers or even personal computers through MIDI terminals.

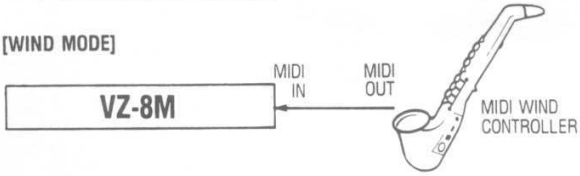
[KEYBOARD MODE]

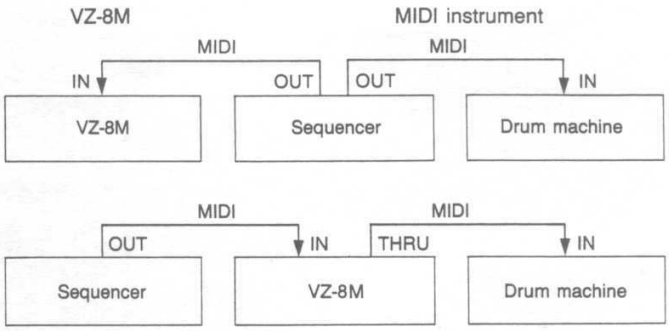


[GUITAR MODE]



[WIND MODE]





MIDI-related settings are made using the MIDI CHANNEL and MIDI DATA functions found in TOTAL-04, 05. For details on how to set MIDI-related parameters, refer to the corresponding function indexes.

STANDARD COMMUNICATION DATA

MODES / MIDI MESSAGES	OP. MEM		NORMAL		COMBI		MUL. CH	
	SEND	RECEIVE	SEND	RECEIVE	SEND	RECEIVE	SEND	RECEIVE
Key pitch, Note ON/OFF, Velocity		○		○		○		○
After touch		○		○		○		○
Pitch bend		○		○		○		○
Definable wheel		○		○		○		○
Modulation wheel		○		○		○		○
Foot VR		○		○		○		○
Main volume		○		○		○		○
Portamento time		○		○		○		○
Portamento ON/OFF		○		○		○		○
Sustain pedal		○		○		○		○
Bend range		○		○		○		○
Program change (*1)		○		○		○		○
Mono mode (SOLO = ON)		○		○		○		○
Poly mode (SOLO = OFF)		○		○		○		○

*1: When PROG CHANGE = DIS is set in TOTAL-04, program change data is not transmitted/received.

SYSTEM EXCLUSIVE MESSAGES

MODES / MIDI MESSAGES	OP. MEM		NORMAL		COMBI		MUL. CH	
	SEND	RECEIVE	SEND	RECEIVE	SEND	RECEIVE	SEND	RECEIVE
Single patch data (*1)			○	○				
Single operation data (*2)	○	○		○		○		○
Multi Channel data (*3)								○
SAVE/LOAD data	○	○	○	○	○	○	○	○
Master tune data		○		○		○		○
Key transpose data		○		○		○		○
Mode change data 1 (*4)		○		○		○		○
Mode change data 2 (*5)				○		○		
Shift change data (*6)		○		○		○		○
Bend range data		○		○		○		○

(*1) Single patch data sent when sound number is changed using VZ-8M controls in NORMAL PLAY MODE, or when SEND REQUEST MESSAGE is received.
Single operation data sent when operation number is changed using VZ-8M controls in OP MEM PLAY MODE, or when SEND REQUEST MESSAGE is received. In individual modes, operation data created in corresponding mode is received; when set to NORMAL MODE, operation data created in NORMAL MODE is received. When set to COMBI MODE, operation data created in COMBI MODE is received, etc.
Above data transmission/reception is impossible if TOTAL CONTROL "EXCLUSIVE" parameter (TOTAL-05) is disabled (set to DIS).

(*2) Transmission/reception is impossible if TOTAL CONTROL "EXCLUSIVE" parameter (TOTAL-05) is disabled (set to DIS).

(*3) Can only be executed in TOTAL CONTROL MODE. Transmission/reception is impossible if TOTAL CONTROL "EXCLUSIVE" parameter (TOTAL-05) is disabled (set to DIS).

(*4) MODE CHANGE-1 is used to switch between NORMAL, COMBI, MULTI CH, and OP MEM modes.

(*5) MODE CHANGE-2 is used to switch between K (Keyboard), G (Guitar), and W (Wind) performance modes.

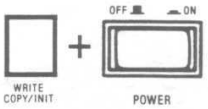
(*6) Transmission/reception is impossible if TOTAL CONTROL "PRG NO" parameter (TOTAL-05) is disabled (set to DIS).

Initializing the VZ-8M

The VZ-8M can be "initialized" in a number of ways, allowing you to reset the entire unit to its initial factory settings or initialize only the data of a specific MODE or FUNCTION, for example. The following describes the various initializing procedures.

SYSTEM ALL INITIALIZE

To initialize **all** internal operation memory, voice and effect data to factory preset values, hold down the WRITE key and turn the unit power ON. All internal data is reset to its original state as listed on page 93.



INITIALIZING VOICE menu FUNCTIONS

To initialize **all parameters** in any **single** VOICE menu function for a selected MODULE, simply press the EDIT key and the PAGE DOWN key and use the PAGE keys to select the desired function. Then hold down the WRITE (COPY/INITIALIZE) key and respond to the prompt by pressing the YES key.
The values of all parameters in the selected function are then reset to their initialized state (see page 94). Parameter values in other functions, however, remain unaffected.

VOICE-00 LINE (M1M2-M7M8)
When this parameter is initialized, LINE DATA of all modules (M1-M8) are initialized automatically.

VOICE-09 ENVELOPE (DCA)
When this parameter is initialized, the data of not only VOICE-09 but AMP VEL RATE in VOICE-19 is automatically initialized.

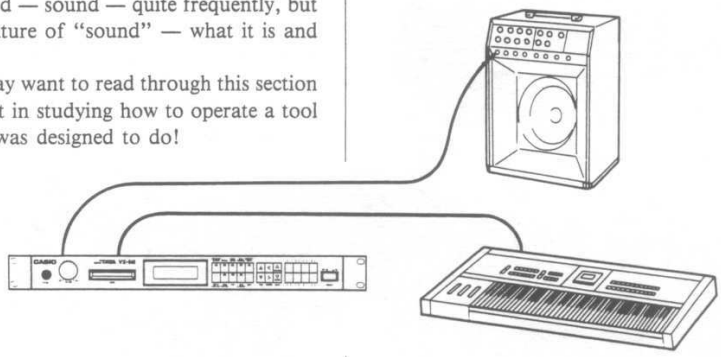
VOICE-03 ENVELOPE (DCO)
When this parameter is initialized, the data of not only VOICE-03 but PITCH VEL RATE in VOICE-18 is automatically initialized.

EFFECT MENU INITIALIZED DATA

PRESET 1 operation memories H-6 throgh H-8 contain initialized data for the EFFECT MENU NORMAL mode, COMBI MODE and MULTI CH mode, respectively. (See page 96～98.)

VZ Sound Seminar: The elements of sound synthesis

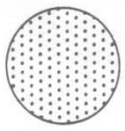
As a "sound synthesizer," your synth module is a device used to create "sounds". You probably use this word — sound — quite frequently, but did you ever actually think about nature of "sound" — what it is and how it is generated?
Before diving into operations, you may want to read through this section carefully — after all, there's no point in studying how to operate a tool without first understanding what it was designed to do!



SOUND: A product of air?

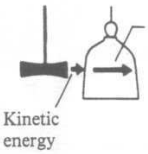
Each day, we hear a great variety of sounds — music, human voices, raindrops — even our own footsteps. In other words, we live our lives literally surrounded by sound. Naturally, we can't see sound — so how can we describe it?
Technically speaking, sound is the sensation that we experience when movement or vibrations in the air are detected by our ears.
As a practical example, let's see how the "sound" of a bell is produced, and how it is sensed by our ears.

If we were to examine a mass of air where no sound is being carried, we would find that air particle density is relatively uniform. Naturally, there would be some movement of air particles, but there wouldn't be enough to generate an audible "sound". For this example, we will strike a bell with a hammer, in such a "sound-free" environment.



Normal air

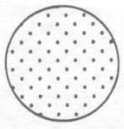
When kinetic (motive) energy is applied to a bell with a hammer, the bell surface is temporarily "deformed" — in other words, the shape of the bell structure is temporarily changed. Energy then goes to work to restore the bell to its original shape — this is called vibration. When the bell surface vibrates, two different — but interrelated — phenomena occur.



Vibrational energy

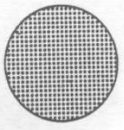
Kinetic energy

When the surface of the bell is "stretched in" (as bell is struck), random air particles surrounding the bell suddenly occupy a much larger air space than normal — in other words, the air suddenly becomes less dense immediately around the bell's surface. This is known as "**rarefaction**." In simple terms, **rarefied** air is air with low atmospheric pressure, or less density than the surrounding air mass.



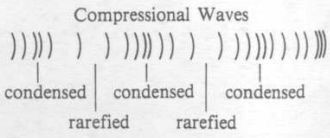
Rarefied air

Immediately after the bell's surface is "stretched" by the hammer, the tension of the bell's surface causes it to spring outwards. This causes the same air particles which were just rarefied to become **compressed**. In simple terms, the air mass around the bell which was low in atmospheric pressure suddenly becomes high in atmospheric pressure.

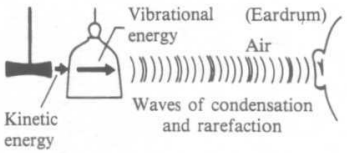


Condensed air

The surface of the bell will then continue to oscillate back and forth until it settles back into its original shape.



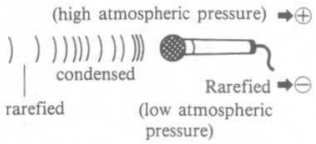
As you might imagine, the cyclical changes in air pressure caused by the oscillation of the bell's surface produced what are known as "**compressional waves.**" These waves of air pressure cause our eardrums to vibrate, and nerves in the inner ear translate these vibrations into "sound."

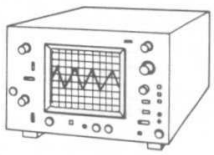


Naturally, the type of vibration produced is dependent on a great number of factors — as the vibrating body differs so will the vibrations, and so will the sound.

Seeing Sounds With Our Eyes: Waveforms

As we discussed in the introduction to this sound seminar, sounds cannot actually be seen with the human eye. However you've probably heard such expressions as "the waveform is different" "this is almost a pure sine wave," with regards to sound. But what exactly is meant by these terms — waveform and wave — and how can they be observed?





Oscilloscope

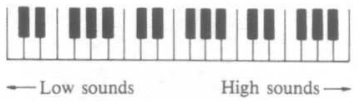
For a moment, let's consider the how a microphone works. As you probably already know, a microphone converts compressional waves into electrical signals, which can then be transmitted to an amplifier and speakers for output as sound. As shown in the illustration, these electrical signals are simple conversions of compressional waves — with condensed air being output as positive (+) electrical charges and rarefied air being output as negative (−) charges. The **compressional waves** of air are, then, transformed into electrical "waves", which can be viewed on electronic devices such as **oscilloscopes**. These waves are cyclical, and their form over time produces a visible shape or form which is called — you guessed it, a **waveform**.

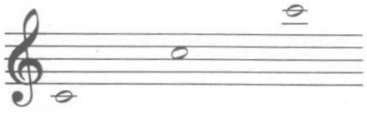
The Three Basic Elements of Sound

When we hear an individual sound, it can be defined by considering three different parameters; **Pitch**, **Timbre** and **Amplitude** (loudness).

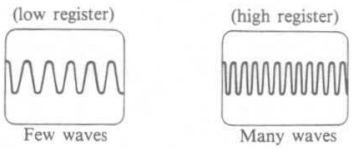
ELEMENT 1: PITCH

Pitch is the quality of a sound which makes it seem higher or lower than other sounds. For example, the notes at the top or right-hand end of a keyboard are "higher in pitch" than those at the left-hand end.
The pitch of a note is determined by the rate at which vibrations are set up in the air particles — i.e. the rate at which cyclical compression and rarefaction takes place.

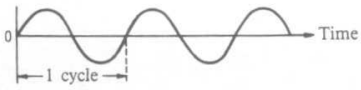




If we convert sounds into electrical signals and look at them on an oscilloscope, we can see that the number of waves per time unit differ between "high-pitched" and "low-pitched" sounds.

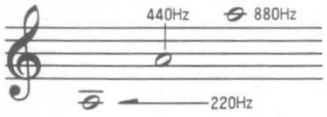


For a moment, let's go back to our bell example. As the bell produces compressions and rarefactions at a fixed rate, waves of particle vibrations are generated in the air surrounding the bell. These waves move away from the fork at a fixed rate — the speed of sound. As waves move away from our sound source (the bell) at a fixed rate, the length of each wave depends on the rate at which the bell's surface vibrates. A single cycle of a sine wave is shown on the right.



The distance that a wave covers in the time it takes to complete one cycle is known as the "**wavelength**," while the number of cycles that are made each second is known as the "**frequency**."

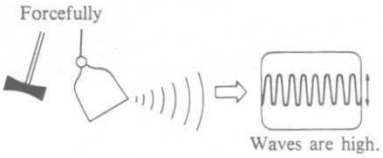
How does all this relate to pitch? Very simple — **the higher the frequency of a sound, the higher the pitch**. A low frequency sound will have a long waveform and a low pitch, while a high frequency sound will have a shorter waveform and a higher pitch. In the world of science (and music!), frequency is measured in units called "Hertz" (Hz). For example, 100Hz indicates that vibrations occur at the frequency of 100 times per second. Also, it's interesting to note that doubling the frequency of a sound will raise it by one octave.



Well, that explains the length and speed of our "wave", but what about its height? Aha! The next element of sound — amplitude....

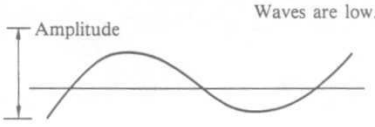
ELEMENT 2: Amplitude

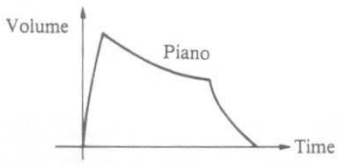
Compared with pitch, amplitude (loudness) is very easy to understand. If we consider the sine wave produced by our bell again, the harder the bell is hit by the hammer, the larger the bell vibrations and the more the air particles are compressed and rarefied. As a result, the peaks and troughs of the sound wave will be larger, and our ears will detect that the sound being produced is much louder. The vertical "height" of the wave, or the distance from the top of a peak to the bottom of a trough in a single cycle is known as **amplitude**. Simply speaking, we perceive amplitude as loudness — **the higher the amplitude, the louder the sound.**



When we consider the loudness of a sound, the dynamics (changes in loudness) are a vital aspect. For example, listen to the sound produced by playing a single note on a piano. As the hammer strikes the strings (**attack**), the output of the piano rises from total silence to a maximum level almost instantly. The sound then starts to die away, or "**decay**", as the vibration of the strings is damped by the surrounding air. When you release the key, the piano dampers deaden the string vibration and the note dies away relatively quickly.

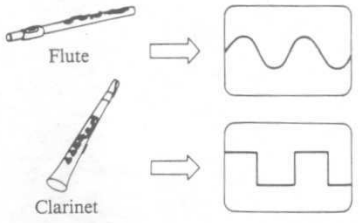
Note that all through this process, the loudness, or amplitude, has been changing. If we were to view these changes in volume over time graphically, we could see that amplitude takes a "shape" over time. This "shape" is known as the note's **amplitude envelope**.





But even if you play, for example, a flute and a clarinet at the exactly the same pitch and at exactly the same volume level, you won't hear the same sound.

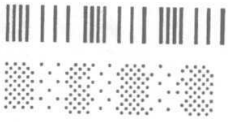
Which brings us to the third element of sound — **timbre**.



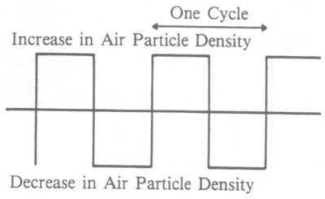
ELEMENT 3: Timbre

Timbre is the quality of a sound that enables us to distinguish the sound from another of the same pitch. If we look once again at the waveform produced by our bell, it's easy to see that the shape of the waveform is determined by the compressions and rarefactions of air produced by the bell's vibration.

Now look at the particles shown on the right.
As you can see, the source of the sound is such that the particles are compressed to a certain pressure for a fixed period of time and then rarefied for an equal period.



If we view this graphically, the resulting waveform is "square". This is, of course, what is known as a "square wave".



Remember though, that the square wave still travels at the same speed as our sine wave, so, if it is of the same wavelength, our ears will interpret its pitch as being the same. But because the air particles are vibrating in a different way, we will hear the sound as an entirely different "**timbre**".

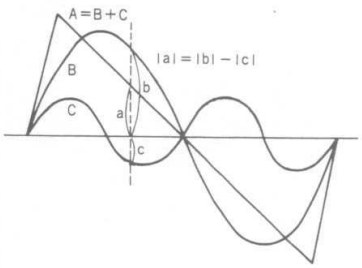
Very basically, we can divide waveforms into three types, shown below.

WAVEFORM	TYPE	TIMBRE	INSTRUMENTS
	Sine wave	Soft	Flute, whistle
	Saw-tooth wave	Bright	Violin, trumpet
	Square wave	Simple	Clarinet, oboe

The VZ-8M offers a total of 8 different waveforms. You'll become extremely familiar with the characteristics of each as you use the VZ-8M.

Fundamental Waves and Harmonics — Shaping the Timbre

Now that you have a basic idea of what sound is and how it is generated, you would probably like to know how you can determine the **shape of a wave** (=timbre) in order to create the kind of sound you want.
First, take a look at this diagram.



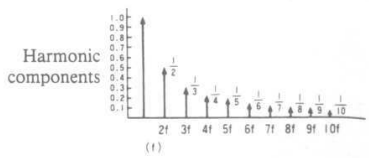
This figure illustrates the process of combining two sine waves in order to form a saw-tooth wave. B is the basic sine wave, while C is a wave which is oscillating at twice the frequency of B (making it one octave higher in pitch), and at only half the amplitude (volume) of B.

When we combine B and C, the result is waveform A. A is still not a perfect saw-tooth wave, but it will gradually approach a perfect saw-tooth shape as additional sine waves at 1/3, 1/4, 1/5, etc. the level of the fundamental wave are added.

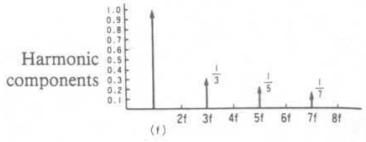
In this manner, any waveform can be created by adding a number of sine waves to a basic sine wave. Waves such as C with frequencies that are integral multiples of the frequency of the fundamental wave are known as "**harmonics**."

The waveform, and thus the timbre are actually determined by the kind of harmonics added to the basic sine wave. In simple terms, almost all sounds with their different timbres that reach our ears include a variety of different harmonics, and it is these harmonics which are responsible for the countless characteristic timbres.

■ Saw-tooth wave



■ Square wave



•Graphs such as the ones above which show the harmonic components of a wave form are called "harmonic spectrums".

ENVELOPES: Sound over time

The word "envelope" may be new to you — but it's an extremely important term in understanding sound, and especially important in sound synthesis.
Literally speaking, an "envelope" is a voltage that changes as a function of time. In the VZ-8M, envelopes are used to shape both the amplitude, pitch and timbre of a sound over time.

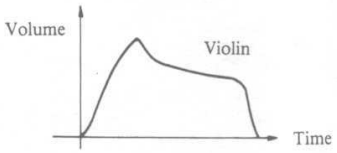
To understand envelopes more clearly, think of the sound of a violin. When the violinist bows a string, the volume, pitch and even timbre change slightly over time. If there were no changes over time, the sound would have no beginning, no pitch variance, and no end!

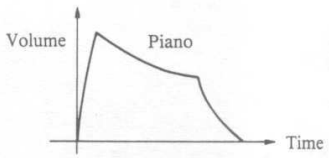
Think now of a piano. If a piano note were to sound continuously without decaying, it would be very difficult to distinguish it from the sound of a flute.

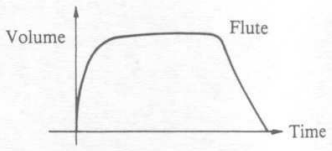
Envelopes, then, are what determine the overall "shape" of the sound over time — including the variations in pitch, volume and timbre.

The VZ-8M lets you create envelope contours in up to 8 steps by making **RATE** and **LEVEL** specifications at up to 8 points in the envelope.

Envelope Curves of Various Instruments (Sound Volume)

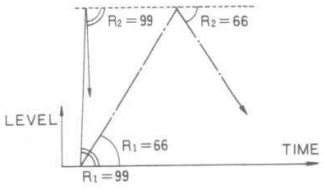






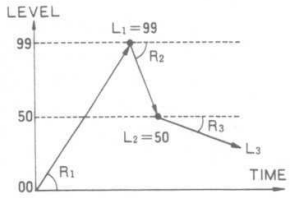
RATE

The RATE indicates the slope (interior angle in relation to horizontal axis) of each step in the envelope. A RATE value of "99" indicates a slope of nearly 90°, while a RATE value of "0" indicates nearly 0°. Since the value used is an absolute value, the slope increases and decreases in direct proportion with the RATE value, regarless of whether the pattern shows a rise or fall. This means that a steep incline results in a quick level change, while a gentle incline results in a slow level change.



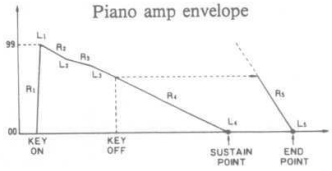
LEVEL

The LEVEL parameter indicates up to what point the envelope rises or falls at each step. For the DCO envelope, LEVEL means pitch height, while for the DCA envelope, LEVEL is equal to the amplitude (volume) level.



How RATEs and LEVELs Interact

To understand the relationship between RATEs and LEVELs, take a close look at a typical amplitude envelope shown on the right.



Musical Sounds vs. Noise

Depending on the type of characteristic vibrations it is based on, a sound may be classified as being either "musical" or "noise". Sounds with regular cyclical vibrations (i.e. sound in which components other than harmonics are very few) are considered to be **musical**, while sounds caused by complicated irregular vibrations (i.e. sounds with many components that are not harmonics) whose pitch can therefore not be measured are classified as **noise**.

SYSTEM INITIALIZED DATA

	Mode	OPERATION MEMORY PST 1 A-1
	Internal	PST 1 64 PRESET TONES PST 2 64 OPERATION MEMORIES
	Compare/Recall	PST 1 voice A-1
WORKING AREA	Operation memory Normal Combination Multi-channel	PST 1 A-1 PST 2 operation memory H-6 see page 96 PST 2 operation memory H-7 see page 97 PST 2 operation memory H-8 see page 98
	Total control	00 MASTER TUNE = 0 (442Hz) 01 TRANSPOSE = C 02 MEMORY PROTECT INT = ON CARD = ON 03 SAVE/LOAD SAVE/LOAD = SAVE CARD/MIDI = CARD1 DATA = VC + OP 04 MIDI CHANNEL CHANNEL = 1 TOTAL = ON 05 MIDI DATA PROGRAM = 0-63 EXCLUSIVE = DIS DEF CONTROL = OFF VOLUME = ENA OVERFLOW = NORMAL

INITIALIZED VOICE PARAMETER MENU DATA

VOICE No.	—	VOICE NAME		OCTAVE	0	TOTAL LEV	99

	M1M2	M3M4	M5M6	M7M8		WAVE	DEPTH	RATE	DELAY	MULTI
INT LINE	MIX	MIX	MIX	MIX	VIBRATO	1	0	75	0	OFF
EXT PHASE	/	OFF	OFF	OFF	TREMOLO	1	0	75	0	OFF

	WAVE FORM	DETUNE		ENVELOPE/VEL RATE									ENV DEPTH		KEY FOLLOW							VELOCITY		AMP SENS
				STEP	1	2	3	4	5	6	7	8			POINT	1	2	3	4	5	6			
M1	1	FIX	OFF	RATE	99	50	50	50	50	50	50	50	DEPTH	99	KEY	C2	F4	C7	A7	E8	C9	SENS	0	0
		HARM	1	LEV	99	0	0	0	0	0	0	0												
		POL(XR)	+	SS/ED	SS							ED	MOD ON/OFF	ON	LEV	99	99	99	99	99	99	CURVE	1	
		OCT	0	E/*	*	*	*	*	*	*	*	*												
		NOTE	0																					
		FINE	0																					
M2	1	FIX	OFF	RATE	99	50	50	50	50	50	50	50	DEPTH	99	KEY	C2	F4	C7	A7	E8	C9	SENS	0	0
		HARM	1	LEV	99	0	0	0	0	0	0	0												
		POL(XR)	+	SS/ED	SS							ED	MOD ON/OFF	ON	LEV	99	99	99	99	99	99	CURVE	1	
		OCT	0	E/*	*	*	*	*	*	*	*	*												
		NOTE	0																					
		FINE	0																					
M3	1	FIX	OFF	RATE	99	50	50	50	50	50	50	50	DEPTH	99	KEY	C2	F4	C7	A7	E8	C9	SENS	0	0
		HARM	1	LEV	99	0	0	0	0	0	0	0												
		POL(XR)	+	SS/ED	SS							ED	MOD ON/OFF	ON	LEV	99	99	99	99	99	99	CURVE	1	
		OCT	0	E/*	*	*	*	*	*	*	*	*												
		NOTE	0																					
		FINE	0																					
M4	1	FIX	OFF	RATE	99	50	50	50	50	50	50	50	DEPTH	99	KEY	C2	F4	C7	A7	E8	C9	SENS	0	0
		HARM	1	LEV	99	0	0	0	0	0	0	0												
		POL(XR)	+	SS/ED	SS							ED	MOD ON/OFF	ON	LEV	99	99	99	99	99	99	CURVE	1	
		OCT	0	E/*	*	*	*	*	*	*	*	*												
		NOTE	0																					
		FINE	0																					
M5	1	FIX	OFF	RATE	99	50	50	50	50	50	50	50	DEPTH	99	KEY	C2	F4	C7	A7	E8	C9	SENS	0	0
		HARM	1	LEV	99	0	0	0	0	0	0	0												
		POL(XR)	+	SS/ED	SS							ED	MOD ON/OFF	ON	LEV	99	99	99	99	99	99	CURVE	1	
		OCT	0	E/*	*	*	*	*	*	*	*	*												
		NOTE	0																					
		FINE	0																					
M6	1	FIX	OFF	RATE	99	50	50	50	50	50	50	50	DEPTH	99	KEY	C2	F4	C7	A7	E8	C9	SENS	0	0
		HARM	1	LEV	99	0	0	0	0	0	0	0												
		POL(XR)	+	SS/ED	SS							ED	MOD ON/OFF	ON	LEV	99	99	99	99	99	99	CURVE	1	
		OCT	0	E/*	*	*	*	*	*	*	*	*												
		NOTE	0																					
		FINE	0																					
M7	1	FIX	OFF	RATE	99	50	50	50	50	50	50	50	DEPTH	99	KEY	C2	F4	C7	A7	E8	C9	SENS	0	0
		HARM	1	LEV	99	0	0	0	0	0	0	0												
		POL(XR)	+	SS/ED	SS							ED	MOD ON/OFF	ON	LEV	99	99	99	99	99	99	CURVE	1	
		OCT	0	E/*	*	*	*	*	*	*	*	*												
		NOTE	0																					
		FINE	0																					
M8	1	FIX	OFF	RATE	99	50	50	50	50	50	50	50	DEPTH	99	KEY	C2	F4	C7	A7	E8	C9	SENS	0	0
		HARM	1	LEV	99	0	0	0	0	0	0	0												
		POL(XR)	+	SS/ED	SS							ED	MOD ON/OFF	ON	LEV	99	99	99	99	99	99	CURVE	1	
		OCT	0	E/*	*	*	*	*	*	*	*	*												
		NOTE	0																					
		FINE	0																					
PITCH				RATE	50	50	50	50	50	50	50	50	RANGE	NAR ROW	KEY	C2	F4	C7	A7	E8	C9	SENS	0	
				LEV	0	0	0	0	0	0	0	0												
				SS/ED	SS							ED	DEPTH	63	LEV	63	63	63	63	63	63	CURVE	1	
				E/*	*	*	*	*	*	*	*	*												

PITCH /AMP	KEY	C2	F4	C7	A7	E8	C9	SENS	0
	RATE	+0	+0	+0	+0	+0	+0	CURVE	1

*With regards to INIT VOICE function (VOICE-21);

1. Only M1 is ON. M2～M8 are all OFF.
2. ENV DEPTH set to "99" for M1, and "85" for M2～M8.

VOICE No.		VOICE NAME		OCTAVE		TOTAL LEV	

	M1M2	M3M4	M5M6	M7M8
INT LINE				
EXT PHASE				

	WAVE	DEPTH	RATE	DELAY	MULTI
VIBRATO					
TREMOLO					

	WAVE FORM	DETUNE	ENVELOPE/VEL RATE									ENV DEPTH	KEY FOLLOW							VELOCITY		AMP SENS
			STEP	1	2	3	4	5	6	7	8		POINT	1	2	3	4	5	6			
M1		FIX	RATE									DEPTH	KEY							SENS		
		HARM	LEV																			
		POL(×R)	SS/ED									MOD ON/OFF	LEV							CURVE		
		OCT	E/＊																			
		NOTE																				
		FINE																				
M2		FIX	RATE									DEPTH	KEY							SENS		
		HARM	LEV																			
		POL(×R)	SS/ED									MOD ON/OFF	LEV							CURVE		
		OCT	E/＊																			
		NOTE																				
		FINE																				
M3		FIX	RATE									DEPTH	KEY							SENS		
		HARM	LEV																			
		POL(×R)	SS/ED									MOD ON/OFF	LEV							CURVE		
		OCT	E/＊																			
		NOTE																				
		FINE																				
M4		FIX	RATE									DEPTH	KEY							SENS		
		HARM	LEV																			
		POL(×R)	SS/ED									MOD ON/OFF	LEV							CURVE		
		OCT	E/＊																			
		NOTE																				
		FINE																				
M5		FIX	RATE									DEPTH	KEY							SENS		
		HARM	LEV																			
		POL(×R)	SS/ED									MOD ON/OFF	LEV							CURVE		
		OCT	E/＊																			
		NOTE																				
		FINE																				
M6		FIX	RATE									DEPTH	KEY							SENS		
		HARM	LEV																			
		POL(×R)	SS/ED									MOD ON/OFF	LEV							CURVE		
		OCT	E/＊																			
		NOTE																				
		FINE																				
M7		FIX	RATE									DEPTH	KEY							SENS		
		HARM	LEV																			
		POL(×R)	SS/ED									MOD ON/OFF	LEV							CURVE		
		OCT	E/＊																			
		NOTE																				
		FINE																				
M8		FIX	RATE									DEPTH	KEY							SENS		
		HARM	LEV																			
		POL(×R)	SS/ED									MOD ON/OFF	LEV							CURVE		
		OCT	E/＊																			
		NOTE																				
		FINE																				
PITCH			RATE									RANGE	KEY							SENS		
			LEV																			
			SS/ED									DEPTH	LEV							CURVE		
			E/＊																			
PITCH /AMP													KEY							SENS		
													RATE							CURVE		

EFFECT MENU INITIALIZED DATA

[NORMAL MODE]

(OPERATION MEMORY PST 2 H-6)

OPERATION No.		OPERATION NAME	INIT NORMAL	OPERATION TUNE	+, 0, 0, 0

1	VOICE No.	PST 1 A-1	2	VOICE No.		3	VOICE No.		4	VOICE No.	
	NAME			NAME			NAME			NAME	
5	VOICE No.		6	VOICE No.		7	VOICE No.		8	VOICE No.	
	NAME			NAME			NAME			NAME	

MODE	NORMAL
K.G.W	K
KEY ASSIGN	

		1	2	3	4
MIDI CH		1			
PORTAMENTO/SOLO	PORTM ON/OFF	OFF			
	PORTM TIME	0			
	PORTM MODE	TIME CONST			
	SOLO	OFF			
	MONO/POLY	MONO			
PITCH BEND	BEND RANGE	2			
	RELEASE	ENA			
MOD WHEEL	SENSITIVITY	50			
	VIB DEPTH	OFF			
	VIB RATE	OFF			
	PITCH	OFF			
	PORTM TIME	OFF			
	TREM DEPTH	OFF			
	TREM RATE	OFF			
	A ENV BIAS	OFF			
DEF CONTROL	SENSITIVITY	50			
	VIB DEPTH	OFF			
	VIB RATE	OFF			
	PITCH	OFF			
	PORTM TIME	OFF			
	TREM DEPTH	OFF			
	TREM RATE	OFF			
	A ENV BIAS	OFF			
FOOT VR	SENSITIVITY	50			
	VIB DEPTH	OFF			
	VIB RATE	OFF			
	PITCH	OFF			
	PORTM TIME	OFF			
	TREM DEPTH	OFF			
	TREM RATE	OFF			
	A ENV BIAS	OFF			
FOOT SW	FOOT SW	SUSTAIN			
VEL TABLE	VEL TABLE SEL	1			
VEL SPLIT	RANGE (FROM)				
	RANGE (TO)				
VEL INV	INVERSE				
DELAY TRIG	DELAY				

PAN	MODE	FIX
	PAN 1	0 (OFF)
	PAN 2	0 (OFF)
	CONTROL 1	MOD
	CONTROL 2	MOD
	RANGE 1	L→R
	RANGE 2	R→L
	RATE	20
	DEPTH	31
	CONTROL	OFF
SPLIT POINT	SP POINT	
	LOWER SP	
	MIDDLE SP	
	UPPER SP	
POS X-FADE	EFFECT	
	POS (FROM)	
	POS (TO)	
	L POS (FROM)	
	L POS (TO)	
	M POS (FROM)	
	M POS (TO)	
	U POS (FROM)	
	U POS (TO)	

Value with MODE set to AUTO in parentheses.

		1	2	3	4	5	6	7	8
AFTER TOUCH	SENSITIVITY	20							
	VIB DEPTH	OFF							
	VIB RATE	OFF							
	PITCH	OFF							
	PORTM TIME	OFF							
	TREM DEPTH	OFF							
	TREM RATE	OFF							
	A ENV BIAS	OFF							
LEVEL	LEVEL								
PITCH	POLARITY								
	OCTAVE								
	NOTE								
	FINE								
VIBRATO INV	INVERSE								
TREMOLO INV	INVERSE								

	ON/OFF	WAVE	DEPTH	RATE	DELAY	MULTI
TOTAL VIBRATO						
TOTAL TREMOLO						