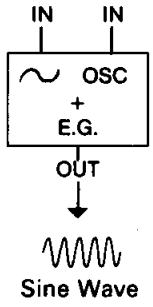
CHAPTER IV: VOICE PROGRAMMING

1. The Basics of FM Synthesis

Before you actually begin programming or editing your own voices, a basic understanding of how digital FM synthesis works will be necessary. In the following explanation, you will learn how the DX27/27S's FM voice generator produces complex voices. This information will help you to understand the process and make it easier for you to create and edit your own voices.

OPERATORS

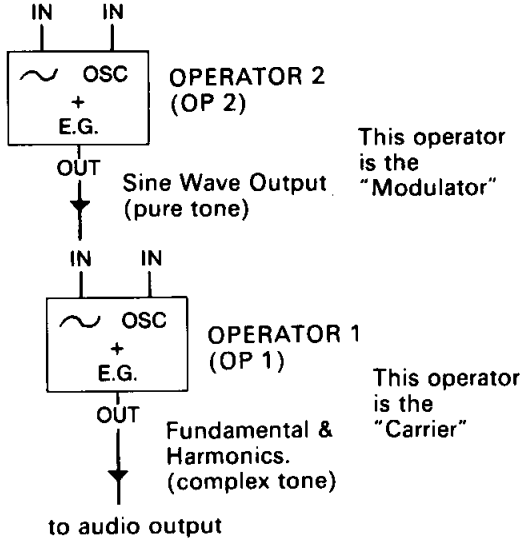
The Yamaha DX series FM digital synthesizers use pure sine waves that interact to create the full harmonic spectrum for any voice. Each digital sine wave oscillator is combined with its own envelope generator to form an "operator."



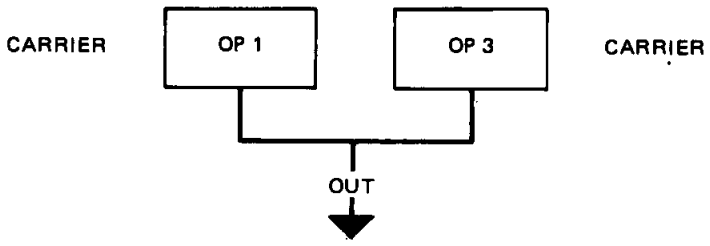
Note that the operator's oscillator has two inputs: one for the oscillator pitch data, and one for modulation data.

CARRIERS AND MODULATORS

The DX27/27S voice generator has 4 operators. When the output of one operator is fed to the modulation input of a second operator, (i.e. the first operator modulates the second) a whole spectrum of harmonics is created that can form an incredibly diverse range of complex waveforms (including the more conventional triangle, sawtooth, and square waveforms). All this from just two operators!



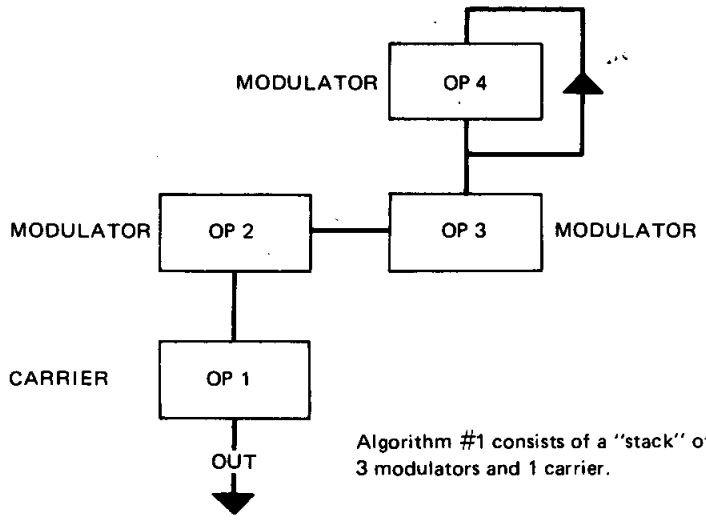
Operators do not have to be connected "vertically" in a modulator-carrier relationship, as shown above. The outputs of two operators can also be mixed—just as the stops in an organ are mixed. In this case the sounds are simply added together with no modulation effect.



ALGORITHMS

We have seen two different ways that two operators may be combined. The DX27/27S uses four operators, offering many potential connection possibilities. These different configurations of operator relationships are called "algorithms," and the DX27/27S offers 8 algorithm choices. These are all printed on top of the DX27/27S panel. In the algorithm diagrams on the panel, the small boxes numbered 1 through 4 are the operators.

ALGORITHM #1

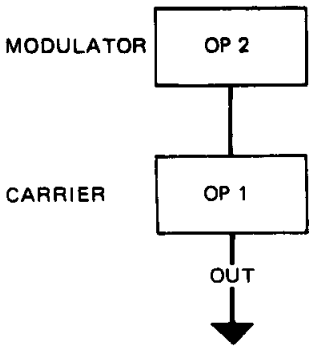


Algorithm #1 consists of a "stack" of 3 modulators and 1 carrier.

HOW ALGORITHMS AFFECT THE SOUND

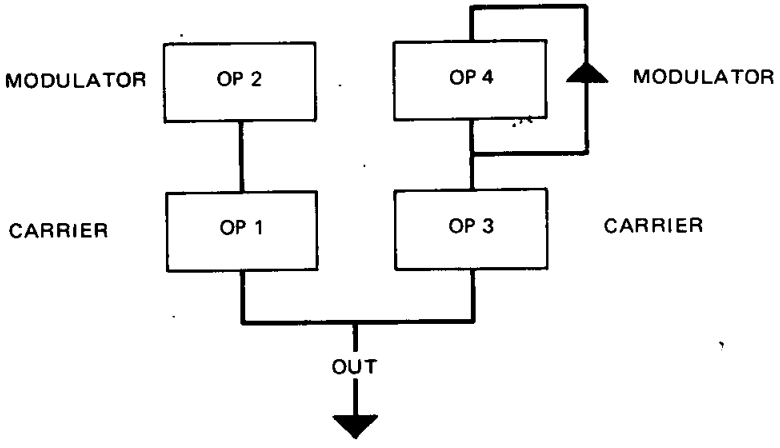
By changing the relative frequencies between operators in a modulator-carrier relationship, you change not only the fundamental pitch of the note, but also the frequencies present in the harmonic structure. Thus, the timbre of the voice can be precisely controlled. In addition, since each operator has its own envelope generator (and a sophisticated one, too!), the harmonic structure of a note can be programmed to vary over time, just as a plucked string changes its overtones as the note decays.

Depending on the selected algorithm, operators can be stacked vertically, connected horizontally, or both. In the vertical arrangement, when the output of one operator is connected to the input of another the result is modulation. By convention, the operator at the bottom of a stack of operators is known as a "carrier." All operators in the same stack above the carrier are "modulators." By increasing the output level of one or more modulators feeding a carrier, the number of harmonics in the resultant sound is increased (its "bandwidth" is increased), making it more brilliant.



Most algorithms have multiple modulators and carriers. In one algorithm a given operator may be a carrier, while in the next it might function as a modulator—the only difference being how it is connected. In algorithm number 5, for example, there are two vertical stacks of two operators, and the outputs of the carriers in these stacks are connected in parallel (horizontally). Algorithm 5 has an equal number of modulators and carriers—two modulators and two carriers.

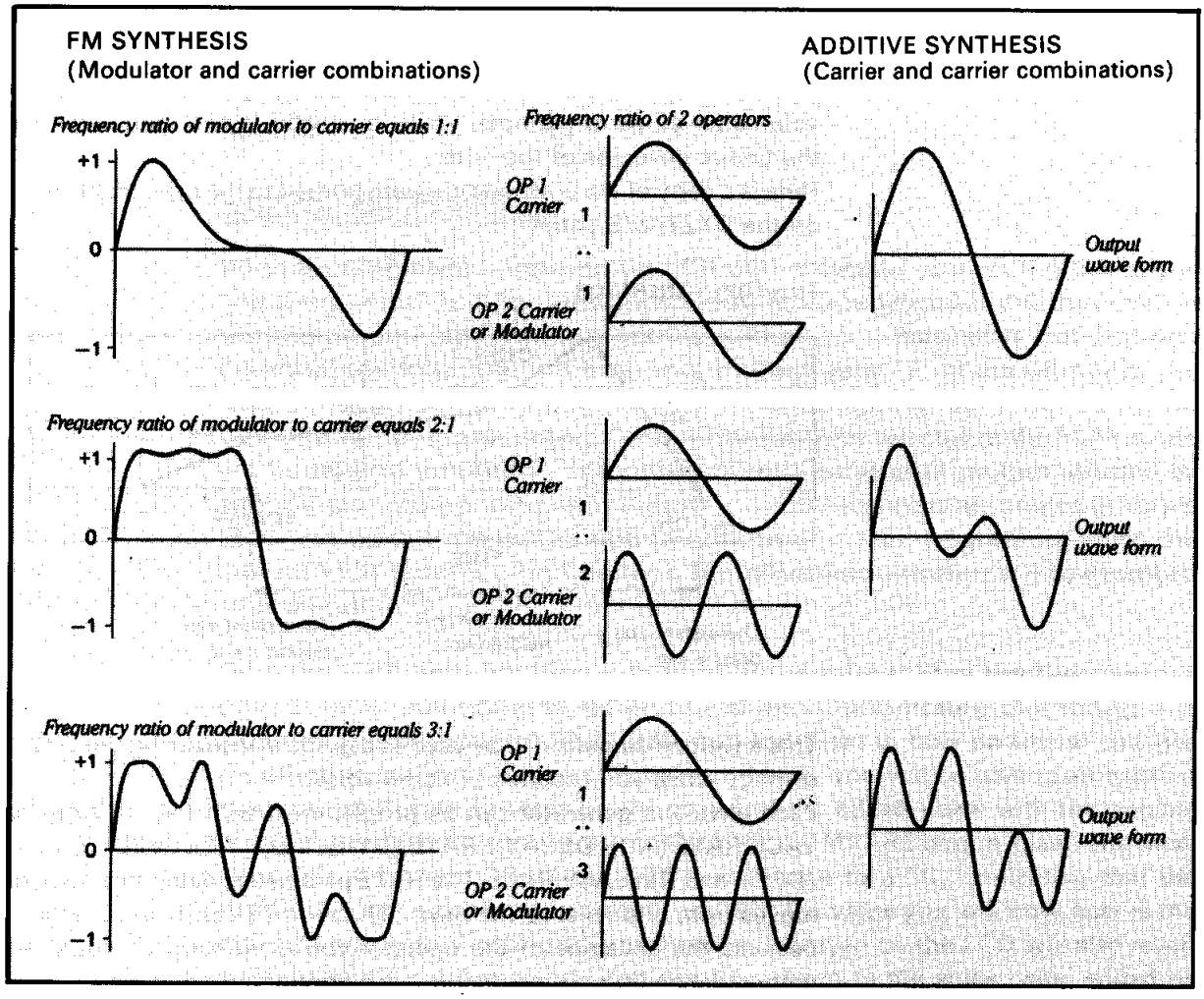
ALGORITHM #5



On the other hand, all operators in algorithm 8 function as carriers. Note that no modulation can occur in this algorithm (except for the feedback loop on operator 4—we'll discuss that later). But algorithm 8 is ideal for creating rich organ voices—think of the operators as different organ "stops," which can be mixed together as desired.

The algorithm alone, however, does not determine the actual sound of the voice. The vital characteristics of the voice you create depend mainly on the frequencies and levels you program into each operator. The 8 algorithms provided in the DX27/27S were specially selected because they offer the broadest range of voice programming possibilities.

The results of using different frequency ratios, as well as different algorithms, are shown graphically in the following illustration. In the left column, the waveforms are created by 1:1, 2:1 and 3:1 ratios between one modulator and one carrier. In the right column, the waveforms are created from the same three ratios, but the two operators are both being used as carriers (connected horizontally, this is known as additive synthesis).



Still more variations can be achieved by changing the relative output levels between operators; the greater the level of the modulating operator, the more harmonics are present.

FEEDBACK

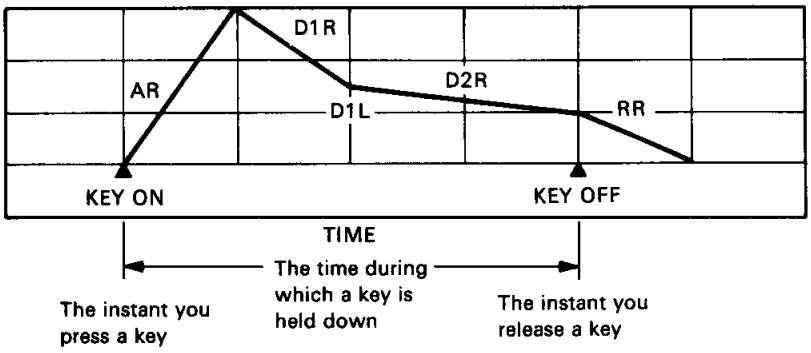
Note that every algorithm has one operator with a "feedback loop"—represented by a line from the output of the operator which feeds back to the input of the same operator. In effect, a feedback loop means that the operator is modulating itself. While every algorithm has one feedback loop, feedback is not necessarily used in every voice. One of the DX27/27S editing functions permits the feedback level to be set from 0 (no feedback) to 7 (maximum feedback).

ENVELOPE GENERATORS

Consider what happens when you play a note on an acoustic instrument. The level of the sound initially goes up to some value, then eventually falls to nothing, following a pattern that is characteristic of the particular instrument played. For example, a low note on a pipe organ starts slowly when you press a key, because it takes a while for the large column of air within the pipe to build up to maximum oscillation level, and takes a while to die down once the key is released. A note played on a wood block, on the other hand, starts quickly as the mallet strikes the block, and stops quickly as the block stops resonating. The characteristic volume pattern of any note played on any instrument is known as its "volume envelope." Most acoustic instruments also have a "timbre envelope," in which the harmonic content of the note changes (the timbre changes) from the time the note is first

played to the time it decays.
Each of the 4 operators available in the DX27/27S can be programmed with its own envelope. The envelope of a carrier will generally contribute to the overall volume envelope of the note, while an envelope of a modulator will contribute to the timbre envelope of the note.
Here is a copy of the envelope diagram printed to the right of the algorithm diagrams on the DX27/27S panel.

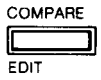
ENVELOPE GENERATOR



This envelope diagram can be used as a guide in visualizing the DX27/27S envelope settings while you program or edit a voice.
Each envelope generator can be programmed with five different parameters: ATTACK RATE (AR), DECAY 1 RATE (D1R), DECAY 1 LEVEL (D1L), DECAY 2 RATE (D2R), and RELEASE RATE. The RATE parameters determine how fast the envelope moves from one level to the next. The term LEVEL is used rather than "volume" because the envelope of the operator you're working on could affect volume or timbre, depending on whether it is a carrier or a modulator.
Any note begins at zero level when you press a key, then begins to approach maximum EG level at a rate determined by the AR (Attack Rate) setting. The envelope may reach maximum level instantly, or it may take over 9 seconds depending on the setting of AR.
When the envelope reaches maximum level, it immediately begins moving towards the next level in the envelope—D1L (Decay 1 Level)—at a speed determined by the setting of D1R (Decay 1 Rate).
The change from maximum EG level to D1R can be either a decrease in level or a sustain at maximum level, depending on the values you choose for D1L.
After reaching D1L, the envelope then begins to decay toward zero level at a speed determined by the setting of the D2R (Delay 2 Rate) parameter. If D2R is set to 0 (no decay), however, the note will be sustained at D1L for as long as you hold the key. Now, when you release the key you have been holding, the envelope will immediately begin to decay toward 0 level at a speed determined by RR (Release Rate). In fact, at whatever point in the envelope you release the key, the envelope will immediately begin moving toward 0 level at the set Release Rate. AR, D1R, and D2R settings of 0 produce sustain at initial level, while an RR setting of 0 produces a slow decay.

2. The EDIT and COMPARE Modes

To actually program or edit a voice, you need to enter the EDIT mode. This is done by pressing the EDIT/COMPARE button.



When the EDIT mode is activated, the LCD will indicate the operator ON/OFF status (the group of four 1s or 0s), the currently selected voice parameter, and the currently selected operator. The latter in the series applies only to parameters that deal with individual operators. You will note, also, a capital letter "E" at the left side of the LCD. This indicates that you are in the EDIT mode, but that the voice has not yet been altered, i.e., it is an unedited voice. The last voice selected in the PLAY mode will be selected for editing. The individual voice parameters are then selected by pressing the corresponding voice buttons—all edit parameters are printed in purple above the voice buttons. The selected parameter is then programmed using the DATA ENTRY slider or −1/+1 buttons. The individual parameters will be described in detail below.

Once the EDIT mode has been called and a parameter change has been made, a small letter "e" will appear at the left side of the LCD, indicating that editing is in progress. You can play the DX27/27S keys and listen to how parameter changes are affecting the voice as you edit. In many cases, you will be editing an existing voice and will want to compare the sound of the edited voice with the original voice. This is done simply by pressing the EDIT/COMPARE button again. The small letter "e" at the left side of the LCD will change to a "C," indicating that the COMPARE mode has been activated, and that the voice you will now hear is the original voice before editing (the parameters displayed on the LCD will also revert to those of the original voice). You can then return to the voice being edited by pressing the EDIT/COMPARE button again. This can be repeated as many times as needed during the editing process. The COMPARE mode can be entered from the EDIT or FUNCTION modes after at least one data change has been made to the original voice.

The EDIT/COMPARE mode can be exited by entering the FUNCTION mode, or by pressing INTERNAL PLAY and selecting another voice. Please note that if you exit the EDIT COMPARE mode and then select a new voice, ANY DATA YOU HAVE EDITED WILL BE ERASED!!! This is because all editing is performed in a special edit buffer memory which is the same memory that a voice is placed when its button is pressed. Note that the presence of a small letter "p" at the left side of the LCD means that the edited voice has not been stored and will be erased if you select a new voice. To save edited data, you must use the STORE function to save the new data in one of the DX27/27S's 24 INTERNAL voice memories. The STORE function will be discussed in this chapter. If you do make a mistake and lose the edited data, the DX27/27S has been provided with a special temporary buffer memory from which the lost data can be recalled (assuming only one error has been made) using the RECALL EDIT function. The RECALL EDIT function was discussed in *CHAPTER III:* THE FUNCTION MODE, under section 5: Memory Management Functions.

3. The Voice Parameters

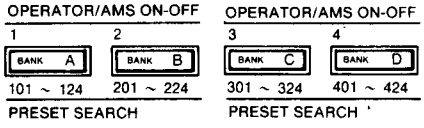
The following is a brief description of each available voice parameter, how it is programmed, and its effect. These parameters are selected by pressing the appropriately labelled (purple labels indicate voice parameters) button while the DX27/27S is in the EDIT mode.

PITCH B MODE: OPERATOR SELECT

This switch (located immediately above the −1 DATA ENTRY button) selects the operator to be worked on. Only one operator can be selected at a time. Only the parameters for the selected operator will be displayed in the LCD panel.

In the EDIT mode, the currently selected operator number is displayed on the right side of the LCD (for example, "OP3"). This only applies to parameters which can be programmed for each individual operator. However, when parameters that affect all operators simultaneously are being edited (the LFO WAVE, SPEED and DELAY parameters, for example), the current operator display will disappear from the LCD and individual operators cannot be selected.

BANK A—D: OPERATOR/AMS "ON-OFF"



Individually turns operators 1 through 4 ON or OFF. In many cases, a voice will not require all operators in an algorithm. Operators that are not needed should be turned OFF while editing. Also, during the voice creation process, it is a good idea to start with all the operators OFF and then turn them ON one at a time as you program and add them to the algorithm. The four digits immediately preceding the algorithm number on the LCD display represent the four operators, 1 through 4, in order from left to right. When an operator is ON, a "1" appears in the corresponding position, and when an operator is OFF, a "0" appears in the corresponding position. Each press of the BANK A through D buttons alternately turns the corresponding operator ON and OFF.

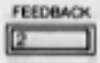
When the AMPLITUDE MODULATION SENSITIVITY parameter is selected (10), these buttons are used to determine to which operators the sensitivity setting will apply.

When the EG COPY function is in use (see page 37), these buttons are used to select the operator to which the data from the currently selected operator will be copied.

1: ALGORITHM

Permits selection of any of the 8 available algorithms. The desired algorithm number is selected by using either the DATA ENTRY slider, −1/+1 buttons, or the parameter button.

2: FEEDBACK

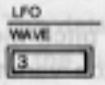


Feedback can be applied to one operator in each algorithm. Pressing this button permits setting the amount (level) of feedback which will be applied.
The feedback level range is from 0 to 7. At 0, feedback is OFF, and at 7, maximum the feedback at maximum.
Data is entered with the DATA ENTRY slider or buttons.

The LFO

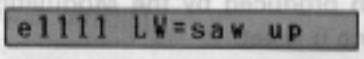
"LFO" stands for Low Frequency Oscillator. This oscillator is used to apply modulation effects such as tremolo or vibrato to the DX27/27S voices. By setting the LFO WAVE, SPEED, and SYNC parameters, you determine the effect that will be applied to the currently selected voice when the Modulation Wheel or Breath Controller is operated. The effect can also be applied without using the Wheel or Breath Controller by adjusting the AMD and PMD parameters. The LFO parameters work together with the MODULATION SENSITIVITY (9 and 10) parameters, and these must be set carefully to achieve the desired effect.

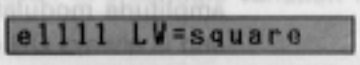
3: LFO WAVE

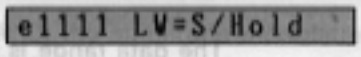


This lets you select the low frequency oscillator waveform. The available waveforms are SAW UP (a rising sawtooth waveform), SQUARE, TRIANGLE, and S/HOLD (sample and hold). When used in conjunction with the LFO SPEED, DELAY, LFO PMD, and LFO AMD, a vast range of phase shifting and flanging-type effects can be obtained. Depending upon the depth of your individual settings for any particular voice, these effects could range from subtle, sympathetic coloration of a "piano" voice, or an extremely broad low-frequency sweep for a "pipe organ".

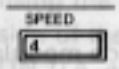
These waveforms are selected using the DATA ENTRY slider or buttons.



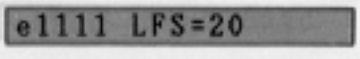




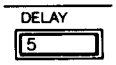
4: LFO SPEED



This sets the speed of the low frequency oscillator. The data range is from 0 to 99. 0 corresponds to the slowest LFO speed (0.0008 Hz), and 99 corresponds to the fastest LFO speed (55 Hz).



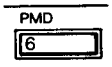
5: LFO DELAY



The DELAY button is used to set a delay from 0 to approximately 10.7 seconds before the LFO modulation effect begins after a key is played. This is useful for simulating brass instruments, human voice, etc., in which a vibrato effect grows gradually after a note is played.

The data range is from 0 to 99. At 0 there is no delay. At a setting of 99, the delay will be approximately 10.7 seconds; the effect slowly increases over a period of 10.7 seconds. With longer delay settings, the modulation effect grows gradually for a remarkably natural sound.

6: LFO PMD

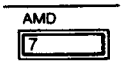


This parameter sets the depth of pitch variation produced by the LFO modulation for all operators. This function is independent from the pitch modulation produced by the Modulation Wheel and Breath Controller, and is always ON once it is set.

The data range is from 0 to 99. At 0, the pitch modulation is OFF. At a setting of 99, the LFO is set for the greatest pitch variation, depending on the PITCH MODULATION SENSITIVITY setting, described below (9). When the PITCH MODULATION SENSITIVITY parameter is set to maximum (7), the maximum pitch variation (PM DEPTH = 99) will be ±800 cents.

Even if this parameter is set to 0, pitch modulation can still be applied by the Modulation Wheel or Breath Controller.

7: LFO AMD



This parameter sets the depth of amplitude variation (tremolo or wow) produced by the LFO modulation for all operators. This function is independent from the amplitude modulation produced by the Modulation Wheel or Breath Controller, and is always ON once it is set.

The data range is from 0 to 99. At 0, the amplitude modulation is OFF, and at a setting of 99, the LFO is set for the greatest amplitude variation, depending on the AMPLITUDE MODULATION SENSITIVITY setting (10). When the AMPLITUDE MODULATION SENSITIVITY parameter is set to maximum (3), the maximum amplitude variation (AM DEPTH = 99) will be 96 dB peak-to-peak.

Even if this parameter is set to 0, amplitude modulation can still be applied by the Modulation Wheel and Breath Controller.

8: LFO SYNC

SYNC
8

The beginning of the LFO cycle is normally synchronized with key-on timing. This parameter lets you turn this synchronization ON or OFF. All operators are affected simultaneously.

When this parameter is ON, the LFO cycle will always begin from the peak of a positive half-cycle (90 degrees phase angle) when a key is played. This produces a clear, consistent attack on all notes.

When the LFO KEY SYNC is OFF, the LFO cycle starts from a random point when a key is played. This is an ideal setting when the LFO is being used to create natural-sounding chorus or phasing effects.

9: PITCH MODULATION SENSITIVITY

MODULATION
PITCH
9

This parameter sets the sensitivity of all operators to the pitch modulation applied by the LFO PMD parameter (above), or by the Modulation Wheel or Breath Controller.

The data range is from 0 to 7. At 0, no pitch modulation can be applied, and at 7, the maximum pitch modulation can be achieved. When the LFO PMD (above) is set at 99, a setting of 7 produces a ±800 cents pitch variation.

10: AMPLITUDE MODULATION SENSITIVITY

SENSITIVITY
AMPLITUDE
10

This sets the operator's sensitivity to LFO effects applied by the LFO PMD or AMD functions, or by the Modulation Wheel or Breath Controller.

Applying the LFO modulation to a carrier operator will result in tremolo, and applying it to a modulator operator will result in a periodic variation in timbre (similar to wah effects).

The data range is from 0 to 3. At 0, the amplitude modulation sensitivity is OFF and no LFO effects can be applied to the selected operators. A setting of 3 will produce the maximum sensitivity and therefore will give the maximum effect depth.

The operators to which the modulation sensitivity is to be applied are selected by using the BANK A through BANK D buttons. The four digits—1 or 0—at the right side of the LCD correspond to operators 1 through 4. When an operator is turned ON (i.e. able to receive amplitude modulation), the corresponding digit will be a "1." When OFF, the corresponding digit will be a "0." The operators are turned ON or OFF alternately each time the corresponding OPERATOR/AMS ON-OFF button is pressed.

11: EG BIAS SENSITIVITY

EG BIAS
11

This sets the operator's sensitivity to the EG BIAS effects applied by the Breath Controller. EG bias changes the overall output level from the operator. The harder you blow into the Breath Controller, the higher the maximum envelope level. When EG BIAS is applied to a carrier operator by the Breath Controller, the result is volume (expression) control. When applied a modulator, the result is brilliance control.
The data range is from 0 to 7. At 0, the EG BIAS sensitivity is OFF and no EG BIAS effects can be applied to the selected operators. A setting of 7 produces the maximum sensitivity and therefore the maximum effect depth.

12: KEY VELOCITY

KEY VELOCITY
12

While the DX27/27S has no key velocity sensitivity of its own, its voice generators will accept key velocity data from other MIDI equipment (like a MIDI controller keyboard, for example). This function determines the sensitivity of each operator to keyboard velocity sensitivity data sent from external MIDI equipment to the DX27/27S MIDI IN terminal (key velocity sensitivity = the harder you play a key, the louder the note. Timbre variations are produced when key velocity sensitivity is applied to a modulator).

The data range is from 0 to 7. At 0, key velocity sensitivity for the selected operator is OFF. A setting of 7 will produce the highest sensitivity, and therefore the greatest effect. If the KEY VELOCITY is set to a value other than 0, the volume heard when DX27/27S keys are played will decrease.

13: FREQUENCY RATIO

OSCILLATOR
FREQ RATIO
13
POLY MONO

These parameters determine the actual frequency of each operator. For operators which function as carriers, this determines the actual pitch of the sound produced. For operators functioning as modulators, this determines the harmonic spectrum of the sound produced.
Each operator can be set to any of the following 64 different frequency ratios:

DX27/27S OPERATOR FREQUENCY RATIOS

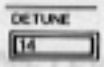
0.50	0.71	0.78	0.87	1.00	1.41
1.57	1.73	2.00	2.82	3.00	3.14
3.46	4.00	4.24	4.71	5.00	5.19
5.65	6.00	6.28	6.92	7.00	7.07
7.85	8.00	8.48	8.65	9.00	9.42
9.89	10.00	10.38	10.99	11.00	11.30
12.00	12.11	12.56	12.72	13.00	13.84
14.00	14.10	14.13	15.00	15.55	15.57
15.70	16.96	17.27	17.30	18.37	18.84

19.03	19.78	20.41	20.76	21.20	21.98
22.49	23.55	24.22	25.95		

These frequency ratios have been carefully chosen as the most useful for voice programming. A ratio of 1.00 sets the selected operator to standard pitch—a pitch of 440 Hz will be produced when the A3 (A above middle C) key is played. A ratio of 0.50 will produce a pitch one octave lower, and a ratio of 2.00 will produce a pitch one octave higher than standard pitch, and so on. The fractional ratios (1.73, for example) produce extremely complex waveforms when combined with operators set to other ratios, permitting the creation of an unlimited variety of sound effects including extremely realistic bells, explosions, etc. Even ratios are useful for creating musical instrument sounds. It is possible to use a modulator set to a fractional ratio at a low operator level with even-ratio operators to add bite to a string sound and many other effects.

The standard DX27/27S keyboard pitch is 8'; therefore, in terms of footage: 0.50 = 16', 1.00 = 8', and 2.00 = 4'.

14: DETUNE



This parameter lets you slightly detune individual operators, making it possible to create richer, fuller voice effects. If DETUNE is applied to carriers, the result is a thick, multi-instrument effect. Applied to modulators, the result is a slight periodic variation in timbre similar to a phase shift effect.

The data range is from −3 to +3, for a maximum detuning range of +2.6 cents. At 0, no detune effect is produced.

```
e1111 DET=-3 OP3
```

15 – 19: ENVELOPE GENERATOR, AR, D1R, D1L, D2R, RR

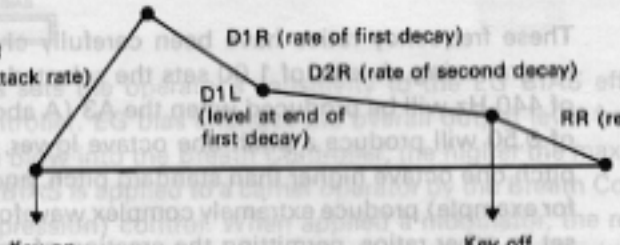
These buttons select the specific envelope generator parameters to be worked on: ATTACK RATE, DECAY 1 RATE, DECAY 1 LEVEL, DECAY 2 RATE, and RELEASE RATE.

The data range for the AR, D1R, and D2R parameters is 0 to 31, with 31 being the fastest rate (instantaneous) and 0 the slowest (i. e. no change). The RR parameter has a data range of 0 to 15, with 15 being the fastest release and 0 being the slowest.

```
e1111 AR=31 OP3
```

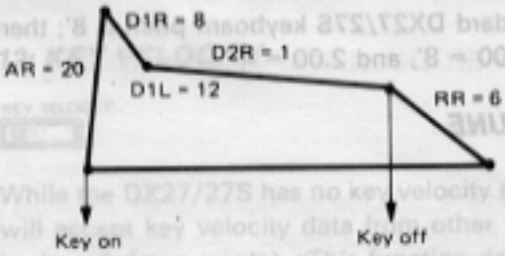
The following EG curve shows the relationship between the RATE and LEVEL parameters.

BASIC EG CURVE

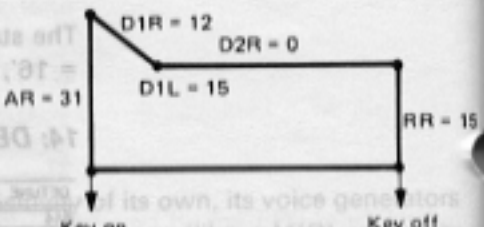


The following EG curves show the parameters for some common instruments.

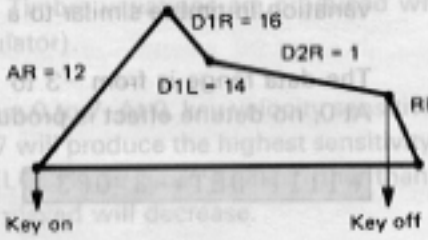
PIANO E.G. CURVE



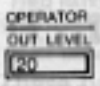
ORGAN E.G. CURVE



BRASS E.G. CURVE



20: OPERATOR OUT LEVEL



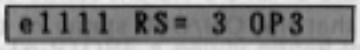
This parameter is used for setting the output level of the selected operator. The data range is from 0 to 99. At 0, the operator is OFF. At 99, the selected operator is set for the maximum output level.

Varying the output level of an operator functioning as a carrier will result in a change of the overall level of the sound contributed to the voice by that operator. Varying the output level of an operator functioning as a modulator results in a change of the harmonic spectrum produced by the carrier, thereby changing the timbre of the sound.

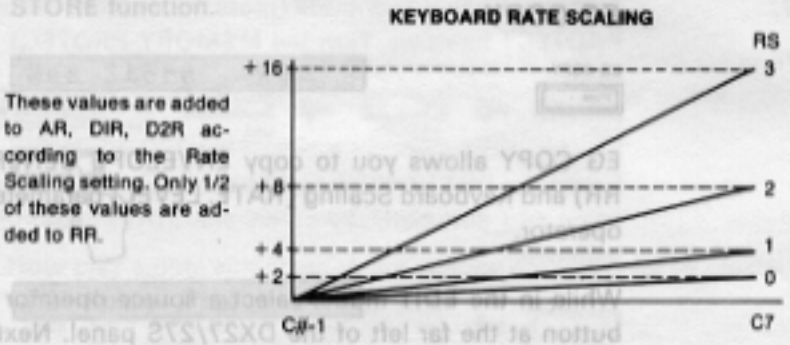
Data is entered using the DATA ENTRY slider or buttons.

21: RATE SCALING

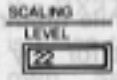
This parameter makes it possible to gradually shorten the overall envelope length (increase EG rate) as the notes get higher. This is particularly useful for simulating the sound of stringed instruments (such as a piano or guitar) in which the envelope of the higher notes is noticeably shorter than the lower notes.



The data range is from 0 to 3. At 0, RATE SCALING is OFF, and at 3 the greatest variation in envelope length is produced.



22: LEVEL SCALING



This parameter produces a gradual decrease in note output level as the notes get higher. Many acoustic instruments exhibit a gradual decrease in level when playing higher notes. This function can be used to create a natural overall keyboard response for any particular voice.

The data range is from 0 to 99. At 0, no level scaling is applied. At 99, the deepest keyboard level scaling effect is produced, and the highest note on the keyboard may be almost inaudible. Set this parameter for the most natural overall balance for each voice.

23: TRANSPOSE

This function is used to transpose the pitch of the entire DX27/27S keyboard up or down two octaves in semitone steps.

The data range is from C1 to C5 (C3 is middle C, C2 is one octave lower than middle C, C4 is one octave higher than middle C, etc.). Immediately after this function is called, the desired new key can be selected by simply pressing any note on the keyboard between C1 and C5 (within a plus or minus two-octave range of middle C). The keyboard's C3 key then assumes the pitch of the key played, and all other keys are adjusted automatically. Pressing any key higher than C5 on the keyboard (which is not possible on the DX27/27S, but might be possible on an external MIDI keyboard) will result in a transposition to C5. This method of data entry can only be used immediately after the TRANSPOSE function is called. Further alterations may be made using the DATA ENTRY control or −1/+1 switches.

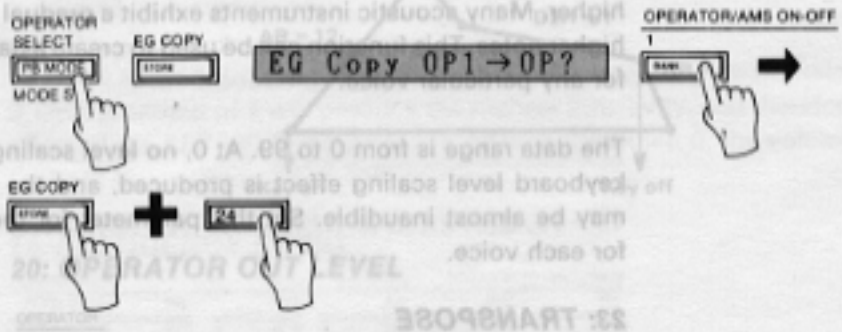
24: CHORUS (DX27S only)

This parameter turns the DX27S's vibrant stereo chorus effect ON or OFF for the selected voice. Note that the ON/OFF status of the chorus effect can be independently programmed for each voice. Since this is a true stereo effect, either the DX27S's internal stereo amplifier and speakers or an external stereo sound system should be used to get the full impact of the chorus sound.

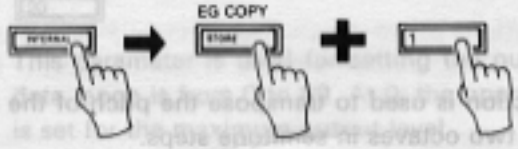
EG COPY

EG COPY allows you to copy ENVELOPE GENERATOR (AR, D1R, D1L, D2R, RR) and Keyboard Scaling (RATE, LEVEL) parameters from one operator to another operator.

While in the EDIT mode, select a source operator with the OPERATOR SELECT button at the far left of the DX27/27S panel. Next, press the EG COPY function button (this is the same as the STORE button). The LCD will respond with "EG Copy OP1→OP?" You may then select a destination operator with the OPERATOR/AMS ON-OFF buttons. While holding down the EG COPY button, select a destination. Release, and repeat for any other operator destination you wish to copy to.



4. Storing Voice Data



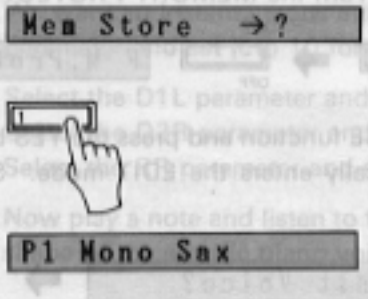
After you have created or edited a voice and have decided that you want to save it for future use, you should STORE the new voice data in one of the 24 INTERNAL memories by using the STORE function. You should do this BEFORE you press any of the voice buttons after leaving the EDIT or FUNCTION modes, or you will lose the new voice data you had in the edit buffer. For this reason, it is a good idea to have a free memory location ready before you begin editing.

If you are editing and storing a voice to INTERNAL memory that was originally selected from PRESET memory, you can still recall the original PRESET memory voice at any time (PRESET memory will never change).

NOTE:

If the INTERNAL memory contains your own original voices, make sure that any voices you want to keep have been saved to cassette tape, so that they can be recalled later.

To STORE a newly edited voice, first exit the EDIT mode by pressing the PLAY mode button. Then, hold down the STORE button (this is the same as the EG COPY button) and press the voice button to which you want to save the edited voice data. The MEMORY PROTECT function must be OFF before attempting to use the STORE function.



5. Two Approaches to Creating Your Own Voices

There are two basic approaches that you can take when programming voices on the DX27/27S. First, you can run through all the existing voices, choose one that is close to the sound you wish to create, and then edit that voice to create your own. Second, you can "initialize" the voice edit buffer (see *CHAPTER III:* 5. MEMORY MANAGEMENT, 7. The Initialize Voice Function), setting all parameters to their initial values, and begin programming your voice from scratch.

The first method, editing an existing voice, is generally a much more efficient approach. If, however, you are looking for a unique voice that is totally unlike any of the available presets, it is probably best to initialize and start from scratch.

If you choose to program a voice from scratch, you'll need to have a clear memory location (or one containing a voice that you either don't want or have already backed up on cassette tape) so that when you've completed programming the voice, you can save it. Since all editing is done in the separate voice edit buffer, nothing is erased while you are actually programming the voice. But when you save the new voice, whatever was in that memory location will be erased and replaced by the new data.

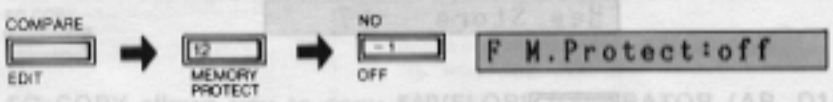
CHAPTER V: VOICE PROGRAMMING EXAMPLE

In this section, we'll go through the steps in creating a fairly percussive electric piano voice from scratch. This simple example should help you understand the programming process.

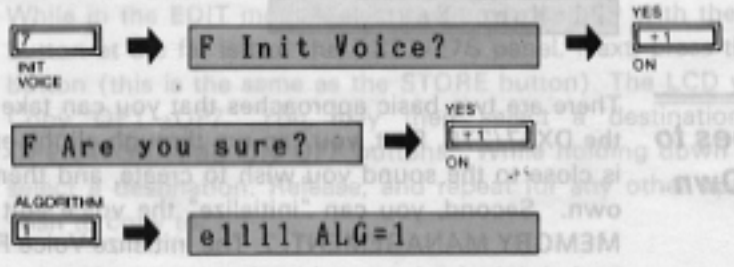
STEP 1:

Initialize a Voice

Enter the FUNCTION mode (press the FUNCTION button) and select the MEMORY PROTECT function. Turn the MEMORY PROTECT OFF.



Select the INIT VOICE function and press the YES button twice. This initializes the voice and automatically enters the EDIT mode. Select the ALGORITHM select parameter.



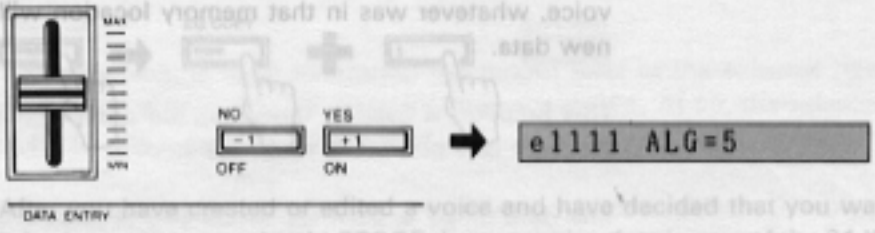
If you play a note now, you will hear a sine wave.

STEP 2:

Selecting the Algorithm

In this voice there are two distinct sound components: the main piano decay sound and a percussive attack "ping." For this purpose, we'll use algorithm 5 which has two separate vertical "stacks" of two operators each.

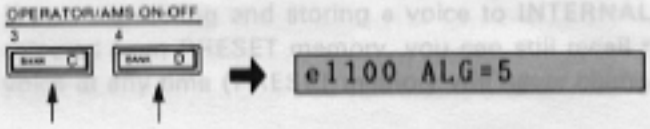
The ALGORITHM parameter is already selected, so choose algorithm 5 by using the DATA ENTRY controls.



STEP 3:

Turn Operators 3 and 4 OFF

We'll start by programming the main piano sound using the left operator stack in algorithm 5 operators 1 and 2. Turn operators 3 and 4 OFF using the corresponding OPERATOR/AMS ON-OFF buttons.

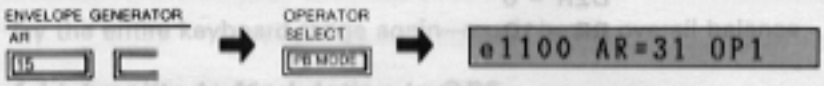


Since the voice has been initialized, the output level of operator 1 will be set at 90 and operator 2 at 0, so at the moment we can only hear the sound from operator 1.

STEP 4:

Set the OP1 (carrier) EG

Select the ENVELOPE GENERATOR AR parameter, and select operator 1 by pressing the OPERATOR SELECT button.



We want an instantaneous attack, so that AR should be set at 31. Select the D1R parameter and set it to 10 for a relatively slow initial decay.

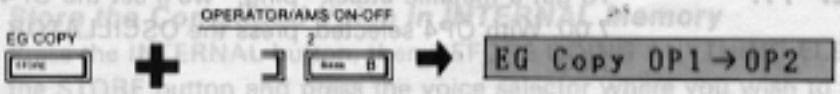
Select the D1L parameter and set to 10.
Select the D2R parameter and set to 8.
Select the RR parameter and set to 8.

Now play a note and listen to the volume envelope we've created. This is the basic shape of the electric piano voice.

STEP 5:

Copy OP1 (carrier) EG Parameters to OP2 (modulator)

Hold down the EG COPY button and press the OPERATOR/AMS ON-OFF 2 button.

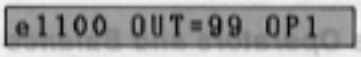


The EG parameters you just set for operator 1 have now been copied to operator 2. You can check this by selecting operator 2 (press OPERATOR SELECT) and looking at the EG parameters (AR– RR).

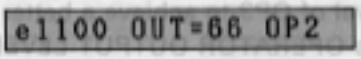
STEP 6:

Set the OP1 and OP2 Output Levels

In this step, we'll create the basic timbre of our piano voice.
First, select OP1, select the OPERATOR OUTPUT LEVEL parameter and set it to 99.



Next, select OP2 and set its output level to 66.

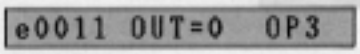


Play a key and note that we no longer have a simple sine wave. By increasing the output level of OP2 we are modulating the carrier, OP1, thereby creating a more complex waveform. In this case, the frequency ratios of OP1 and OP2 are left at their initialized values of 1.00, since this is the basic timbre we want for this voice.

STEP 7:

Turn OFF OP1 and OP2, Turn ON OP3 and OP4

Now that we've created the basis for our piano voice, turn OP1 and OP2 OFF so that we can concentrate on creating the attack sound using the remaining operator stack (OP3 and OP4). Turn OP3 and OP4 ON.



STEP 8:

Set the OP3 (carrier) EG

Before we actually set the OP3 EG parameters, select OP3 using the OPERATOR SELECT button, call the OPERATOR OUTPUT LEVEL parameter and set it to 99. Now enter the following EG parameters:

AR = 31
D1R = 13
D1L = 0
D2R = 0
RR = 10

STEP 9:

Copy the OP3 (carrier) EG Parameters to OP4 (modulator)

Hold down the EG COPY button and press the OPERATOR/AMS ON-OFF 4 button.

```
EG Copy OP3→OP4
```

STEP 10:

Raise the OP4 (modulator) Output Level

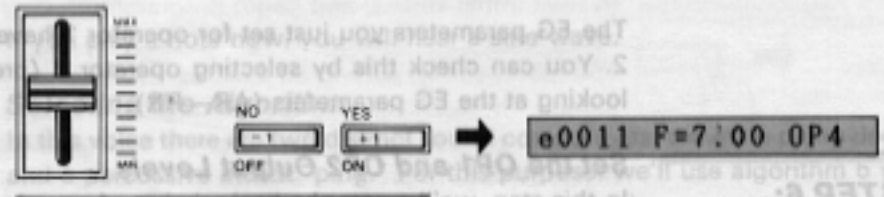
Select OP4, select the OPERATOR OUTPUT LEVEL parameter and set it to 71.

```
e0011 OUT=71 OP4
```

STEP 11:

Set the OP4 Frequency Ratio

To get a metallic attack "ping," we'll set the OP4 output level frequence ratio to 7.00. With OP4 selected, press the OSCILLATOR FREQ RATIO button and set to 7.00.



Play a note and listen to the attack sound.

STEP 12:

Combine all of the Operators and Balance the Levels

Turn OP1 and OP2 back on so that we can here the combined sound of the two operator stacks. Play a note. At this point the attack sound is far too loud, so we'll reduce the output level of OP3 to achieve a better balance.
Select OP3, press the OPERATOR OUTPUT LEVEL button, and set to 70.

```
e1111 OUT=70 OP3
```

Play a note—our piano voice is improving.

STEP 13:

Set the Feedback Level

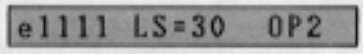
We can enhance the attack sound of the voice by adding just a touch of "bite" by using feedback. Select the FEEDBACK parameter and set it to 5.

```
e1111 FBL=5
```

STEP 14:

Set the Keyboard Level Scaling

Play a few notes or chords across the range of the keyboard. At this point the upper-range notes are a little to loud and tinny for proper overall keyboard balance. Select the KEYBOARD LEVEL SCALING PARAMETER, select OP1, and set it to 20. Next, select OP2 and set it to 30.



Try the entire keyboard range again—much better overall balance.

STEP 15:

Add Amplitude Modulation to OP2

As a final enhancement to our voice, let's add just a touch of amplitude modulation to OP2—the main piano sound modulator. This will create a subtle chorus effect.

Select the LFO WAVE parameter, set it to triangle.
Select the LFO SPEED parameter, set it to 28.
Select the AMD (Amplitude Modulation Depth) parameter, set it to 52.
Select the MODULATION SENSITIVITY, AMPLITUDE parameter, set it to 1 for OP2 only (press the OPERATOR/AMS ON-OFF button).

Now try the voice. That's it! Name the new voice, if you like, by entering the FUNCTION mode and using the VOICE NAME function. The only step that remains is to store our new voice in an INTERNAL memory location.

STEP 16:

Store the Completed Voice in INTERNAL Memory

Press the INTERNAL button, then BEFORE DOING ANYTHING ELSE: hold down the STORE button and press the voice selector where you wish to store the new voice.

As a final precaution, go back to the FUNCTION mode and turn the MEMORY PROTECT ON.

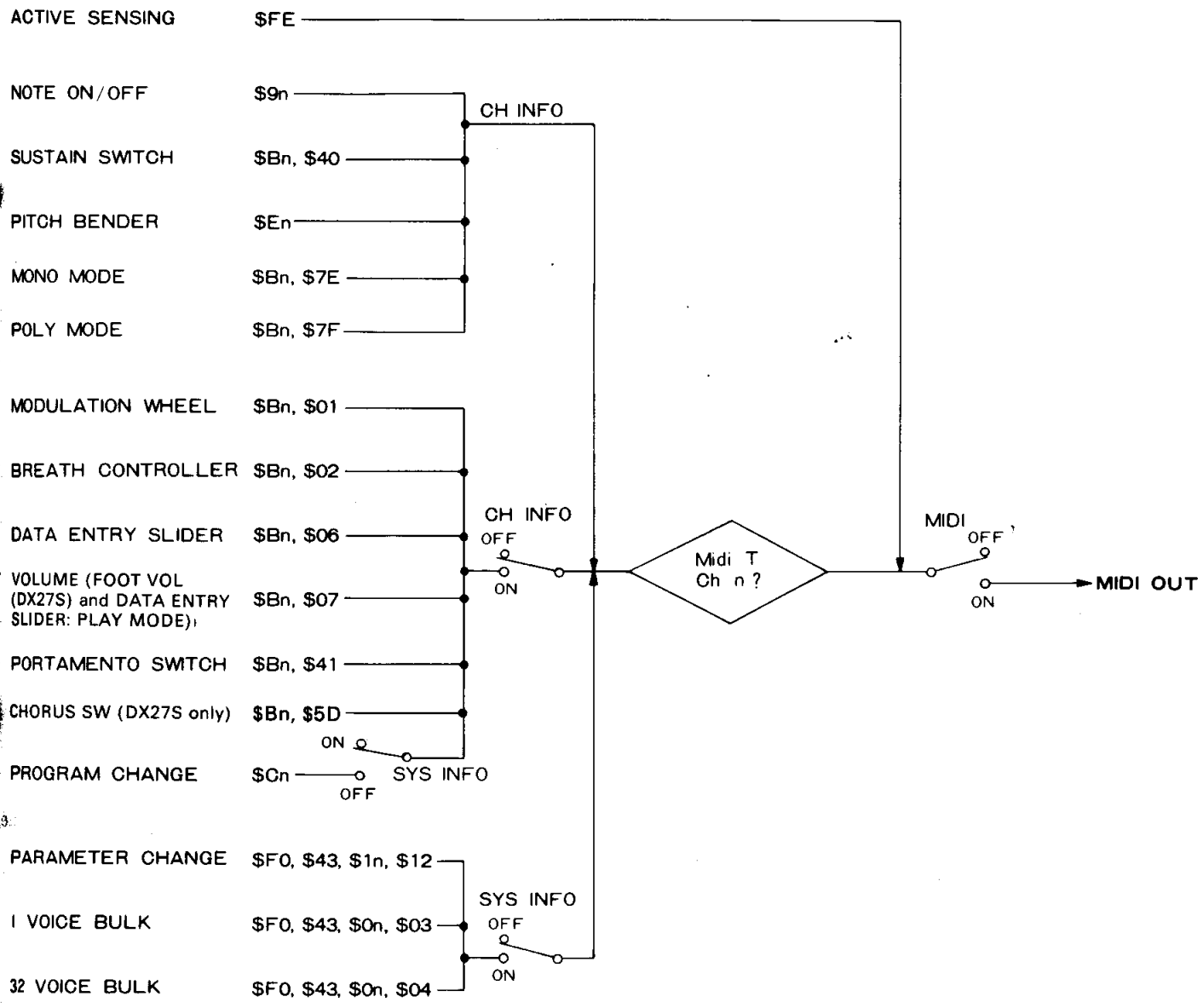
GENERAL SPECIFICATIONS

Keyboard	61 keys
Sound Source	FM Tone Generator (4 operators, 8 algorithms)
Simultaneous Note Output	8 notes, reverse priority
Internal Memory	24-voice INTERNAL memory (read/write) 192-voice PRESET memory (read only) 96-voice number bank (read/write)
Effects	PITCH BEND, MODULATION, PORTAMENTO, SUSTAIN, KEY VELOCITY (reception only) CHORUS (DX27S only)
Controls	PITCH BEND WHEEL, MODULATION WHEEL, VOLUME, SPEAKER ON/OFF (DX27S only)
External Control Terminals	BREATH CONTROL, FOOT SWITCH, FOOT CONTROL (DX27S only)
Connecting Terminals	OUTPUT (DX27, rated output level −20dB/output impedance 10kΩ or less), OUTPUT I & II (DX27S, rated output level −20dB/output impedance 10kΩ or less) PHONES DX27..... (rated output level −16dB/output impedance 47Ω or less), DX27S..... (rated output level −10dB/output impedance 47Ω or less), FOOT SWITCH (PORTAMENTO ON-OFF/SUSTAIN ON-OFF), MIDI IN, MIDI OUT, MIDI THRU, CASSETTE (transmission speed 1,200 baud), BREATH CONTROL, DC IN (DX27 only), FOOT CONTROL (DX27S only)
Amplifier	5W + 5W built-in (DX27S only)
Power Supply	US & Canadian Model: 120V, 60Hz General Model: 220V, 50/60Hz
Dimensions (W x H x D)	
DX27	909(W) x 82(H) x 270(D)mm (35.8" x 3.2" x 10.6")
DX27S	1,091(W) x 82(H) x 270(D)mm (42.9" x 3.2" x 10.6")
Weight	
DX27	7.5kg (16.5lbs)
DX27S	10.5kg (23.1lbs)
Standard Accessories	Music Stand, AC Adapter PA-1210 (DX27 only), Cassette Cable, Explanation Cassette Tape
Optional Accessories	FC-4/FC-5 Foot Switches, BC-1 Breath Controller, FC-7 Foot Controller (DX27S only)

* 0db-0.775Vr.m.s.

* Specifications and appearance are subject to change without notice.

1. Transmission Conditions



2. Transmission Data

All MIDI data is transmitted when the MIDI ON/OFF function is ON. The MIDI transmission channel is determined by the setting of the MIDI CHANNEL function.

2-1. Channel Information

2-1-1 Channel Voice Message

(1) Key On/Off

Status	1001nnnn(9n)	n=channel no.
Note. no.	0kkkkkkk	k=36(C1) ~ 96(C6)
Velocity	01000000(40)	Key on
	00000000(00)	Key off

(2) Control Change

Status	1011nnnn(Bn)	n=channel no.
Control no.	0ccccccc	
Control code	0vvvvvvv	

a) Transmitted whether MIDI CHANNEL INFO is ON or OFF

Control no.	Control code.
C=64: Sustain sw.	V=0: OFF, 127: ON
C=126: MONO mode	V=1
C=127: POLY mode	V=0

b) Transmitted when MIDI CHANNEL INFO is ON

Control No.	Control code
C=1: Modulation Wheel	V=0 ~ 127
C=2: Breath Control	V=0 ~ 127
C=6: Data Entry slider FOOT VOL (DX27S)	V=0 ~ 127
C=7: Volume (data entry)	V=0 ~ 127
C=65: Portamento sw.	V=0: OFF, 127: ON
C=93: Chorus sw. (DX27S)	V=0: OFF, 127: ON
C=96: Data Entry +1	V=127
C=97: Data Entry −1	V=127

(3) Program Change

Status	1100nnnn(Cn)	n=channel no.
Program no.	0ppppppp	p=0 ~ 23: INTERNAL p=24~119: BANK

This data is transmitted when a voice selector is pressed during the play mode, when MIDI CHANNEL INFO is ON and MIDI SYS INFO is OFF.

(4) Pitch Bend

Status	1110nnnn(En)	n=channel no.
Code (LSB)	0uuuuuuu	
Code (MSB)	0vvvvvvv	

The transmitted data is as follows:

MSB	LSB	
00000000	00000000	Lowest value
01000000	00000000	Center value
01111111	01111110	Highest value

2-2 System Information

2-2-1 System Real-Time Message

Active sensing Status	11111110(FE)

Transmitted once approximately every 200 milliseconds

2-2-2 System Exclusive Message

Transmitted only when MIDI SYS INFO is ON

(1) Parameter Change

Status	11110000(F0)	
ID no.	01000011(43)	
Substatus/ch. no.	0001nnnn(1n)	n=channel no.
Parameter group no.	00010010(12)	
Parameter no.	0ppppppp	
Data	0ddddddd	
EOX	11110111(F7)	

This data is transmitted when voice or function Parameters are changed in the EDIT or FUNCTION modes. The voice parameters transmitted are those given in voice parameter table 5-2, and the function parameters transmitted are shown in function parameter table 5-3.

(2) 1 Voice Bulk Data

Status	11110000(F0)	
ID no.	01000011(43)	
Substatus/ch. no.	0000nnnn(0n)	n=channel no.
Format no.	00000011(03)	
Byte count	00000000(00)	
Byte count	01011101(5D)	
Data	0ddddddd	93 bytes
	0ddddddd	
Checksum	0eeeeeee	
EOX	11110111(F7)	

The data for one voice is transmitted when a voice selector is pressed in the PLAY mode. Data in the voice edit buffer is transmitted when a format no. f=3 dump request is received. The transmitted data is shown in voice parameter table 5-2. The checksum is the lowest 7 bits of the two's complement sum of all data bytes (the same applies below).

Functions not available on this unit are set as follows:

CHORUS: 0 (DX27)
PEG PR1=99, PR2=99, PR3=99
PL1=50, PL2=50, PL3=50
FOOT VOLUME RANGE = 99 (DX27)

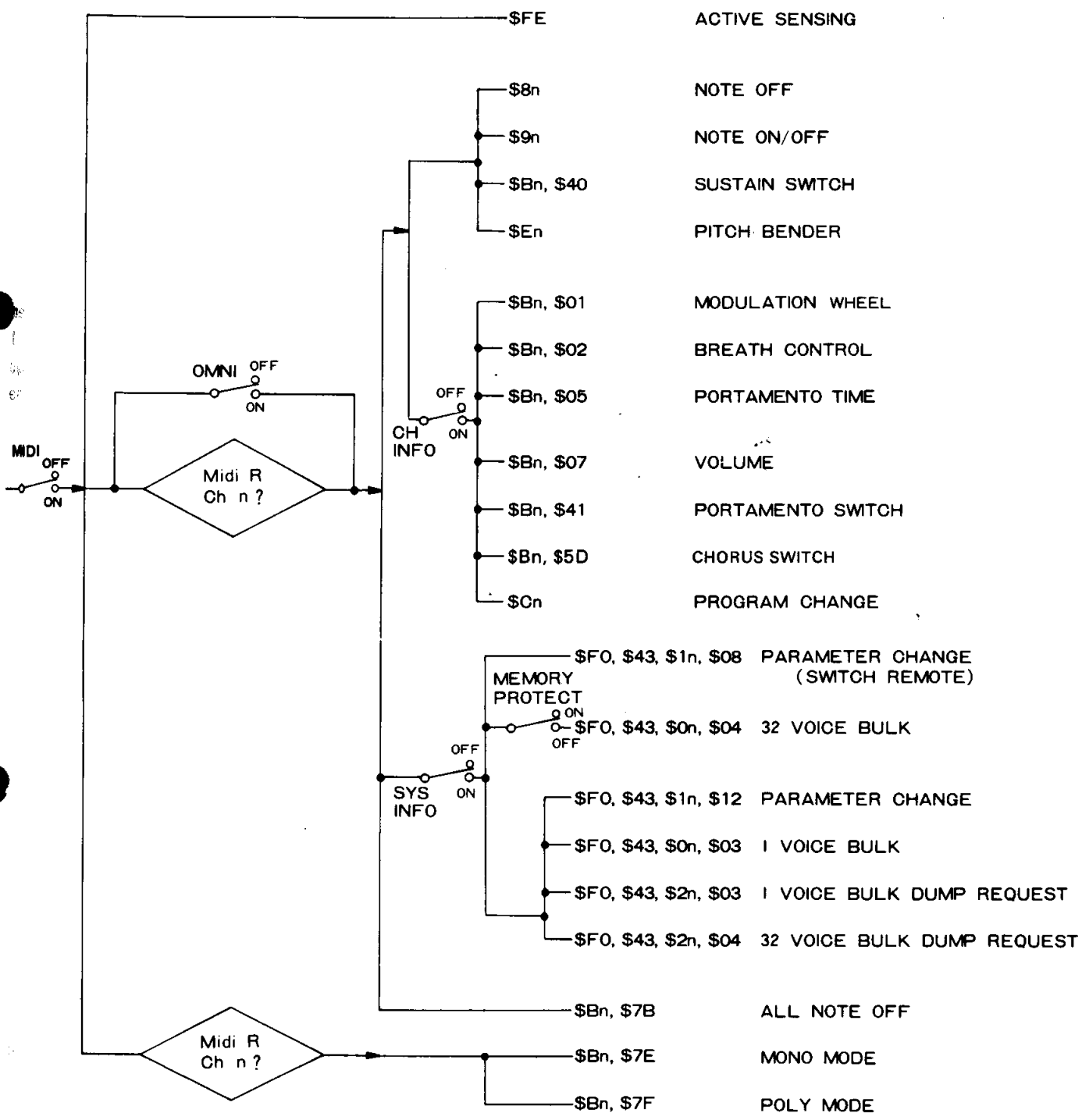
(3) 32 Voice BULK Data

Status	11110000(F0)	
ID no.	01000011(43)	
Substatus/ch. no.	0000nnnn(0n)	n=channel no.
Format no.	00000100(04)	
Byte count	00100000(20)	

Byte count	00000000(00)	
Data	0ddddddd	4096 bytes
	0ddddddd	
Checksum	0eeeeeee	
EOX	11110111(F7)	

The data of 32 voices, including the 24 voices in RAM memory,will be transmitted if the YES key is pressed in response to the "MIDI Transmit?" display which appears when the SYS INFO key is pressed twice in the FUNCTION mode. The data for all 32 voices will also be transmitted when a format no. f=4 dump request is received. The transmitted data is shown in voice data table 5-1. 55 bytes of 0's are added to the73 bytes in this table, so 128 bytes are transmitted for each voice. 4096 bytes are therefore transmitted for all 32 voices. Voices 25 through 32 are transmitted with initialized voice parameters.

3. Reception Conditions



4. Reception Data

All MIDI data is received when the MIDI ON/OFF function is ON. When a specific MIDI receive channel has been selected using the MIDI CHANNEL function, and the OMNI mode is OFF, MIDI data will be received only on the specified channel. MIDI data will be received on all channels when the OMNI mode is ON.

4-1. Channel Information

4-1-1 Channel Voice Message

(1) Key Off

Status	1000nnnn(8n)	n=channel no.
Note no.	0kkkkkkk	k=0(C-2)~127(G8)
Velocity	00000000(00)	

(2) Key On/Off

Status	1001nnnn(9n)	n=channel no.
Note no.	0kkkkkkk	k=0(C-2)~127(G8)
Velocity	0vvvvvvv	v=0: key off
		v=1~127: key on

The key on note level will vary according to the received velocity value (only when the KEY VELOCITY setting is greater than 0). The range of this instrument is C#−1 to C7. If a higher or lower key number is received, it will be output within the range limits. For example, received C#7 through C8 data will be output as notes in the C#6 through C7 range.

(3) Control Change

Status	1011nnnn(Bn)	n=channel no.
Control no.	0ccccccc	
Control code	0vvvvvvv	

a) Received whether MIDI CHANNEL INFO is ON or OFF

Control no.	Control code.
C=64: Sustain sw.	V=0~126: OFF, 127: ON

b) Received when MIDI CHANNEL INFO is ON

Control no.	Control code
C=1: Modulation Wheel	V=0~127
C=2: Breath Control	V=0~127
C=5: Portamento time	V=0~127
C=7: Volume	V=0~127
C=65: Portamento sw.	V=0~63: OFF, 64~127: ON
C=93: Chorus sw.	V=0~63: OFF, 64~127: ON

(4) Program Change

Status	1100nnnn(Cn)	n=channel no.
Program no.	0ppppppp	

Received only in the PLAY mode when MIDI CHANNEL INFO is ON. Number 120 through 127 will be processed as 119.

(5) Pitch Bend

Status	1110nnnn	n=channel no.
Code(LSB)	0uuuuuuu	
Code(MSB)	0vvvvvvv	

Functions only on MSB data:

MSB	
00000000	Lowest value
01000000	Center value
01111111	Highest value

4-1-2 Channel Mode Message

Status	1011nnnn	n=channel no.
	0ccccccc	
	0vvvvvvv	

Received whether MIDI CHANNEL INFO is ON or OFF

C=123	V=0	All notes OFF
C=126	V=1	MONO mode ON
C=127	V=0	POLY mode ON

4-2 System Information

4-2-1 System Real-Time Message

Active sensing	
Status	11111110(FE)

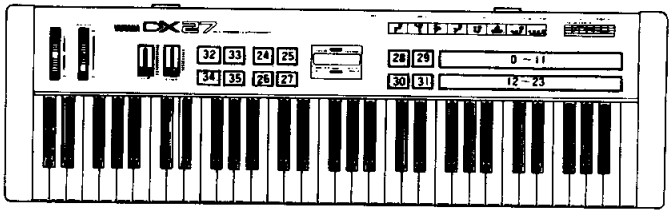
Sensing begins when this code is received once. If status and data are not received within 300 milliseconds the MIDI receive buffer will be cleared and the currently output note will be turned OFF.

4-2-2 System Exclusive Message

(1) Parameter Change (switch remote)

Status	11110000(F0)	
ID no.	01000011(43)	
Substatus/ch. no.	0001nnnn(1n)	n=channel no.
Parameter group no.	00001000(08)	
Switch no.	0mmmmmmm	
Data	0ddddddd	d=0: OFF, 1~127: ON
EOX	11110111(F7)	

All panel switches are controlled. The switch numbers are arranged as shown in the illustration below. Received only when MIDI SYS INFO is ON.



(2) Parameter Change

The format is the same as the transmitted parameter change data. Received only when MIDI SYS INFO is ON. Permits changing voice and function parameters while the EDIT mode is active. It is also possible to change modes: PLAY, EDIT,etc. The parameter no. and data received are show in voice parameter table 5-2 and function parameter table 5-3.

(3) 1 Voice Bulk Data

Received only when MIDI SYS INFO is ON. The format is the same as for the transmitted 1 voice bulk data. The 93 voice data bytes are read into the voice edit buffer, replacing the current voice data. The 93 received data bytes are shown in voice parameter table 5-2.
CHORUS, FOOT VOLUME RANGE and PEG data are ignored.

(4) 32 Voice Bulk Data

Received only when MIDI SYS INFO is ON. The format is the same as for the transmitted 32 voice bulk data. This data can be received only when the MEMORY PROTECT function is OFF. The received voice data is stored in the 24 INTERNAL voice memory locations. Voices numbered 25 and higher will be ignored. The "MIDI RECEIVED" display appears to confirm complete reception of voice bulk data.

(5) Dump Request

Status	11110000(Fn)	
ID no.	01000011(43)	
Substatus/ch. no.	0010nnnn(2n)	n=channel no.
Format no.	0fffffff	f=3, 4
EOX	11110111(F7)	

Received only when MIDI SYS INFO is ON. When received the bulk data corresponding to the received format code will be dumped via MIDI OUT.

f=3: 1 voice bulk data
f=4: 32 voice bulk data

5. System Exclusive Data

5-1. VOICE DATA (VMEM format)

Parameter no. P	Parameter	
0	ATTACK RATE	OP 4
1	DECAY 1 RATE	
2	DECAY 2 RATE	
3	RELEASE RATE	
4	DECAY 1 LEVEL	
5	KEYBOARD SCALING LEVEL	
6	AMPLITUDE MODULATION ENABLE/EG BIAS SENSITIVITY/KEY VELOCITY	
7	OUTPUT LEVEL	
8	OSCILLATOR FREQUENCY	
9	KEYBOARD SCALING RATE/DETUNE	
10 ⌇ 19	SAME AS FOR OP4	OP 2
20 ⌇ 29	SAME AS FOR OP4	OP 3
30 ⌇ 39	SAME AS FOR OP4	OP 1
40	LFO SYNC/FEEDBACK LEVEL/ALGORITHM	
41	LFO SPEED	
42	LFO DELAY	
43	PITCH MODULATION DEPTH	
44	AMPLITUDE MODULATION DEPTH	
45	PITCH MODULATION SENSITIVITY/AMPLITUDE MODULATION SENSITIVITY/LFO WAVE	
46	TRANSPOSE	
47	PITCH BEND RANGE	
48	CHORUS SWITCH *1/PLAY MODE/SUSTAIN FOOT SWITCH/ PORTAMENTO FOOT SWITCH/PORTAMENTO MODE	
49	PORTAMENTO TIME	
50	FOOT VOLUME RANGE *1	
51	MODULATION WHEEL PITCH MODULATION RANGE	
52	MODULATION WHEEL AMPLITUDE MODULATION RANGE	
53	BREATH CONTROL PITCH MODULATION RANGE	
54	BREATH CONTROL AMPLITUDE MODULATION RANGE	
55	BREATH CONTROL PITCH BIAS RANGE	
56	BREATH CONTROL EG BIAS RANGE	
57 ⌇ 66	VOICE NAME 1 ⌇ VOICE NAME 10	
67	PITCH EG RATE 1	*2
68	2	*2
69	3	*2
70	LEVEL 1	*2
71	2	*2
72	3	*2

*1: DX27S only
*2: not used

5-2. VOICE PARAMETERS (VCED format)

parameter no. P	parameter		LCD Display	Data	Note	
0	ATTACK RATE	OP4	AR	0 ~ 31		EDIT
1	DECAY 1 RATE		D1R	0 ~ 31		
2	DECAY 2 RATE		D2R	0 ~ 31		
3	RELEASE RATE		RR	0 ~ 15		
4	DECAY 1 LEVEL		D1L	0 ~ 15		
5	KEYBOARD SCALING LEVEL		LS	0 ~ 99		
6	KEYBOARD SCALING RATE		RS	0 ~ 3		
7	EG BIAS SENSITIVITY		EBS	0 ~ 7		
8	AMPLITUDE MODULATION ENABLE			0, 1		
9	KEY VELOCITY		KVS	0 ~ 7		
10	OUTPUT LEVEL		OUT	0 ~ 99		
11	OSCILLATOR FREQUENCY		F	0 ~ 63	Center = 3	
12	DETUNE		DET	0 ~ 6	Center = 3	
13 ~ 25	SAME AS FOR OP4	OP2				
26 ~ 38	SAME AS FOR OP4	OP3				
39 ~ 51	SAME AS FOR OP4	OP1				
52	ALGORITHM		ALG	0 ~ 7		FUNCTION
53	FEEDBACK LEVEL		FBL	0 ~ 7		
54	LFO SPEED		LFS	0 ~ 99		
55	LFO DELAY		LFD	0 ~ 99		
56	PITCH MODULATION DEPTH		PMD	0 ~ 99		
57	AMPLITUDE MODULATION DEPTH		AMD	0 ~ 99		
58	LFO SYNC		SYNC	0, 1		
59	LFO WAVE		LW	0 ~ 3		
60	PITCH MODULATION SENSITIVITY		PMS	0 ~ 7		
61	AMPLITUDE MODULATION SENSITIVITY		AMS	0 ~ 3		
62	TRANSPOSE		MID. C	0 ~ 48		
63	PLAY MODE POLY/MONO		Poly Mode	0, 1		
64	PITCH BEND RANGE		P Bend Range	0 ~ 12		
65	PORTAMENTO MODE		Full T. Porta	0, 1		
66	PORTAMENTO TIME		Porta Time	0 ~ 99		
67	FOOT VOLUME RANGE		Foot Vol	0 ~ 99	*1	
68	SUSTAIN FOOT SWITCH		Foot Sw	0, 1	Pair	
69	PORTAMENT FOOT SWITCH		Foot Sw	0, 1	Pair	
70	CHORUS SWITCH		Chorus	0, 1	*1	
71	MODULATION WHEEL PITCH MODULATION RANGE		MW Pitch	0 ~ 99		
72	MODULATION WHEEL AMPLITUDE MODULATION RANGE		MW Ampli	0 ~ 99		
73	BREATH CONTROL PITCH MODULATION RANGE		BC Pitch	0 ~ 99		
74	BREATH CONTROL AMPLITUDE MODULATION RANGE		BC Ampli	0 ~ 99		
75	BREATH CONTROL PITCH BIAS RANGE		BC P Bias	0 ~ 99		
76	BREATH CONTROL EG BIAS RANGE		BC E Bias	0 ~ 99		
77 ~ 86	VOICE NAME 1 ~ VOICE NAME 10			32 ~ 127 (ASCII)		
87	PITCH EG RATE 1				* 2	
88	2				* 2	
89	3				* 2	
90	LEVEL 1				* 2	
91	2				* 2	
92	3				* 2	

*1: DX27S only
*2: not used

5-3. FUNCTION PARAMETERS

Parameter no. P	Parameter	LCD Display	Data	Note
93	OPERATOR ENABLE/DISABLE OP1/OP2/OP3/OP4		0 , 1	
94	OPETATOR SELECT		0 ~ 3	
95	EDIT MODE 1=ON	E, e	0 , 1	※
96	FUNCTION MODE 1=ON	F, f	0 , 1	※
97	STORE MODE 1=ON	Mem Store	0 , 1	※
98				※
99				※
100	PLAY MODE 1=ON	P, p	0 , 1	※
101				
102				
103	MASTER TUNE 64=CENTER	M. Tune	0 ~ 127	※
104	MIDI SWITCH 1=ON	Midi :	0 , 1	※
105	MIDI CH INFO	Ch.Info :	0 , 1	※
106	OMNI 0=OFF 1=ON	Omni :	0 , 1	※
107	MIDI TRANS CH	Midi T Ch	0 ~ 15	※
108	MIDI RECV CH	Midi R Ch	0 ~ 15	※
109	MIDI SYS INFO	Midi Sys.Info	0 , 1	※
110	32 VOICE BULK DUMP	Midi Transmit ?	1	※
111	RECALL EDIT	Recall Edit ?	0 , 1	※
112	INIT VOICE	Init Voice ?	0 , 1	※
113	SAVE	Save to Tape ?	0 , 1	※
114	VERIFY	Verify Tape ?	0 , 1	※
115	LOAD	Load Tape ?	0 , 1	※
116	LOAD SINGLE	Load Single ?	0 ~ 127	※
117				
118				
119	MEMORY PROTECT 1=ON	M.Protect	0 , 1	※
120	KEY SHIFT 24=CENTER	Key Shift	0 ~ 48	※
121	PITCH BEND MODE 1=ON	Bend Mode	0 , 1	※
122	KEY SHIFT	K	0 , 1	※
123	COMPARE	C	0 , 1	※
124	PITCH BEND MODE		0 ~ 2	※
125	PRESET SEARCH No.		0 ~ 95	※
126	BANK VOICE No.		0 ~ 95	※
127	BANK VOICE DATA		0 ~ 119	※

※ Receive only

[Digital Programmable Algorithm Synthesizer] Date : 4/16, 1986
Model DX27 MIDI Implementation Chart Version : 1.0

Function ...		Transmitted	Recognized	Remarks
Basic	Default	1 - 16	1 - 16	memorized
Channel	Changed	1 - 16	1 - 16	
Mode	Default	3	1, 2, 3, 4	memorized
	Messages	POLY, MONO(M=1)	POLY, MONO(M=1)	
	Altered	XXXXXXXXXXXXXX	x	
Note Number		36 - 96	0 - 127	
	True voice	XXXXXXXXXXXXXX	13 - 108	
Velocity	Note ON	x 9nH,v=64	o v=1-127	
	Note OFF	x 9nH,v=0	x	
After Touch	Key's	x	x	
	Ch's	x	x	
Pitch Bender		o	o 0-12 semi	7 bit resolution
Control Change	1	o X1	o X1	Modulation wheel
	2	o X1	o X1	Breath control
	5	x	o X1	Portamento time
	6	o X1	x	Data entry knob
	7	o X1		Data entry knob in play mode
	7		o X1	Volume
	64	o	o	Sustain foot sw
	65	o X1	o X1	Portamento f sw
	96	o X1	x	Data entry +1
	97	o X1	x	Data entry -1
Prog Change	True #	o 0 - 119 X3 XXXXXXXXXXXXXX	o 0 - 127 X1 0 - 119	
System Exclusive		o X2	o X2	Voice parameters
System Common	Song Pos	x	x	
	Song Sel	x	x	
	Tune	x	x	
System Real Time	Clock	x	x	
	Commands	x	x	
Aux Mes- sages	Local ON/OFF	x	x	
	All Notes OFF	x	o (123,126,127)	
	Active Sense	o	o	
	Reset	x	x	

Notes: All MIDI communications are enabled if MIDI switch is on.
X1 = transmit/receive if CH information switch is on.
X2 = transmit/receive if system information switch is on.
X3 = transmit if CH information switch is on and system information switch is off.

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

[Digital Programmable Algorithm Synthesizer] Date : 4/16, 1986
Model DX27S MIDI Implementation Chart Version : 1.0

Function ...		Transmitted	Recognized	Remarks
Basic	Default	1 - 16	1 - 16	memorized
Channel	Changed	1 - 16	1 - 16	
Mode	Default	3	1, 2, 3, 4	memorized
	Messages	POLY, MONO(M=1)	POLY, MONO(M=1)	
	Altered	XXXXXXXXXXXXX	x	
Note Number		36 - 96	0 - 127	
	True voice	XXXXXXXXXXXXX	13 - 108	
Velocity	Note ON	x 9nH,v=64	o v=1-127	
	Note OFF	x 9nH,v=0	x	
After Touch	Key's	x	x	
	Ch's	x	x	
Pitch Bender		o	o 0-12 semi	7 bit resolution
Control Change	1	o X1	o X1	Modulation wheel
	2	o X1	o X1	Breath control
	5	x	o X1	Portamento time
	6	o X1	x	Data entry knob
	7	o X1		Foot volume and Data entry knob in play mode
	7		o X1	Volume
	64	o	o	Sustain foot sw
	65	o X1	o X1	Portamento f sw
	93	o X1	o X1	Chorus sw
	96	o X1	x	Data entry +1
	97	o X1	x	Data entry -1
Prog Change	True #	o 0 - 119 X3 XXXXXXXXXXXXX	o 0 - 127 X1 0 - 119	
System Exclusive		o X2	o X2	Voice parameters
System Common	Song Pos	x	x	
	Song Sel	x	x	
	Tune	x	x	
System Real Time	Clock	x	x	
	Commands	x	x	
Aux Mes- sages	Local ON/OFF	x	x	
	All Notes OFF	x	o (123,126,127)	
	Active Sense	o	o	
	Reset	x	x	

Notes: All MIDI communications are enabled if MIDI switch is on.
X1 = transmit/receive if CH information switch is on.
X2 = transmit/receive if system information switch is on.
X3 = transmit if CH information switch is on and system information switch is off.

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

YAMAHA DX27 DX27S VOICE/FUNCTION DATA

DATA NAME : _____

DATE : _____

NUMBER : _____

PROGRAMMER : _____

										AME			OP
													4
													3
													2
													1
ALGORITHM	FEEDBACK	WAVE	SPEED	DELAY	PMD	AMD	SYNC	PITCH	AMPLITUDE	EG BIAS	KEY VELOCITY		
		LFO						MODULATION SENSITIVITY					
1	2	3	4	5	6	7	8	9	10	11	12		

OP												
4												
3												
2												
1												
FREQ RATIO	DETUNE	AR	D1R	D1L	D2R	RR	OUT LEVEL	RATE	LEVEL	TRANSPOSE	(CHORUS)	
OSCILLATOR		ENVELOPE GENERATOR					OPERATOR	KEYBOARD SCALING				
13	14	15	16	17	18	19	20	21	22	23	24	

POLY/MONO	PITCH BEND RANGE	PORTAMENTO		FOOT SW ASSIGN/ (VOL)	WHEEL RANGE		BREATH RANGE			
		MODE	TIME		PITCH	AMPLITUDE	PITCH	AMPLITUDE	PITCH BIAS	EG BIAS

DX27 DX27S DATA NAME

DATE : _____

PROGRAMMER : _____

No.	VOICE NAME	REMARKS
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

DX27 DX27S DATA NAME

DATE : **PROGRAMMER :**

A			B		
No.	VOICE NAME	REMARKS	No.	VOICE NAME	REMARKS
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		
19			19		
20			20		
21			21		
22			22		
23			23		
24			24		

FCC INFORMATION (USA)

While the following statements are provided to comply with FCC Regulations in the United States, the corrective measures listed below are applicable worldwide.

This series of Yamaha professional music equipment uses frequencies that appear in the radio frequency range and if installed in the immediate proximity of some types of audio or video devices (within three meters), interference may occur.

This series of Yamaha professional music equipment has been type tested and found to comply with the specifications set for a class B computing device in accordance with those specifications listed in subpart J of part 15 of the FCC rules. Those rules are designed to provide a reasonable measure of protection against such interference.

This, however, does not guarantee that interference will not occur. If your professional music equipment should be suspected of causing interference with other electronic devices, verification can be made by turning your professional music equipment off and on. If the interference continues when your equipment is off, the equipment is not the source of interference. If your equipment does appear to be the source of the interference, you should try to correct the situation by using one or more of the following measures:

Relocate the equipment or the electronic device that is being affected by the interference.

Use power from different branch (circuit breakers or fuse) circuits for the professional music equipment and the device being affected or install AC line filters.

In the case of radio or TV interference, relocate the antenna or, if the antenna lead-in is 300 ohm ribbon lead, change the lead-in to co-axial type cable.

If these corrective measures do not produce satisfactory results, please contact your authorized Yamaha professional products dealer for suggestions and/or corrective measures. If you can not locate a authorized Yamaha professional products dealer in your general area contact the professional music Service Department, Yamaha international, 6600 Orangethorpe Ave., Buena park, CA 90620, USA.

If for any reason, you should need additional information relating to radio or TV interference, you may find a booklet prepared by the Federal Communications Commission helpful; "How to Identify and Resolve Radio—TV interference Problems". This booklet is available from the U.S. Government Printing Office, Washington D.C. 20402—Stock No. 004-000-00345-4.

Bescheinigung des Importeurs

Hiermit wird bescheinigt, daß der/die/das

Digital Synthesizer Typ : DX27S

(Gerät, Typ, Bezeichnung)

in Übereinstimmung mit den Bestimmungen der

VERFÜGUNG 1046/84

(Amtsblattverfugüng)

funk-entstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Yamaha Europa GmbH

Name des Importeurs

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Bör endast bytas av servicepersonal.
Explosionsfara vid felaktig hantering.

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NIPPON GAKKI CO., LTD. HAMAMATSU, JAPAN

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