

YAMAHA



DIGITAL PROGRAMMABLE ALGORITHM SYNTHESIZER
SYNTHÉTISEUR NUMÉRIQUE À ALGORITHMES
PROGRAMMABLES

DIGITAL PROGRAMMIERBARER ALGORITHMUS
SYNTHESIZER

OWNER'S MANUAL
MANUEL D'UTILISATION
BEDIENUNGSANLEITUNG

CONGRATULATIONS!

Your Yamaha DX100 Digital Programmable Algorithm Synthesizer incorporates state-of-the-art digital FM tone generation technology, providing extraordinarily vibrant, rich voices and outstanding playability. The DX100 has a programmable 24-voice INTERNAL memory (RAM) from which any voice can be selected at the touch of a button, two 96-voice PRESET (ROM) memories (a total of 192 fine preset voices!), a 96-voice BANK memory that permits storage of PRESET voices in any configuration for one-touch selection, and a cassette interface that permits unlimited storage of FM voices. Of course, the DX100 is fully programmable, allowing you to create your own FM voices or sound effects. Broad MIDI compatibility is also provided so the DX100 can control or be controlled via other MIDI-compatible music equipment.

To ensure that you gain maximum benefit from all the performance and flexibility provided by the DX100, we urge you to read this owner's manual thoroughly while actually trying out all of the available functions.

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PRECAUTIONS

1. Location

Avoid locations exposed to direct sunlight or other sources of heat. Also avoid locations subject to vibration, excessive dust, cold or moisture.

2. Cleaning

Do not attempt to clean the exterior with chemical solvents; this may damage the finish. Clean with a soft, dry cloth.

3. Service and Modifications

Do not open the DX100 or attempt to make your own repairs or modifications to any part of the instrument. Such actions may not only result in electrical shock or damage, but will also void the product warranty. Refer all servicing to a qualified Yamaha service center.

4. Relocation

When moving the instrument be sure to unplug the AC adaptor (PA-1210, optional) as well as all other connecting cables.

5. Handling

Avoid applying excessive force to switches and slide controls, dropping or rough handling. The DX100 is ruggedly constructed using reliable solid-state circuitry, but it is still a fine instrument and should be treated with care.

6. Electrical Storms (Lightning)

Digital circuitry, such as that used in the DX100, is sensitive to voltage spikes and surges. Be sure to remove all connecting cables in the event of an electrical storm.

7. Electromagnetic Fields

Digital circuitry is also sensitive to electromagnetic fields such as those produced by television sets, radio receivers, transmitters, transceivers, etc. The DX100 should be kept several feet away from any such sources in order to prevent possible random malfunctions.

CHAPTER I: SETTING UP

1. Audio Outputs

The DX100 has a single mono audio output for its tone generator channel. This is labelled OUTPUT. It permits sending a mono signal to either a mono or stereo sound system, or a mixing console for recording or PA applications.

2. Optional Foot Switch

The FOOT SW phone jack is for an optional footswitch. It accepts a Yamaha FC-4 or FC-5 footswitch or equivalent for portamento/sustain control; press for sustain or portamento release to damp or turn portamento off.

3. Optional BC-1 Breath Controller

Yamaha's unique BC-1 breath controller is plugged into the mini-jack on the rear panel.

4. Headphones

The PHONES jack accepts any standard pair of stereo headphones. The audio signal is sent to the headphones in mono. Headphone volume is controlled by the VOLUME control on the top panel.

5. MIDI Terminals

These terminals are used when connecting the DX100 to other MIDI (Musical Instrument Digital Interface) compatible equipment such as digital sequence recorders, modular FM voice generators, drum machines, etc. The MIDI OUT terminal transmits MIDI data from the DX100 to other MIDI equipment. The MIDI OUT terminal will normally be connected to the MIDI IN terminal of the receiving equipment. The MIDI IN terminal receives MIDI data from external MIDI equipment such as a digital sequence recorder, music computer or modular FM voice generator. The DX100's MIDI IN terminal will normally be connected to the MIDI OUT terminal of the transmitting equipment. The MIDI THRU terminal re-transmits the data received at the MIDI IN terminal. Thus, data received via the DX100 MIDI IN terminal can be simultaneously sent to other MIDI equipment.

6. Cassette

The DIN connector end of the supplied cassette cable is plugged into the DX100 CASSETTE connector. The three plugs on the other end of the cable should be connected to a cassette data recorder (the kind normally used with personal computers, etc.) as follows:

- RED → cassette deck microphone input.
- WHITE → cassette deck earphone output.
- BLACK → cassette deck remote input (where applicable).

7. Battery, AC Power Adaptor

The DX100 operates off 6 "C" size batteries which are inserted in the battery compartment at the bottom of the synthesizer. To operate the DX100 from an AC power outlet, insert the optional PA-1210 AC power adaptor cord into the DC IN jack located on the rear panel of the DX100, and then plug the standard 2-prong plug into an AC wall socket. Be sure that your local line voltage matches that specified on the PA-1210. You will find the POWER switch next to the DC IN jack on the rear panel of the DX100.

NOTE:

When setting up your system, be sure to turn ON the DX100 (and any effects units used) BEFORE turning ON the main amplifier system. This will prevent the initial power-on shock surge from possibly damaging your amplifier and speaker system.

8. Power-ON, Low Battery LED Indicator

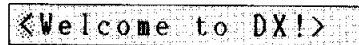
The DX100 features a Power-ON LED indicator, located immediately to the right of the LCD indicator on the top panel. It glows when the Power switch on the rear panel is turned ON. Additionally, it flashes to warn of low battery power should such an occasion arise (batteries provide approximately 10 hours of continual use.)

9. LCD Contrast Control

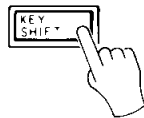
An LCD Contrast Control, located on the back panel, is provided in the DX100 to provide a clearly visible readout under most lighting circumstances.

10. ID Function

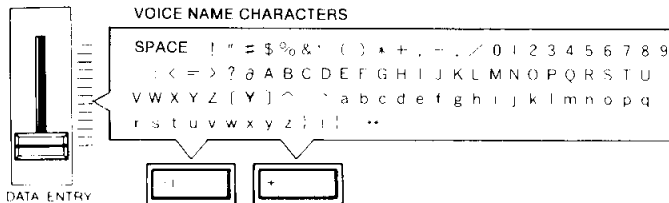
It is possible to change the "Welcome to DX!" message which appears when the power is first switched ON to anything you like—your name, for example. To change the ID, hold the KEY SHIFT button while turning the power ON. The current ID message will be displayed with a cursor over the first character.



The cursor can then be moved to any character position on the display by successively pressing the KEY SHIFT button.



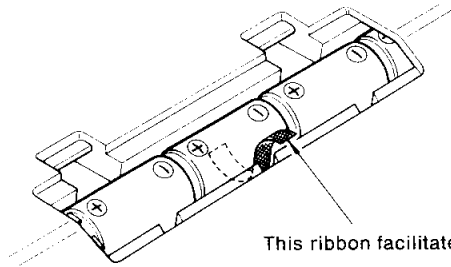
Choose the position to enter a new character, then using the DATA ENTRY slider or buttons, select the new character from the available character set.



Move the cursor to the next character position and enter the next character as described above. When your new ID message is complete, simply press any button other than the KEY SHIFT, DATA ENTRY, STORE or FUNCTION buttons to enter the normal operation mode. The new ID message you have entered will now be displayed every time you turn the instrument ON.

11. When Using Dry Batteries

Insert 6 C size dry batteries (optional). Remove the cover at the rear of the main unit and insert the batteries while checking the polarity. When doing so, be sure to set the ribbon for removing batteries under the second one from the left.



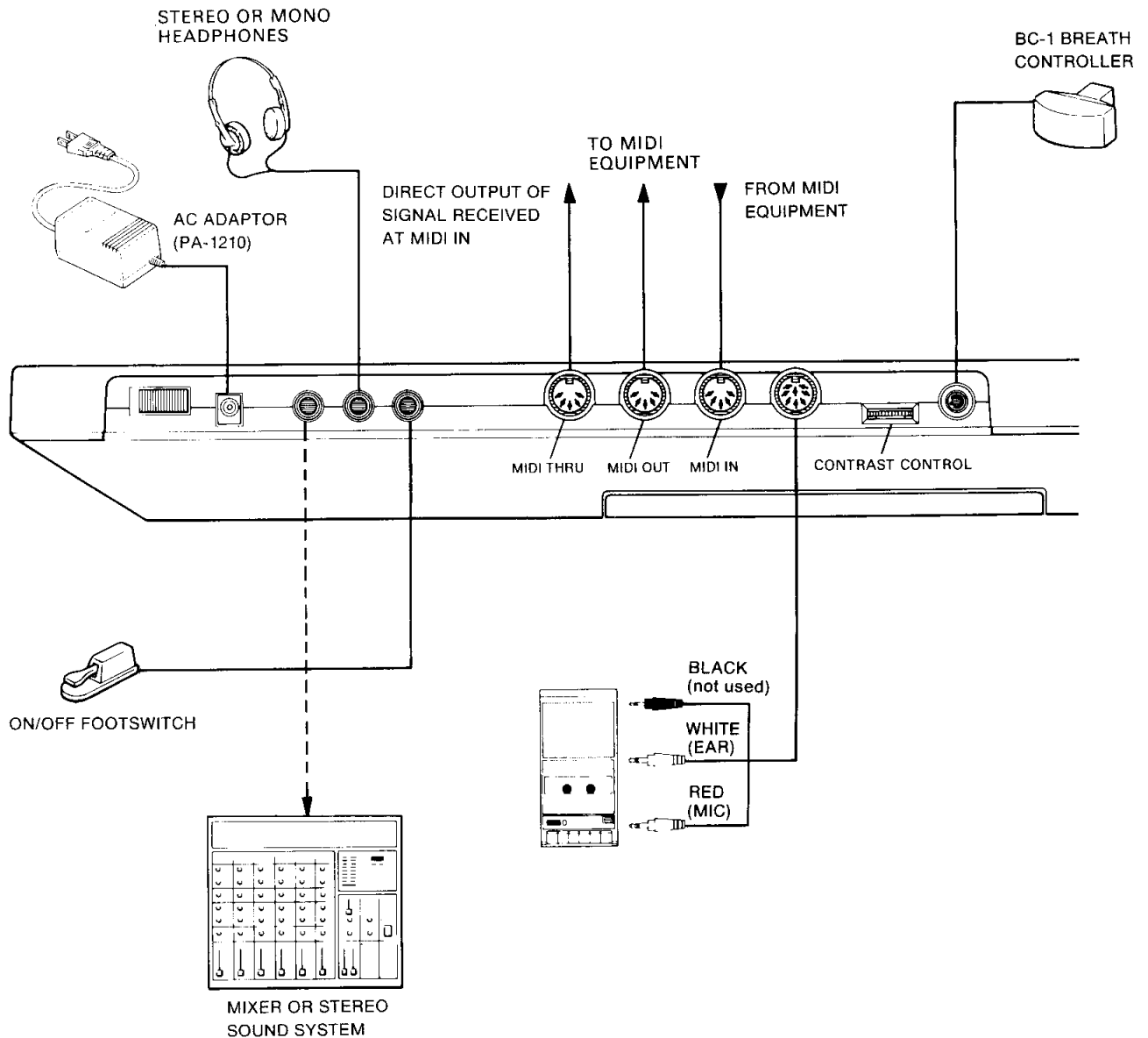
This ribbon facilitates removal of the batteries.

After inserting the dry batteries, replace the cover of the battery compartment.

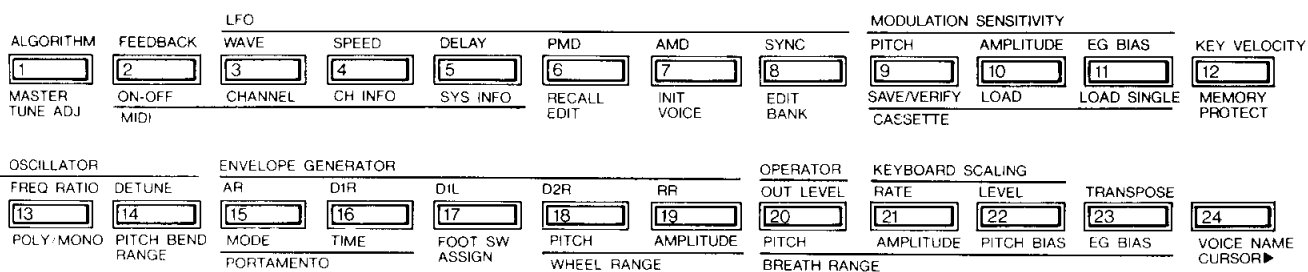
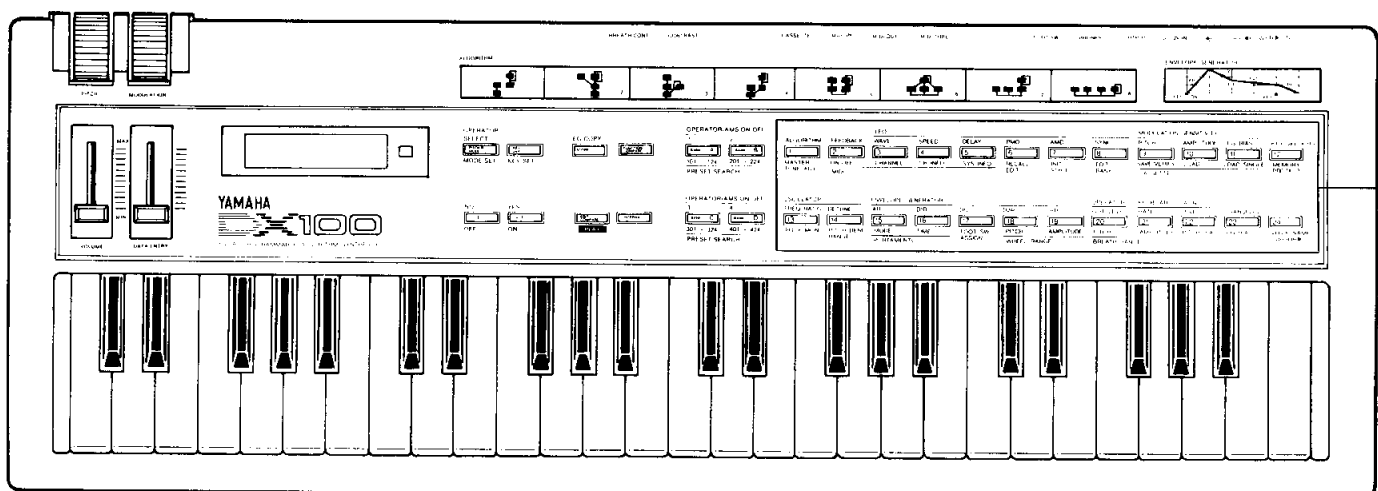
NOTE:

We recommend that you use the AC adaptor (PA 1210) in preference to batteries whenever possible; it is much more economical.

DX100 CONNECTIONS



CHAPTER II: PLAYING THE DX100



1. DX100 Voice Memory Configuration

The DX100 has three different voice memories which serve different purposes. They are:

The 24-voice INTERNAL memory.

This voice memory is used for quick selection of voices for performance, and it is to this memory that original voices you have edited or programmed are initially stored. Cassette LOAD and STORE operations are also carried out to and from the 24-voice INTERNAL memory. Voices from the 192-voice PRESET memory may also be stored in the INTERNAL memory.

The 96-voice BANK memory (4 BANKS x 24 voices each).

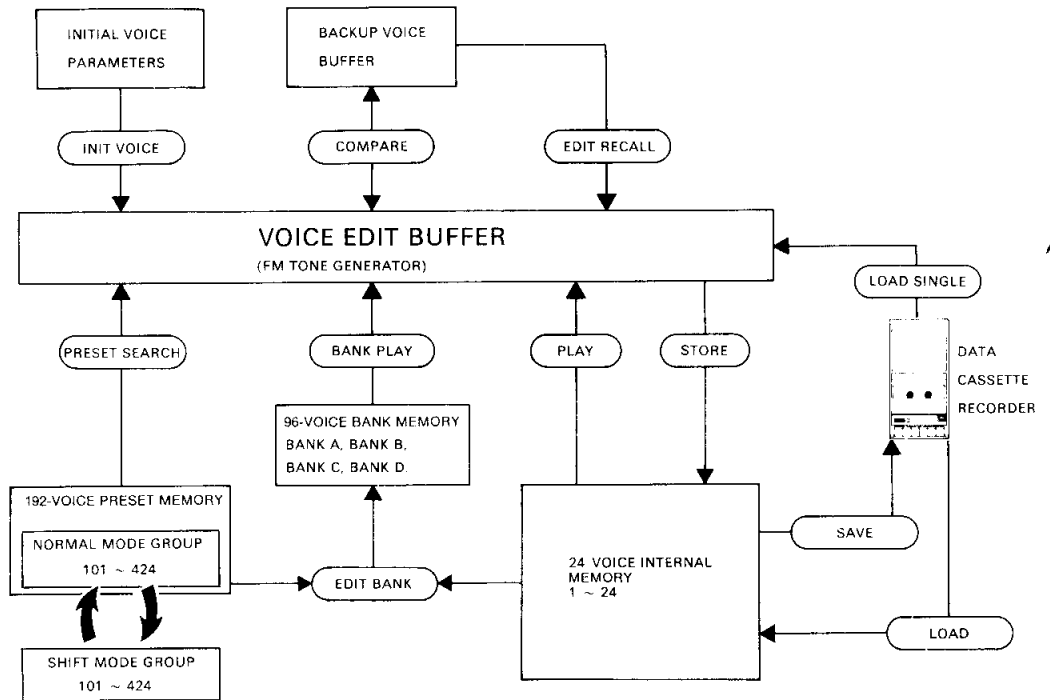
The BANK memory incorporates four 24-voice BANKS—A, B, C and D. The BANK is most useful for storing groups of voices you have arranged for specific purposes. The different banks may be programmed with different voice groups you need for different "sets" in a performance, or you can categorize your voices into BANKS (i.e. piano-type voices in one bank, brass in another, etc.), or any combination you like. The BANK can be loaded with voices from the PRESET memory (described below) or from the INTERNAL memory using the EDIT BANK function.

The 192-voice PRESET memory.

This is a read-only memory which contains 192 FM voices. These are organized into two groups of 96 voices each. The first group is accessible in the NORMAL

mode, while the second group is accessed in the SHIFT mode (these modes will be described below). These voices may be selected and stored in the BANK or INTERNAL memories as desired. They can also be directly accessed and played using the PRESET SEARCH function.

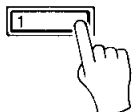
The chart below shows the overall DX100 voice memory configuration. The VOICE EDIT BUFFER is a special memory into which a voice is placed when selected. Whether a voice is selected from the INTERNAL memory, the BANK memory, or the PRESET memory, it is placed in the VOICE EDIT BUFFER where it can be played, edited, stored in another memory location or saved on cassette.



NOTE:
The voices in the PRESET memory are numbered as follows: each group of 96 voices—the NORMAL group and the SHIFT group—is further subdivided into four groups of 24 voices each (101–124, 201–224, 301–324, and 401–424). Thus you have NORMAL group voices 101–424, and SHIFT group voices 101–424.

2. The INTERNAL PLAY Mode

To access the 24-voice INTERNAL memory, enter the INTERNAL PLAY mode by pressing the INTERNAL PLAY button. Next, select a voice from the INTERNAL memory by pressing the corresponding voice selector button (1–24). At this point, the LCD display will indicate the voice number and voice name. These are preceded by a "P," indicating that the INTERNAL PLAY mode has been selected.



P 1 Ivory Ebony

In this mode, you can play any of the voices currently in the DX100's 24-voice INTERNAL memory individually.

3. The **BANK PLAY** Mode

The BANK PLAY mode enables you to access the 96 BANK memory locations. These initially contain the first group of 96 voices from the 192-voice PRESET ROM. By using the SHIFT mode, however, you can also access the second group of presets while in the BANK PLAY mode. Later, you can store any voices you like in any order in any of the BANKS.

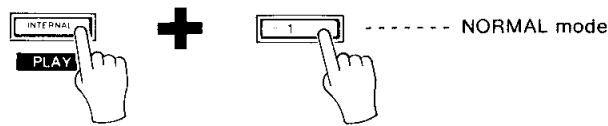
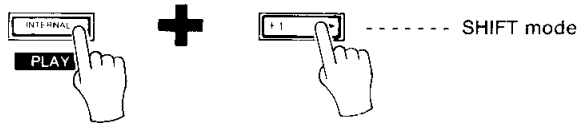
While in the INTERNAL PLAY mode, press any of the BANK buttons; BANK A—BANK D. This will select the appropriate BANK, and the 24 voices in that bank can be selected by pressing any of the DX100's 24 voice buttons.

PA 2 Uppt piano

The SHIFT Mode

By entering the DX100 SHIFT mode while in BANK PLAY, the correspondingly numbered voice from the second (SHIFT) group of preset voices will be selected. Note that in the BANK PLAY mode this only applies to voices which have been stored in the BANK memory from the 192-voice PRESET memory. Voices stored in the BANK from the 24-voice INTERNAL memory will not change when the SHIFT mode is selected.

To enter the SHIFT mode, hold down the INTERNAL PLAY button and press the +1 button. To return to the NORMAL mode hold down the INTERNAL PLAY button and press the -1 button.



4. The 192-Voice PRESET Memory

The DX100 comes with 192 different pre-programmed voices in an internal ROM (Read Only Memory). These voices can be loaded individually into the DX100's selectable 24-voice INTERNAL memory, or into any location in the DX100 BANK memory.

THE 192 PRESET ROM VOICES NORMAL MODE VOICES

Group 1		Group 2		Group 3		Group 4	
01 IvoryEbony	Piano	01 Solid Bass	Bass	01 Easy Synth	Comping	01 Glocken	Percussion II
02 Uprt piano		02 SyntheBass		02 Easy Clav		02 Hamarimba	
03 HonkeyTonk		03 Mono Bass		03 >>WOW<<		03 SteelDrums	
04 Elec Grand		04 Elec Bass		04 Metal Keys		04 Tube Bells	
05 Pianobells		05 Fretless		05 PickPluck		05 Templegong	
06 Acous Elec		06 Horns		06 S/H Synth		06 Good Vibes	
07 OldElectro	E.P	07 Flugelhorn	Brass	07 Heavysynth	Lead Synth	07 Racing Car	Effects I
08 NewElectro		08 Hard Brass		08 Harnosolo		08 Helicopter	
09 High Tines		09 PowerBrass		09 Feed Lead		09 Alarm Call	
10 Wood Piano		10 BC1Trumpet		10 Mono Lead		10 Dopplar FX	
11 Vibrabelle		11 Strings		11 Lyrisyln		11 Storm Wind	
12 Pianobrass		12 Silk Cello		12 Schmooh		12 Birds	
13 Jazz Organ	Organ	13 Orchestra	Strings	13 Claranette	Lead Acoustic	13 Hole in 1	Effects II
14 Ham<n>Eggs		14 SoloViolin		14 Pan Floot		14 <<Smash>>	
15 Club Organ		15 Box Cello		15 Lead Reed		15 FM SQUARE	
16 <6 Tease>		16 Richstring		16 Mono Sax		16 FM PULSE	
17 GentlePipe		17 5th String		17 Flutewood		17 FMSAWTOOTH	
18 Full Ranks		18 Harpsi low		18 <BC1> Sax		18 LFO NOISE	
19 Plukguitar	Plucked Strings	19 Harpsi Hi	Other KBD	19 BC1 Hrmnca	Percussion I	19 PINK NOISE	Effects II
20 Soft Harp		20 Fuzz Clav		20 Timpani		20 Windbells	
21 Jazz Guit		21 Clear Clav		21 Xylosnare		21 Synvox	
22 Old Banjo		22 Squeezebox		22 Synballs		22 Whistling	
23 Kotokoto		23 Celeste		23 Clockwerks		23 Voices	
24 Folk Guit		24 Circustime		24 HeiferBell		24 Mars to ??	

SHIFT MODE VOICES

Group 1		Group 2		Group 3		Group 4	
01 Piano 1	Piano	01 Clickorgan	Organ	01 Rich Strg 1	Strings	01 Snare Bass	Percussion I
02 Piano 2		02 Drawbars		02 Rich Strg 2		02 SnareDrum 1	
03 Piano 3		03 Guitar 2		03 Rich Strg 3		03 SnareDrum 2	
04 Piano Vel		04 Fuzz Guit		04 Pizzicato		04 Tom Toms	
05 Honkeyton2		05 Brt Guitar		05 Harpsicrd 1		05 SteelDrum 2	
06 Deep Grand		06 Zither		06 Harpsicrd 2		06 Synth Perc	
07 PhaseGrand		07 Harp 1		07 Clav 1		07 Xylophone 1	
08 Left Hand	E.P	08 Lute	Plucked Strings	08 Clav 2	Other KBD	08 Xylophone 2	Percussion II
09 Elec Grnd 2		09 Sitar		09 Mute Clav 1		09 Marimba	
10 E Grnd Vel		10 SynthBass 1		10 Mute Clav 2		10 Mamarimba	
11 E Piano 1		11 SynthBass 2		11 LeadSynth 1		11 Glocken 2	
12 E Piano 2		12 Pluck Bass		12 Cheeky		12 Vibe	
13 E Piano 3		13 Flap Bass		13 RubberBand		13 TublarBell	
14 E P String		14 Uprt Bass		14 Hollowlead		14 BellsBells	
15 Hard Tines	Organ	15 Brass 1	Brass	15 Huff Talk	Lead Acoustic	15 Wild War !!	Effects
16 PercoPiano		16 Brass 2		16 Harmonica 1		16 YS 11	
17 Organ 1		17 Brass 3		17 Harmonica 2		17 Wave	
18 Organ 2		18 Brass 4		18 Horn		18 Winds	
19 Elec organ		19 Brass 5		19 Flute 1		19 Shogakko	
20 16 8 4 2 F		20 Brass 6		20 Flute 2		20 Fantasy	
21 Theater		21 Brass 7		21 Oboe		21 SpaceChime	
22 Small Pipe	22 Strings 1	22 Trombone	22 Ghosties				
23 Mid Pipe	23 Strings 2	23 BC1 Horns	23 Space Talk				
24 Big Pipe	24 Strings 3	24 Bassoon	24 Zing Plop				

The PRESET voice can also be accessed directly and played using the PRESET SEARCH function.

PRESET SEARCH

This function allows you to directly access the voices in the PRESET memory in the order they appear in the PRESET memory.

PRESET SEARCH is accessed in the FUNCTION mode. To enter the FUNCTION mode, press the FUNCTION button. Then press any of the PRESET SEARCH selectors to access the corresponding voices (these are the same as the BANK A–D selectors used in the BANK PLAY mode). In the NORMAL (NON-SHIFT) mode, the PRESET SEARCH selectors call PRESET voice groups 101–124, 201–224, 301–324, and 401–424 from the NORMAL preset voice group. In the SHIFT mode (described previously in “The BANK PLAY Mode”), the correspondingly numbered voices from the SHIFT preset voice group are selected. The 24 voices in each group are selected by pressing the corresponding voice selector. After selecting PRESET SEARCH 101–124, for example, the LCD will appear as follows:

F301 Easy Synth

“F” indicates that you are in the FUNCTION mode PRESET SEARCH function. This function lets you review the voices in the PRESET memory. It is also possible to store a voice selected in this mode into any of the 24-voice INTERNAL memory locations by using the STORE function described later in this manual.

CHAPTER III: THE FUNCTION MODE

The FUNCTION mode permits access to four groups of functions: tuning functions, MIDI functions, memory management functions, and performance functions. In this chapter, we'll describe each of these functions; what they do and how they are programmed.

1. Accessing the FUNCTION Mode

The FUNCTION mode is selected by pressing the FUNCTION button. Individual parameters to be programmed are then called by pressing the appropriate voice button. Note that when the FUNCTION mode is active, pressing a voice button calls the corresponding FUNCTION parameters, not the corresponding voice. The available functions are printed in brown below each voice button. Two additional functions, the MODE SET and KEY SET buttons are NOT included among the voice buttons; these function buttons are located immediately above the DATA ENTRY -1 and +1 buttons.

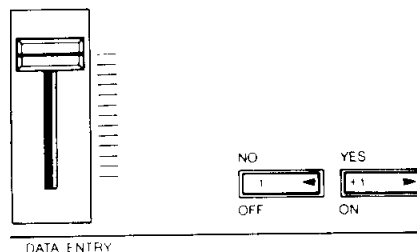
When the FUNCTION mode is selected, the LCD should look something like this.

A rectangular LCD display showing the text "F M. Tune = 0". The "F" is in a larger font than the rest of the text.

The "F" in the first character position of the LCD indicates that the FUNCTION mode is active. Following the "F" is the name of the selected function and its current data. In the example above, the MASTER TUNE function is selected (press the 1 button), and the data is currently set at 0.

2. Entering Function Data

Once the desired function has been selected, its value can be changed by using either the linear DATA ENTRY slider located to the left of the panel, or the adjacent -1/+1 buttons.



Moving the DATA ENTRY slider away from you increases the value of the selected parameter, and moving the control towards you decreases the data value. Pressing the -1 button decreases the value of the selected parameter by one, and pressing the +1 button increases the value by one. While the DATA ENTRY slider is valuable for quickly approaching the desired value of parameters that have a large data range, the +1 and -1 buttons permit precise step-wise location of a specific value. The switches are also easier to use with parameters that only have two values (i.e. ON or OFF). In some cases, you will be required to answer YES or NO to prompts that appear on the LCD display. The -1/+1 buttons are used for this purpose.

3. The Performance Parameters

"Performance parameters" are programmable parameters which pertain mainly to real-time performance effects, such as how the Pitch Bend and Modulation Wheels affect the sound. After a function is selected using the corresponding button, it can be incremented by continuing to press the same button.

* Note that performance parameters 13 through 24 can be set differently for each individual voice. Once you have changed any of these function parameters for a particular voice, you can save your new settings with the INTERNAL voice by using the STORE function. (see *CHAPTER IV: VOICE PROGRAMMING*, 4. Storing Voice Data).

13: POLY/MONO



This function selects either the POLY or MONO output mode. Voices programmed with the POLY mode will let you play up to 8 notes. In the MONO mode, the DX100 acts as monophonic keyboard.

Once the POLY/MONO function is selected, subsequent presses of button #13 will alternate between the POLY and MONO modes. The DATA ENTRY buttons can also be used; the -1 button selects POLY and the +1 button selects MONO.

14: PITCH BEND RANGE



This function sets the pitch range of the Pitch Bend Wheel located at the upper left of the DX100 panel. The Pitch Bend Wheel automatically centers at normal pitch. Moving the Wheel upward (away from the player) will raise the pitch, and moving it downward (toward the player) will lower the pitch. These pitch bend directions can also be reversed by holding down the PITCH B MODE button while switching the DX100 power ON. This provides the same depth of effect but in the opposite direction of wheel movement. This can be useful in performance situations.

The data range is from 0 to 12. At 0, the Pitch Bend Wheel is off and will have no effect. Each increment between 1 and 12 represents a semitone (i.e. the pitch variation between any white key and a black key immediately next to it). Thus, if this function is set to 12, maximum travel of the Pitch Bend Wheel either above or below its center position will produce a one-octave pitch variation.

The DATA ENTRY slider and -1/+1 buttons can be used to enter the data. Once the PITCH BEND RANGE function is called, subsequent presses of button #14 will increment (increase) the data value.

PITCH B MODE: MODE SET



This function button, located immediately above the DATA ENTRY -1 button, offers a choice of three Pitch Bend Wheel modes: Low, High and Kon. In the Low mode, the Pitch Bend Wheel affects only the lowest note played on the keyboard. In other words, if a chord is played, the Pitch Bend Wheel will affect only the pitch of the lowest note in the chord—this makes it possible to produce some interesting effects. The High mode is just the opposite, only the highest note played will be affected by the Pitch Bend Wheel. In the Kon (Key on) mode, all notes played are affected by the Pitch Bend Wheel.

The DATA ENTRY slider, the -1/+1 buttons and the PB MODE button can be used to select the desired mode.

NOTE:

The PB MODE parameter is NOT individually programmable for each voice.

15: PORTAMENTO MODE



Two different portamento modes are available: Full Time Portamento and Fingered Portamento. When the POLY/MONO function (button #13) is set to POLY, only the Full Time Portamento mode is accessible. In the MONO mode, however, you have a choice between the Full Time and Fingered portamento modes.

- (1) "Full T. Porta" (MONO and POLY modes): A conventional portamento effect in which portamento occurs whenever a new note is played.
- (2) "Fingered Porta" (MONO mode): Portamento only occurs if the previously played note is held while the next note is played. This mode is useful in recreating the effect of guitar string bending techniques, acoustic bass or bass guitar slide effects, etc. If you lift your hand off the DX100 keyboard between notes, there will be no portamento effect.

Once the PORTAMENTO MODE function is called, subsequent presses of button #15 will alternate between the two available portamento modes (provided that the MONO mode is selected). The DATA ENTRY slider and -1/+1 buttons can also be used to select the desired portamento mode.

16: PORTAMENTO TIME



This function sets the speed of the portamento effect.

The data range is from 0 to 99. At 0, the portamento is off. A setting of 99 will produce the longest portamento effect.

Data can be entered using the DATA ENTRY slider and -1/+1 buttons. Once the PORTAMENTO TIME function has been called, subsequent presses of button #16 (PORTAMENTO TIME) will increment the data value.

17: FOOT SWITCH ASSIGN



This function selects whether the Yamaha FC-4 or FC-5 footswitch plugged into the rear-panel footswitch jack will act as a SUSTAIN or PORTAMENTO pedal. Depending upon which of the two functions has been selected by button #17 (select by using the -1/+1 buttons), the footswitch, when pressed, will operate accordingly. When it is not pressed, the selected effect is OFF. The PORTAMENTO function parameters can be adjusted by using the PORTAMENTO MODE and PORTAMENTO TIME buttons (#15 and #16, respectively). In the SUSTAIN mode, the footswitch will sustain notes played to the limit set by the ENVELOPE GENERATOR'S D2R parameter (see *CHAPTER IV: ENVELOPE GENERATOR*, 18: D2R) when it is set to a rate other than 0, even though the keys have been released. If the EG D2R is set to 0, then the D1L level will be maintained until the footswitch is released.

18: MODULATION WHEEL RANGE, PITCH



As you move the DX100 Modulation Wheel away from you, an increasing amount of LFO (Low Frequency Oscillator) modulation is applied to the selected voice.

The LFO modulation can be made to modulate the pitch of the voice, producing a range of vibrato type effects. The WHEEL RANGE, PITCH function is used to set the maximum depth of pitch modulation which can be applied using the Modulation Wheel. The actual effect produced depends on the settings of the LFO parameters (these will be discussed in *CHAPTER IV: VOICE PROGRAMMING*). Note, however, that the appropriate voice PITCH MODULATION SENSITIVITY parameter must be set to a value higher than 0 for pitch modulation to be effective. (The voice PITCH MODULATION SENSITIVITY parameter will also be discussed in *CHAPTER IV*.) The data range is from 0 to 99. At 0, pitch modulation is OFF, and moving the Modulation Wheel will cause no pitch modulation to be applied to the voice. A setting of 99 will produce the greatest possible pitch modulation depth.

Data is entered using the DATA ENTRY slider or buttons. Once this function is called, subsequent presses of button #18 will increment the data value.

NOTE:

Modulation Wheel control direction is reversed along with the Pitch Bend Wheel when the PITCH B MODE SET button is pressed while turning on the power to the DX100.

19: MODULATION WHEEL RANGE, AMPLITUDE



The LFO modulation can also be made to modulate the amplitude (level) of specified voice elements (operators), producing a range of tremolo or timbre modulation (wah-wah) type effects. The WHEEL RANGE, AMPLITUDE function is used to set the maximum depth of amplitude modulation that can be applied by using the Modulation Wheel. The actual effect produced depends on the settings of the LFO parameters (discussed in *CHAPTER IV: VOICE PROGRAMMING*). The appropriate voice AMPLITUDE MODULATION SENSITIVITY parameter must be set to a value higher than 0 for amplitude modulation to be effective. (The voice AMPLITUDE MODULATION SENSITIVITY parameter will also be discussed in *CHAPTER IV*.)

The data range is from 0 to 99. At 0, amplitude modulation is OFF, and moving the Modulation Wheel will cause no amplitude modulation to be applied to the voice. A setting of 99 produces the greatest possible amplitude modulation depth.

Data is entered using the DATA ENTRY slider or buttons. Once this function is called, subsequent presses of button #19 will increment the data value.

The Yamaha Breath Controller

The optional Yamaha BC-1 Breath Controller is a unique way of adding musical expression as you play the DX100 keyboard. The BC-1 is held in the mouth just like the mouthpiece of a wind instrument. Blowing harder or softer into the BC-1 mouthpiece produces a corresponding effect. The Breath Controller can be used to apply varying amounts of pitch or amplitude LFO modulation, just like the Modulation Wheel. In addition, it can be set up to directly affect the pitch, amplitude or timbre in response to breath pressure. When used to directly affect amplitude (EG BIAS), for example, the Breath Controller can be used to add realistic tonguing effects to brass and other wind instrument sounds.

The four BREATH parameters listed below determine just how the Breath Controller will affect the DX100's sound. These parameters may be set individually, or combined for more complex effects.

20: BREATH RANGE, PITCH

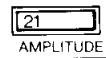


This function is used to set the maximum depth of the LFO pitch modulation that can be applied by using the Breath Controller. The actual effect produced depends on the settings of the LFO parameters (discussed in *CHAPTER IV: VOICE PROGRAMMING*). Note, however, that the appropriate voice PITCH MODULATION SENSITIVITY parameter must be set to a value higher than 0 for pitch modulation to be effective. (The voice PITCH MODULATION SENSITIVITY parameter will be discussed in *CHAPTER IV: VOICE PROGRAMMING*.)

The data range is from 0 to 99. At 0, the pitch modulation is OFF, and applying breath pressure to the Breath Controller will have no effect. A setting of 99 will produce the greatest possible pitch modulation depth.

Data is entered using the DATA ENTRY slider and -1/+1 buttons. Once this function is called, subsequent presses of button #20 will increment the data value.

21: BREATH RANGE, AMPLITUDE



This function is used to set the maximum depth of the LFO amplitude modulation that can be applied by using the Breath Controller. It works exactly like the previous instructions for setting the LFO pitch modulation (20: BREATH RANGE, PITCH) except that this function affects amplitude.

22: BREATH RANGE, PITCH BIAS

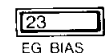


This function uses the breath pressure applied to the BC-1 Breath Controller to directly control the pitch of the voice. In other words, the LFO has no effect. Only your breath pressure directly affects the pitch of the voice.

The data range is from 0 to 99. At 50, pitch bias is OFF. A setting of 99 will allow the Breath Controller to raise the pitch 4-octaves, and a setting of 0 will allow it to lower the pitch 4-octaves.

Data is entered using the DATA ENTRY slider and -1/+1 buttons. Once this function is called, subsequent presses of button #22 will increment the data value.

23: BREATH RANGE, EG BIAS



This function uses the breath pressure applied to the BC-1 Breath Controller to directly control the amplitude or timbre of the voice, according to settings of the corresponding voice parameters which will be covered in *CHAPTER IV*. The LFO has no effect—only your breath pressure directly affects the amplitude or timbre of the voice.

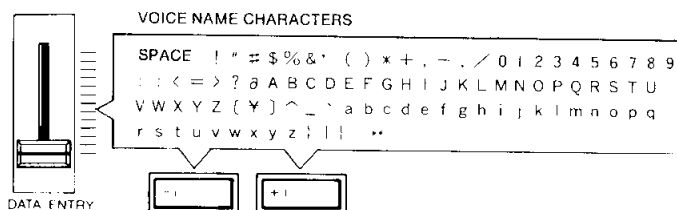
The data range is from 0 to 99. At 0, EG bias is OFF. A setting of 99 allows the greatest amplitude or timbre variation to be produced by the Breath Controller.

Data is entered by using the DATA ENTRY slider and -1/+1 buttons. Once this function is called, subsequent presses of button #23 will increment the data value.

24: VOICE NAME



This function moves the LCD cursor from left to right, allowing you to name any new voice or sound you have created before storing it. When button #24 is pressed, the cursor flashes over the first letter in the name of the voice presently occupying a space in the INTERNAL memory. The DATA ENTRY slider or -1/+1 buttons are used to move through the selectable characters (A to Z) and symbols, while subsequent presses of the the VOICE NAME CURSOR button will move the LCD cursor to the immediate right.



KEY SET



During either of the normal DX100 play modes, pressing the KEY SHIFT button instantly transposes the pitch of the entire DX100 keyboard up or down to the key that was programmed using this function. When KEY SHIFT is engaged, the letter "K" will appear as the first character in the LCD display until the KEY SHIFT button is pressed again, returning the keyboard to normal pitch.

To set or program the key that the DX100 will transpose to when the KEY SHIFT button is pressed in either play mode, enter the FUNCTION mode and press KEY SET.

The transpose range for the KEY SHIFT function is up or down two octaves. The data range is from -24 to +24, with 0 corresponding to standard keyboard pitch. Each increment corresponds to a shift in pitch of one semitone—a setting of 2 would raise the pitch of the entire keyboard up a whole step.

Immediately after calling the KEY SET function, data can be entered simply by pressing any key on the keyboard. The pressed key then assumes the pitch of C3, and all other keys are adjusted accordingly. Pressing the A2 key, for example, will produce a setting of -3. Pressing the C5 key, will result in a setting of +24. Subsequent changes can be made using the DATA ENTRY slider or -1/+1 buttons, or you can continue to select new keys from the keyboard provided that you press the KEY SET button first each time.

NOTE:

The KEY SET function is not individually programmable for each voice.

4. Tuning Functions

1: MASTER TUNE ADJ



This is the DX100 MASTER TUNE function. All voices are affected simultaneously. The programmable data range is from -64 to +63. When set at 0, the pitch of the A3 key is the standard 440 Hz. At the lowest setting (-64), the overall pitch of the keyboard is 100 cents (1 semitone) lower than standard pitch. At the highest setting (+63), the overall pitch of the keyboard is 100 cents higher than standard pitch.

Use the DATA ENTRY slider or -1/+1 buttons to enter the data for this parameter. Once the MASTER TUNE function is called, subsequent presses of button #1 will increment the data value.

5. Memory Management Functions

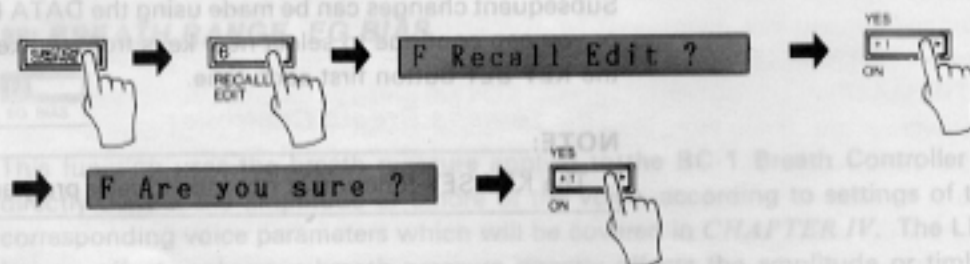
The Memory Management functions include functions for loading voices from the DX100's 192-voice PRESET memory, for storing and loading the 24 INTERNAL memory voices to and from cassette tape, initializing the voice memory, recalling voice data from a special "safety" buffer memory, and turning the DX100 memory write/protect function ON and OFF.

6: RECALL EDIT



In addition to the voice edit buffer, the DX100 has a special edit recall buffer memory which maintains the last edited voice data. If after editing or creating a new voice, you inadvertently call new data into the voice edit buffer (by pressing one of the voice selector buttons) before storing the edited voice data, the voice in the edit buffer that you had spent so much time editing will be replaced with the new data. If you only make the mistake once, you can recover the edited data from the backup voice buffer and put it back into the voice edit buffer by using this function.

To do this, first press the FUNCTION button, and then the RECALL EDIT button. The LCD will read "Recall Edit ?" Confirm your intention to recall the data into the voice edit buffer by pressing the +1 button. The DX100 will again respond, this time with "Are you sure ?" Press the +1 button again to actually execute the recall edit function. The EDIT mode will then be entered, and the voice edit buffer will contain the data called from the backup voice buffer. Pressing another function button, the PLAY mode button, or the EDIT mode button during the above process will abort the RECALL EDIT function.

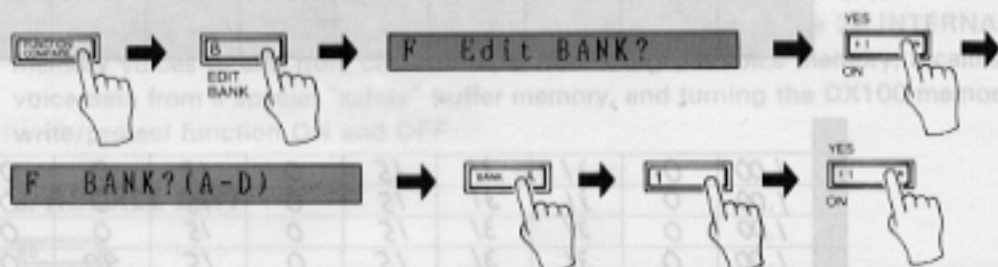


4. Tuning Functions

locations (for convenience and for ease of selection during a performance) you could use the EDIT BANK function to place your 10 voices in locations 1–10 in BANK A.

The DX100 has 4 banks of 24 voices in the BANK memory. This means that you can have 4 personally-arranged 24-voice groups to choose from (i.e., a separate BANK for each set in a performance).

To enter the EDIT BANK function, press the FUNCTION button followed by the EDIT BANK button. The LCD will respond with "Edit BANK?" Reaffirm your intention to complete the process by pressing the +1 button. The LCD will again respond, this time with "BANK? (A-D)." Select a BANK for editing, and then the button corresponding to the voice you want to change. Now, select a new voice for that position by using the DATA ENTRY slider or the -1/+1 buttons. You can change as many of the voices as you like. When you're finished, press the INTERNAL PLAY button to exit the EDIT BANK function.



The following diagram shows approximately where in the DATA ENTRY control range the INTERNAL and PRESET voices are located.

IN NORMAL MODE

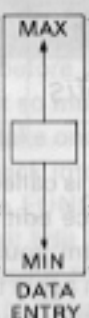
NORMAL MODE PRESETS
101 ~ 424

INTERNAL RAM 1 ~ 24

IN SHIFT MODE

SHIFT MODE PRESETS
101 ~ 424

INTERNAL RAM 1 ~ 24



NOTE:

The BANK memories are not actually loaded with the voice data, but the voice number. Thus, when a BANK memory location is selected, the voice corresponding to the voice number stored in that location is called from its memory in either the INTERNAL or PRESET memories.

9: CASSETTE SAVE/VERIFY



This function actually has two "sub-functions": SAVE and VERIFY. After calling this function, subsequent presses of button #9 alternates between the SAVE and VERIFY sub-functions. Normally, however, you will start with the SAVE function, which saves the entire contents of the DX100's INTERNAL voice memory onto cassette tape. The VERIFY function is then used to compare the data saved on cassette with the data still in INTERNAL memory, to make sure that no errors occurred in the SAVE process.

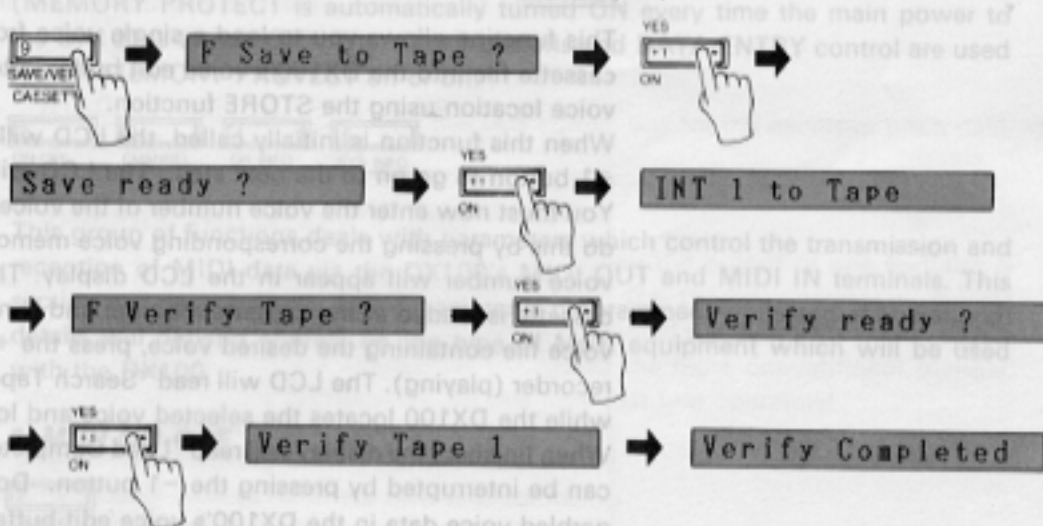
Before using this function, make sure that an appropriate data cassette recorder is properly connected to the DX100, as described in *CHAPTER 1: SETTING UP*.

When this function is initially called, the LCD will read "Save to Tape ?" Confirm your intention to save the contents of the 24 voices to cassette tape by pressing the +1 button. The display will then read "Save ready?" At this point, make sure that the cassette recorder is set up properly with a suitable blank tape, and then set up the recorder to begin recording. To perform the actual save operation, press the +1 button. (Pressing the -1 button prior to the final step in the above process will abort the CASSETTE SAVE function.) As the DX100 saves each voice to tape, the LCD display will indicate the voice number being saved.

When all 24 voices have been saved, the DX100 will automatically go into the VERIFY mode, so that you can make sure that the data was recorded properly.

Stop the cassette recorder. The LCD will now read "Verify Tape ?" To verify, first rewind the tape to the beginning of the data just saved, and then press the +1 button in response to the "Verify Tape ?" display showing. The display will now read "Verify ready?" Press the +1 button to confirm and then start the cassette recorder (playing). The DX100 will now read in each voice from the cassette tape, and compare it with the corresponding voice data in the INTERNAL voice memory, while the LCD indicates the verification process. If the cassette and INTERNAL data matches, the display will read "Verify Completed." You can then enter any of the PLAY modes by simply pressing the corresponding mode selector button.

If an error is encountered, this will be displayed on the LCD. If this happens, go back and try the SAVE process—followed by the VERIFY process—one more time. If the error persists, then you may have to carefully adjust the record and/or playback level of the cassette recorder, or use a higher quality recorder or tape. Be sure to check that all cassette connections are set up properly.



10: LOAD



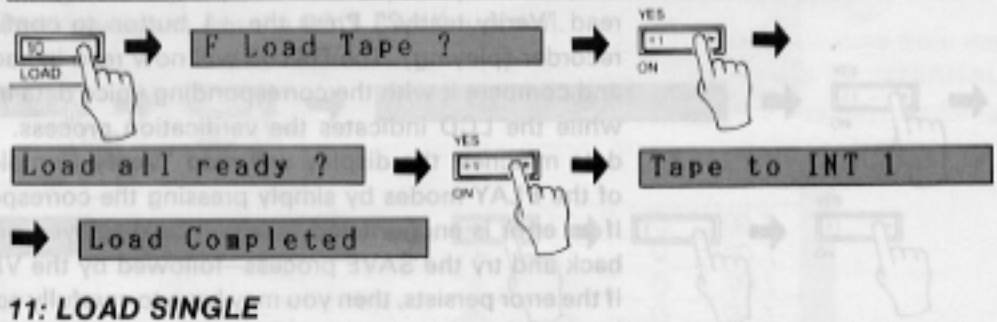
This function loads a complete set of 24 voices from cassette tape into the DX100's INTERNAL voice memory. Before using this function make sure that all cassette connections have been set up properly, as described in CHAPTER 1: SETTING UP. Also make sure that the DX100's MEMORY PROTECT function (12) is OFF. When this function is initially called, the LCD will read "Load Tape ?" Confirm your intention to load a complete set of 24 voices from cassette tape into the RAM voice memory (remember, this will erase any voices previously in the INTERNAL voice memory) by pressing the +1 button. The LCD will now read "Load all ready?" At this point, make sure the appropriate cassette tape is loaded into the recorder and is rewound to the beginning of the desired voice data. To execute the load,

press the DATA ENTRY YES button again and start the cassette recorder (playing). (Pressing the -1 button prior to the final step in the above process will abort the CASSETTE LOAD function.) The DX100 will indicate each voice on the LCD as it is loaded. When the load function is completed, the LCD will read "Load Completed."

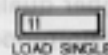
Stop the cassette recorder and turn the DX100's MEMORY PROTECT function back ON. The LOAD function can be interrupted at any time by pressing the -1 button. This can, however, result in incomplete data loading, possibly causing "garbled" voice data to appear in one memory location.

NOTE:

Be sure to turn the MEMORY PROTECT function back ON after a successful LOAD operation.



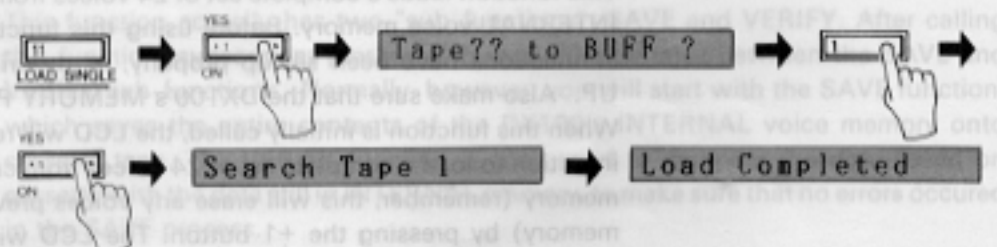
11: LOAD SINGLE



This function allows you to load a single voice from a previously saved 24-voice cassette file into the DX100's voice edit buffer, after which it can be stored in any voice location using the STORE function.

When this function is initially called, the LCD will read "Load Single ?" Press the +1 button to go on to the next step. The LCD will now read "Tape ?? to BUFF?" You must now enter the voice number of the voice you wish to load from cassette; do this by pressing the corresponding voice memory selector button. The selected voice number will appear in the LCD display. Then, make sure the appropriate cassette is loaded in the cassette recorder and is rewound to the beginning of the voice file containing the desired voice, press the +1 button, and start the cassette recorder (playing). The LCD will read "Search Tape," followed by the tape number while the DX100 locates the selected voice and loads it into the voice edit buffer. When finished, the display will read "Load Completed." The LOAD SINGLE function can be interrupted by pressing the -1 button. Doing this, however, may result in garbled voice data in the DX100's voice edit buffer.

The loaded voice may now be stored into any voice location by holding down the STORE button while pressing the voice button. This must be done before another voice button is pressed if you desire to keep the loaded voice in memory. Otherwise, the loaded voice data in the voice edit buffer will be erased and replaced by the voice data called by the pressed voice button.



DX21 CASSETTE LOAD

NOTE:

If you have a voice set programmed on a Yamaha DX21 Digital Programmable Algorithm Synthesizer, these voices can be transferred from data cassette to the DX100. Of course, since the DX100 has 24 voice memories while the DX21 has 32, using the DX100 cassette LOAD operation will load only the first 24 voices of the DX21 32-voice set into the INTERNAL memory. The other voices (25–32) can be loaded using the DX100 LOAD SINGLE function. The voice numbers for voices 25 through 32 are accessed by pressing the STORE, FUNCTION, EDIT, INTERNAL PLAY, and BANK A–D buttons.

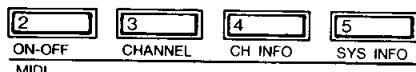
12: MEMORY PROTECT



This function turns the DX100 MEMORY PROTECT function on or off. When on, the INTERNAL RAM voice memory cannot be altered using the STORE or CASSETTE LOAD functions. The MEMORY PROTECT function does not affect the voice edit buffer, so the INIT VOICE, RECALL EDIT, and CASSETTE LOAD SINGLE functions will operate whether MEMORY protect is on or off.

When this function is called, the LCD will read either "M. Protect:on" or "M. Protect:off," according to the current state of the MEMORY PROTECT function (MEMORY PROTECT is automatically turned ON every time the main power to the DX100 is turned ON). The -1/+1 buttons and DATA ENTRY control are used to turn MEMORY PROTECT on or off.

6. MIDI Functions



This group of functions deals with parameters which control the transmission and reception of MIDI data via the DX100's MIDI OUT and MIDI IN terminals. This section will describe how each parameter is programmed, while actual operational details will depend entirely on the type of MIDI equipment which will be used with the DX100.

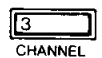
2: MIDI ON-OFF



This function turns the DX100's MIDI capabilities ON or OFF. When on, the DX100 can transmit or receive MIDI data to or from external MIDI equipment. When off, no MIDI data interchange is possible.

This function is turned ON or OFF using the -1/+1 buttons or DATA ENTRY slider.

3: CHANNEL

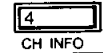


The DX100 is capable of receiving or transmitting data on any one of the 16 available MIDI channels. It can also be set in the OMNI mode which enables it to receive on all channels simultaneously. This function is used to set the desired MIDI receive or transmit channel or to activate the OMNI receive mode. The receive or transmit

channel is normally set to match the transmission or reception channel of the MIDI equipment to which the DX100 is connected.

Data is entered using the DATA ENTRY control or -1/+1 buttons. Subsequent presses of the CHANNEL button will move through the "Omni: on/off," "Midi R Ch=1-16," and "Midi T Ch=1-16" selection modes.

4: CH INFO



This is the MIDI channel information "button." It turns the transmission and reception of all MIDI BASIC EVENT DATA and OTHER EVENT DATA (exceptions noted below) ON or OFF. This function is turned ON or OFF using the -1/+1 buttons.

Data transmitted and received whether this function is OFF or ON include:

- * KEY ON/OFF
- * SUSTAIN FOOTSWITCH ON/OFF
- * PITCH BEND WHEEL POSITION
- * MONO/POLY MODE SWITCH

Data received whether this function is ON or OFF:

- * ALL NOTES OFF

Data NOT transmitted when this function is OFF include:

- * MODULATION WHEEL POSITION
- * BREATH CONTROLLER DATA
- * DATA ENTRY SLIDER AND SWITCH DATA
- * VOLUME (DATA ENTRY slider in PLAY mode)
- * PORTAMENTO FOOTSWITCH ON/OFF
- * PROGRAM CHANGE (VOICE NUMBER) DATA

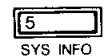
Data not received when this function is OFF include:

- * All of the above
- * PORTAMENTO TIME

NOTE:

The above MIDI data is generally common to all keyboards and equipment compatible with the MIDI system. Due to differences in the features provided by some manufacturers, however, complete compatibility can not be guaranteed.

5: SYS INFO



This function turns the transmission and reception of MIDI SYSTEM EXCLUSIVE INFORMATION data ON or OFF. The -1/+1 buttons are used to turn this function ON or OFF. When this function is ON, voice parameter changes made in the DX100's EDIT or FUNCTION modes are transmitted in real time.

If the SYS INFO button is pressed again, the "Midi Transmit?" display will appear. If the YES button is then pressed, then the DX100 will perform a bulk dump of all voice data—INTERNAL voices 1 through 24. Voices 25-32 will be dumped as INIT VOICE parameters.

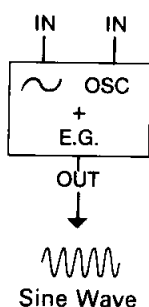
CHAPTER IV: VOICE PROGRAMMING

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 DX100'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

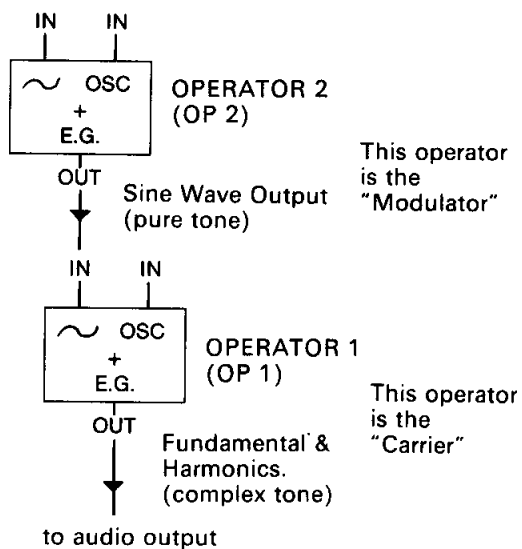
The Yamaha DX series FM digital synthesizers use pure sine waves that interact to create the full harmonic spectrum for any voice. Each digital sine wave oscillator is combined with its own envelope generator to form an "operator."



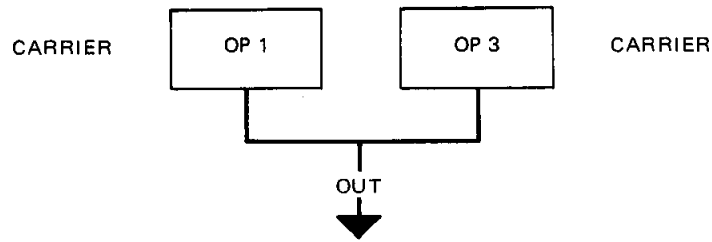
Note that the operator's oscillator has two inputs: one for the oscillator pitch data, and one for modulation data.

CARRIERS AND MODULATORS

The DX100 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!



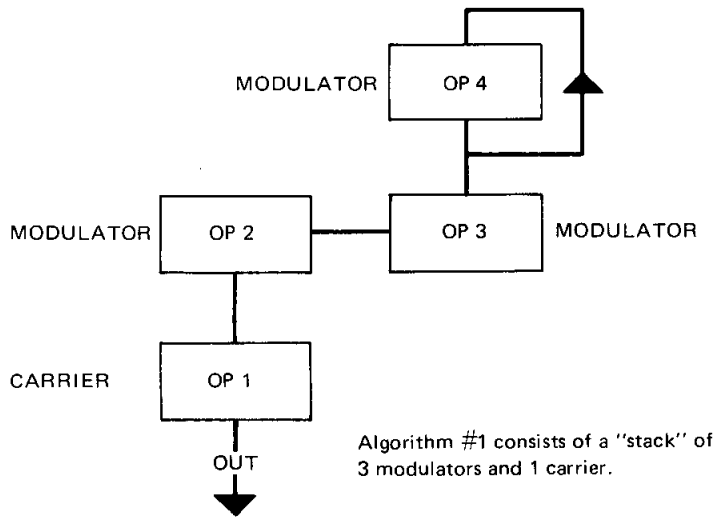
Operators do not have to be connected "vertically" in a modulator-carrier relationship, as shown above. The outputs of two operators can also be mixed—just as the stops in an organ are mixed. In this case the sounds are simply added together with no modulation effect.



ALGORITHMS

We have seen two different ways that two operators may be combined. The DX100 uses four operators, offering many potential connection possibilities. These different configurations of operator relationships are called "algorithms", and the DX100 offers 8 algorithm choices. These are all printed on top of the DX100 panel. In the algorithm diagrams on the panel, the small boxes numbered 1 through 4 are the operators.

ALGORITHM #1

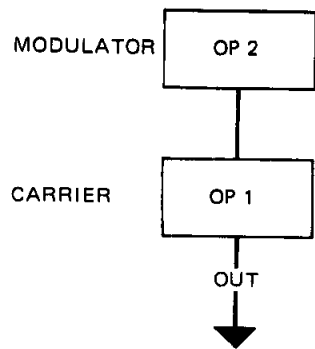


Algorithm #1 consists of a "stack" of 3 modulators and 1 carrier.

HOW ALGORITHMS AFFECT THE SOUND

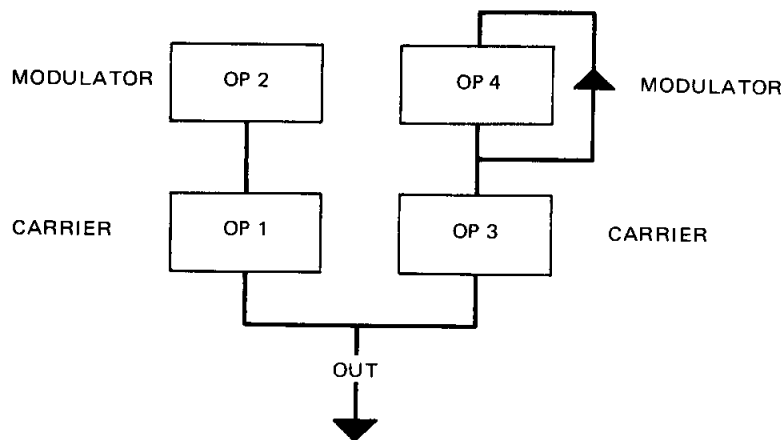
By changing the relative frequencies between operators in a modulator-carrier relationship, you change not only the fundamental pitch of the note, but also the frequencies present in the harmonic structure. Thus, the timbre of the voice can be precisely controlled. In addition, since each operator has 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.

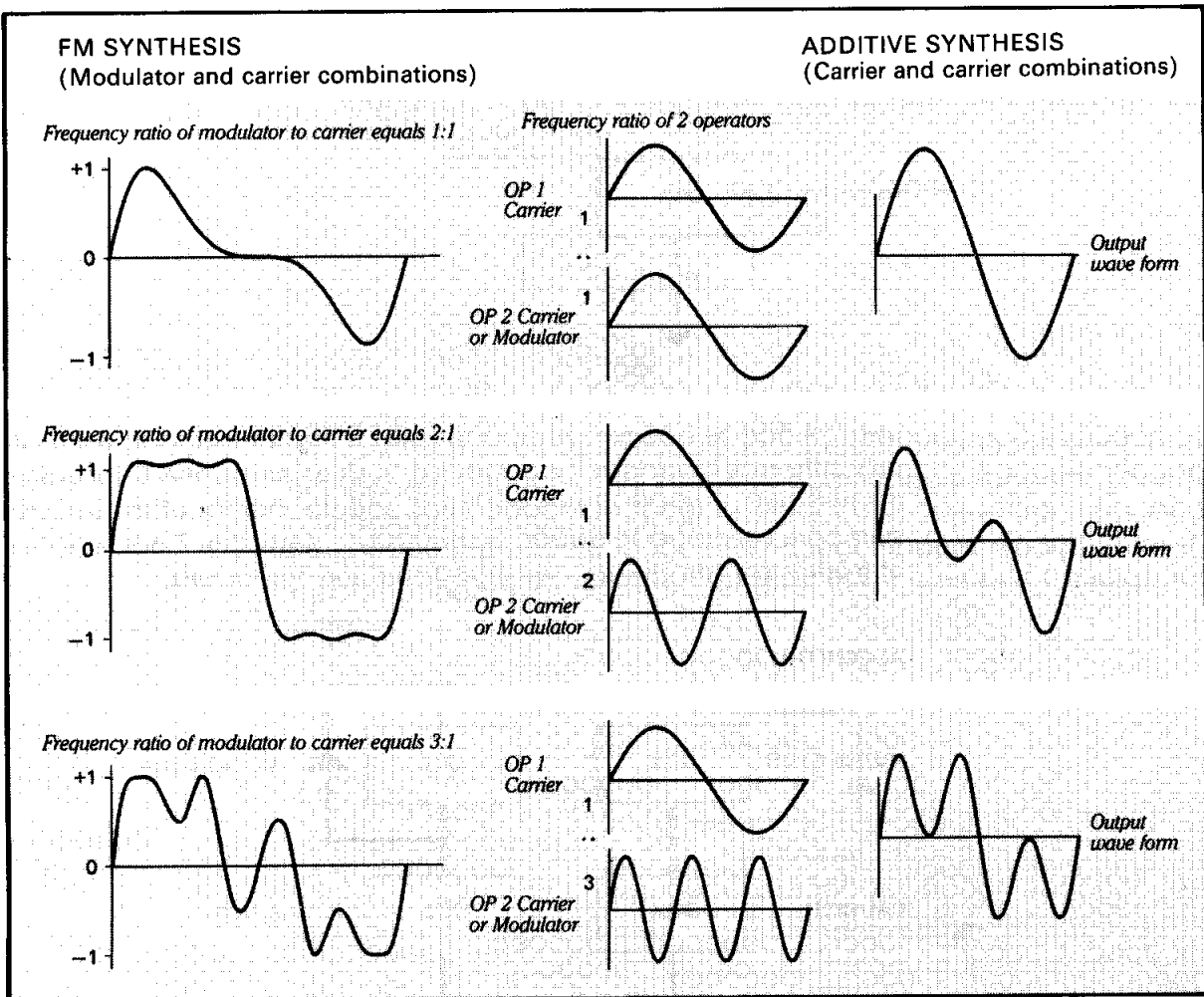
ALGORITHM #5



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 DX100 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 DX100 editing functions permits the feedback level to be set from 0 (no feedback) to 7 (maximum feedback).

ENVELOPE GENERATORS

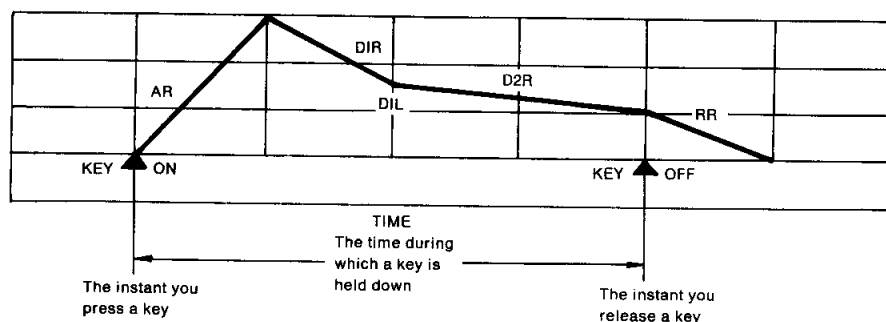
Consider what happens when you play a note on an acoustic instrument. The level of the sound initially goes up to some value, then eventually falls to nothing, following a pattern that is characteristic of the particular instrument played. For example, a low note on a pipe organ starts slowly when you 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 DX100 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 DX100 panel.

ENVELOPE GENERATOR



This envelope diagram can be used as a guide in visualizing the DX100 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 (Decay 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.

E1111 ALG= 5

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 DX100 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 DX100'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 DX100 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 DX100 is in the EDIT mode.

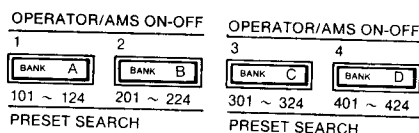
PITCH B MODE: OPERATOR SELECT



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
2

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.

e1111 FBL=4

The LFO

"LFO" stands for Low Frequency Oscillator. This oscillator is used to apply modulation effects such as tremolo or vibrato to the DX100 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

LFO
WAVE
3

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.

e1111 LW=saw up

e1111 LV=square

e1111 LV=triangl

e1111 LW=S/hold

4: LFO SPEED

SPEED
4

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).

e1111 LFS=20

5: LFO DELAY

DELAY
5

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.

e1111 LFD=30

6: LFO PMD

PMD
6

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

AMD
7

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.

e1111 AMD=35

8: LFO SYNC

SYNC
0

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
0

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.

e1111 PMS= 6

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.

e1111 AMS=3 0000

11: EG BIASENSITIVITY

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.

e1111 EBS= 7 OP3

12: KEY VELOCITY

KEY VELOCITY

12

While the DX100 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 DX100 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 DX100 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:

DX100 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		

effects applied by the Breath
from the operator. The harder
maximum envelope level. When
Controller, the result is volume
the result is brilliance control.
activity is OFF and no EG BIAS
ing of 7 produces the maximum

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 DX100 keyboard pitch is 8'; therefore, in terms of footage: 0.50 = 16', 1.00 = 8', and 2.00 = 4'.

14: DETUNE

DETUNE
14

While the DX100 has no key velocity sen
its own, its voice generators
ment (like a MIDI controller
the sensitivity of each operator
ernal MIDI equipment to the
the harder you play a key, the
founder the note. Timbre variations are produced when key velocity sensitivity is

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

ENVELOPE GENERATOR
AR D1R D1L D2R RR
15 16 17 18 19

These parameters determine the actual fre
of each operator. For operators
pitch of the sound produced.
mines the harmonic spectrum
different frequency ratios.

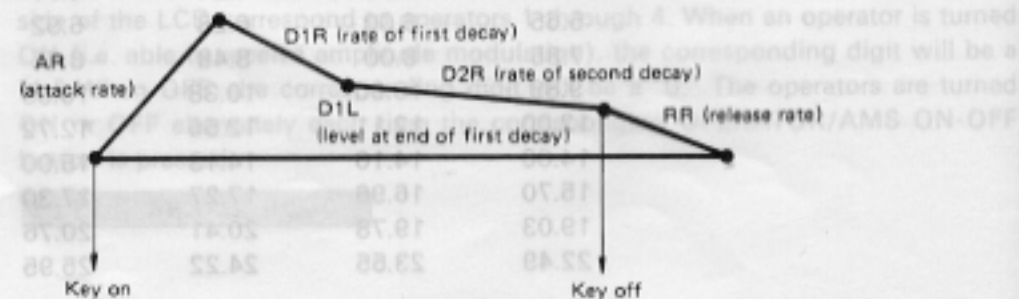
These buttons select the specific envelope generator parameters to be worked on: ATTACK RATE, DECAY 1 RATE, DECAY 1 LEVEL, DECAY 2 RATE, and RELEASE RATE.

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.

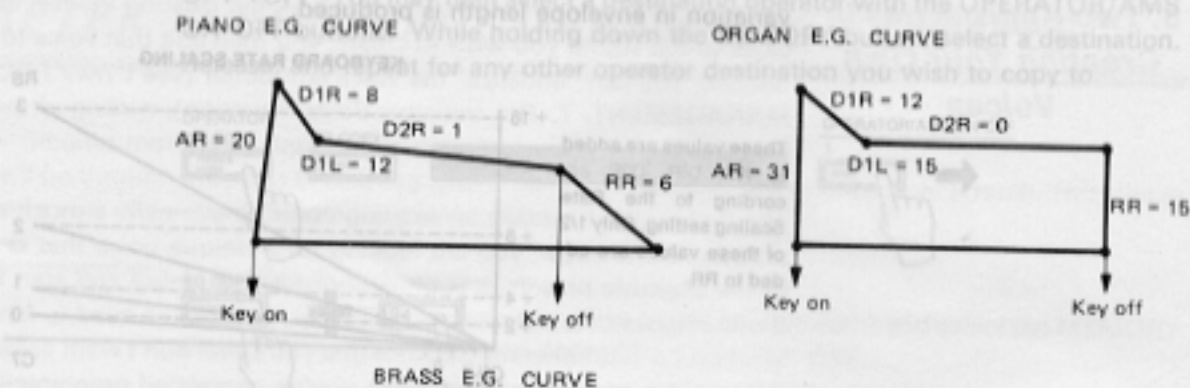
e1111 AR=31 OP3

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.



20: OPERATOR OUT LEVEL

OPERATOR
OUT LEVEL
20

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.

e1111 OUT=99 OP3

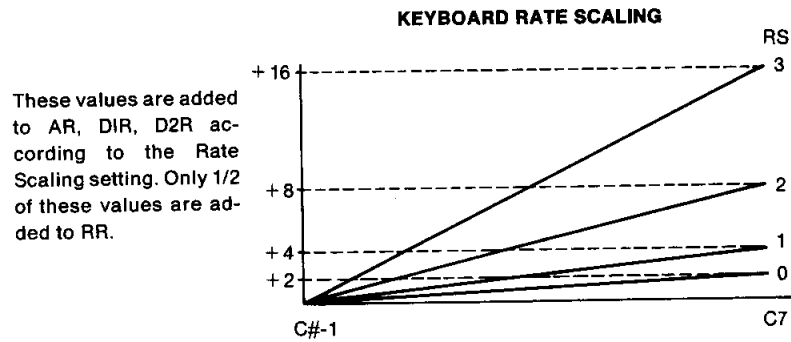
21: RATE SCALING

KEYBOARD
RATE
21

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.

e1111 RS= 3 OP3

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

SCALING

LEVEL

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

TRANSPOSE

This function is used to transpose the pitch of the entire DX100 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 DX100, 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.

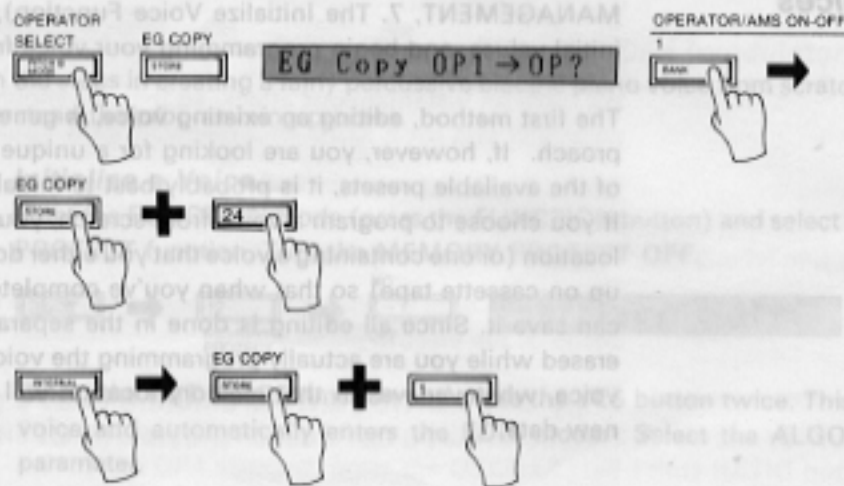
EG COPY

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 DX100 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

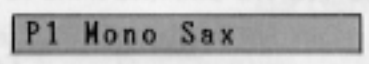
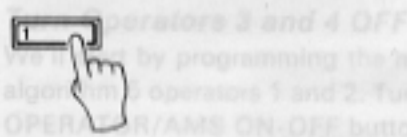
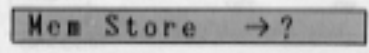
After you have created or edited a voice and have decided that you want to save it for future use, you should STORE the new voice data in one of the 24 INTERNAL memories by using the STORE function. You should do this BEFORE you press any of the voice buttons after leaving the EDIT or FUNCTION modes, 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.



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.

5. Two Approaches to Creating Your Own Voices

There are two basic approaches that you can take when programming voices on the DX100. 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.

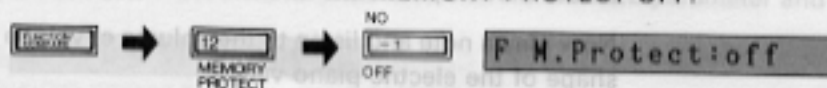
CHAPTER V: VOICE PROGRAMMING EXAMPLE

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.

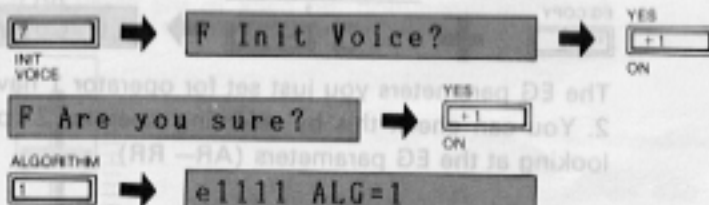
STEP 1:

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.



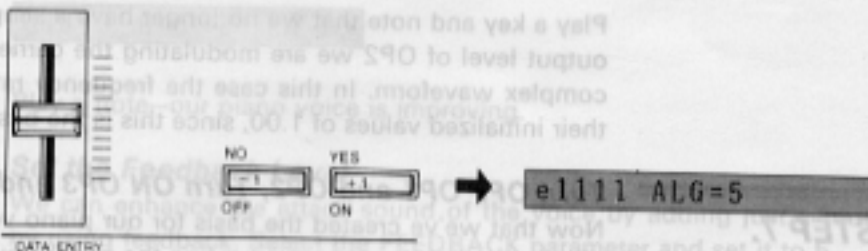
If you play a note now, you will hear a sine wave.

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.

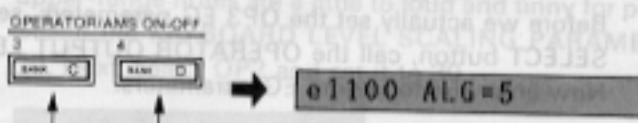
The ALGORITHM parameter is already selected, so choose algorithm 5 by using the DATA ENTRY controls.



STEP 3:

Turn Operators 3 and 4 OFF

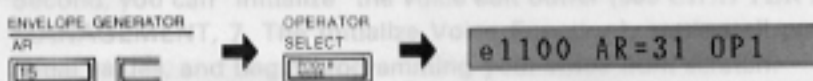
We'll start by programming the main piano sound using the left operator stack in algorithm 5 operators 1 and 2. Turn operators 3 and 4 OFF using the corresponding OPERATOR/AMS ON-OFF buttons.



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.

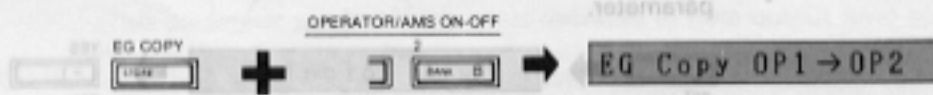
Select the D2R parameter and set to 8.

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.

e1100 OUT=99 OP1

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

e1100 OUT=66 OP2

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.

e0011 OUT=0 OP3

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