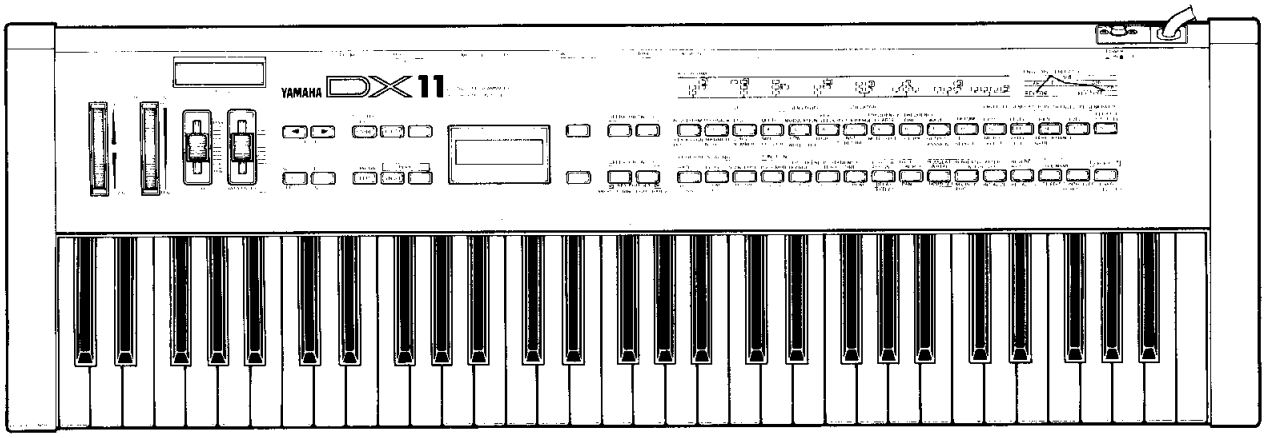
YAMAHA

DIGITAL PROGRAMMABLE ALGORITHM SYNTHESIZER
SYNTHÉTISEUR PROGRAMMABLE FM NUMÉRIQUE À ALGORITHMES
DIGITALER PROGRAMMIERBARER ALGORITHMUS SYNTHESIZER
SINTETIZADOR DIGITAL ALGORITMICO PROGRAMABLE

DX11

OPERATING MANUAL
MANUEL D'UTILISATION
BEDIENUNGSANLEITUNG
MANUAL DE INSTRUCCIONES



INTRODUCTION

Thank you for purchasing the Yamaha DX11 FM Digital Programmable Algorithm Synthesizer. The DX11 is an 8-note polyphonic keyboard that can act as up to 8 independent instruments. Some of the many features of the DX11 are...

- 61-note velocity and pressure sensitive keyboard.
- 128 preset and 32 user-programmable voice memories.
- 32 user-programmable performance memories.
- Data is compatible with the TX81Z tone generator and the DX21/27/27S/100 synthesizers.
- Data can be stored on a RAM cartridge or cassette tape.
- FM synthesis using non-sinewave waveforms.
- Two independent LFOs and eight vibrato generators.
- 13 Microtonal Scales (2 user-programmable and 11 preset).
- Pan, Chord and Delay effects.
- Alternate Voice Assign lets you play a different voice with each successive note.
- Quick Edit functions.
- Illuminated LCD for good visibility.

In order to take full advantage of the DX11's functions, please read this manual carefully.

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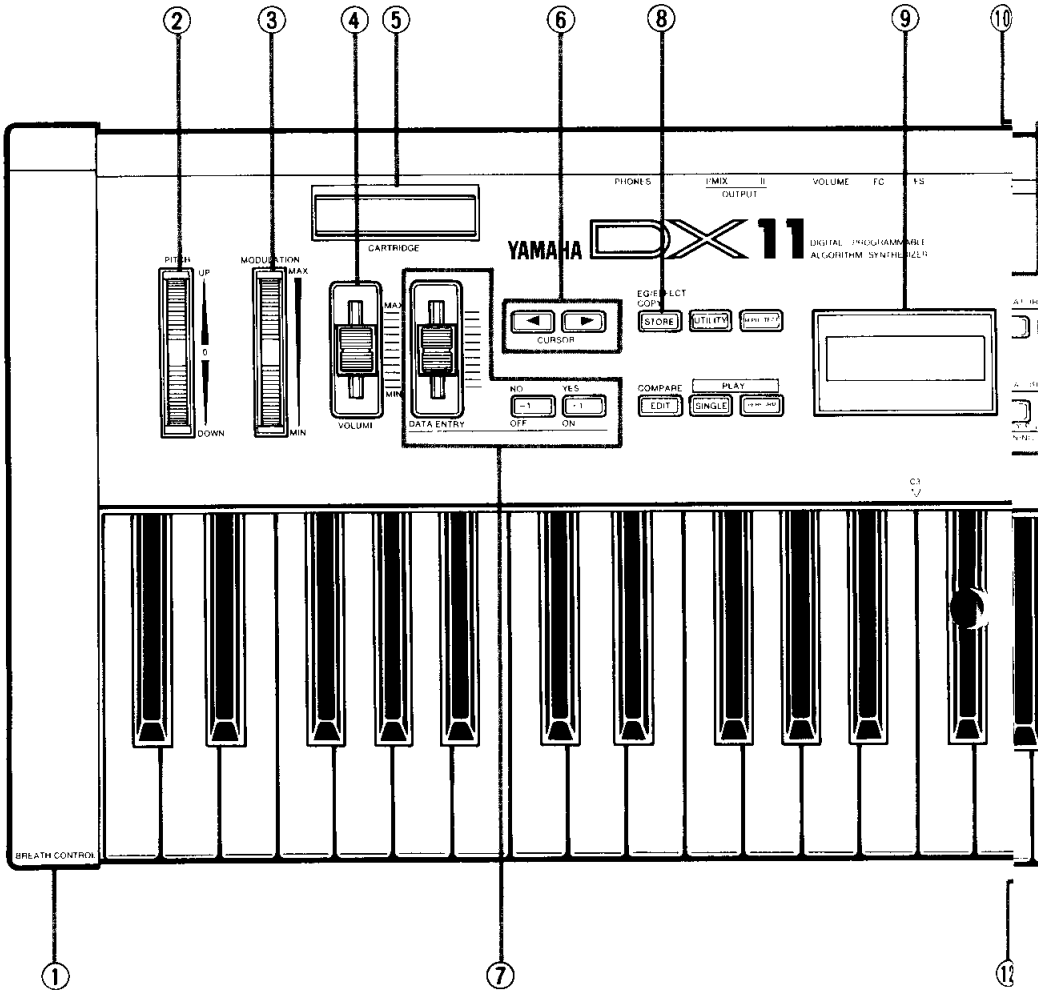
PRECAUTIONS

- Avoid placing the DX11 in direct sunlight or close to a source of heat. Also, avoid locations where the unit is likely to be subjected to vibration, excessive dust, cold or moisture.
- Avoid rough handling, such as applying excessive force to the switches or dropping the unit. While the internal circuitry is of reliable integrated circuit design, the unit should be treated with care.
- Always grip the plug directly when removing it from an AC outlet. Removing the plug from the AC outlet by pulling the cord can result in damage to the cord and possibly a short circuit. It is also a good idea to disconnect the DX11 from the AC outlet if you don't plan to use it for an extended period of time.
- If necessary, clean the DX11 using a slightly damp cloth, and dry with a soft cloth. Never use solvents (such as benzine or thinner) since they can melt or discolor the finish.
- All computer circuitry, including that in the DX11, is sensitive to voltage spikes. For this reason, the unit should be turned off and unplugged from the AC outlet in the event of an electrical storm. This precaution will avoid the chance that a high voltage spike caused by lightning will damage the unit.
- Computer circuitry is also sensitive to electromagnetic radiation. Be careful not to set it too close to equipment (such as a television set) that generates electromagnetic fields. Proximity to such equipment could cause malfunctions in the DX11's digital circuitry and interfere with the operation of the other unit.
- When inserting a cartridge, make sure it is facing the correct way, and do not use excessive force.
- This unit contains no user servicable parts. Opening it or tampering with it can lead to electrical shock as well as damage, and will void the product warranty. Refer all servicing to qualified Yamaha personnel.

SPECIFICATIONS

- **Keyboard**
  61 keys C1—C6, velocity and pressure sensitive
- **Tone Generator**
  FM tone generator: 4 operator (8 wave) x 8 voice
- **Polyphony**
  8 notes
- **Memory**
  128 ROM voice, 32 RAM voice, 32 RAM performance
- **Controls**
  PITCH, MODULATION, VOLUME, DATA ENTRY
- **Display**
  LCD (16 characters x 2 lines, illuminated)
- **Terminals**
  BREATH, PHONES, OUTPUT (I/MIX, II), VOLUME PEDAL, FOOT CONTROLLER, FOOT SWITCH, MIDI (IN, OUT, THRU), CASSETTE
- **Dimensions (W x H x D)**
  901 x 298 x 63 mm (35 1/2 x 11 3/4 x 2 1/2")
- **Weight**
  7.0 kg (15 lbs 6 ozs)
- **Power Requirements**
  U.S. & Canadian models: 120V, 50/60 Hz
  General models: 220—240V, 50Hz
- **Power Consumption**
  10 W
- **Included Items**
  Cassette cable



FRONT/REAR PANEL

FRONT PANEL

① **BREATH CONTROLLER JACK:** A breath controller (BC1 or BC2) connected to this jack can control the Pitch Modulation, Amplitude Modulation, Pitch Bias or EG Bias of a voice, for the expressive phrasing typical of a wind instrument.

② **PITCH WHEEL:** This bends the pitch up or down. The range of the effect will depend on the Pitch Bend settings for each voice.

③ **MODULATION WHEEL:** This controls modulation effects (vibrato, tremolo and"wah"). The actual effect depends on the Modulation Wheel settings for each voice.

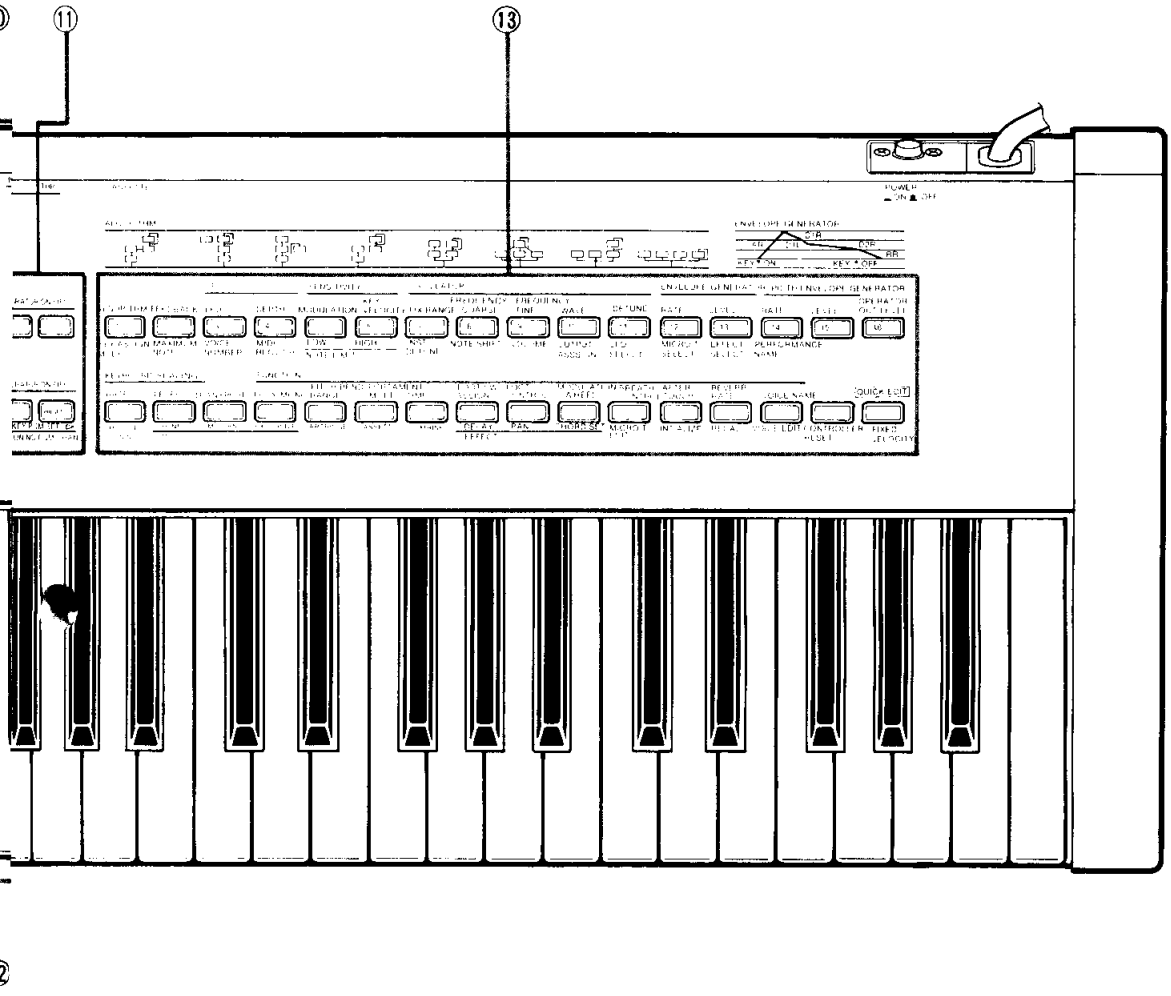
④ **VOLUME:** In Single mode, this controls the overall volume. In Performance mode, it controls the voices played by the built-in keyboard.

⑤ **CARTRIDGE SLOT:** A RAM cartridge such as the RAM4 can store DX-11 data.

⑥ **CURSOR:** These keys move the blinking cursor in the LCD.

⑦ **DATA ENTRY SLIDER and −1/+1:** These are used to change the data shown in the LCD. The −1/+1 keys adjust data values down/up in steps of one, and are also used to answer "no/yes" to prompts in the LCD.

⑧ **STORE:** Voices or performances can be stored in DX-11 internal memory or in a RAM cartridge. In Single Edit mode, this key is used to copy an Envelope setting from operator to operator. In Utility mode, this key is used to copy an Effect setting to another effect memory.



⑨ **LCD:** A 16-character two-line Liquid Crystal Display, illuminated for visibility.

⑩ **INTERNAL:** Select internal memories.

⑪ **BANK A—D:** These keys select preset voice banks A—D. In Single Edit mode they turn operators on/off.

⑫ **CARTRIDGE:** Select memories from a data cartridge.

⑬ **SELECT 1—32:** In Single Play mode these keys select voices. In Performance Play mode they select performances. In other modes they select the functions printed above and below the keys.

KEYBOARD: A 61-note keyboard, with Velocity and Aftertouch sensitivity.

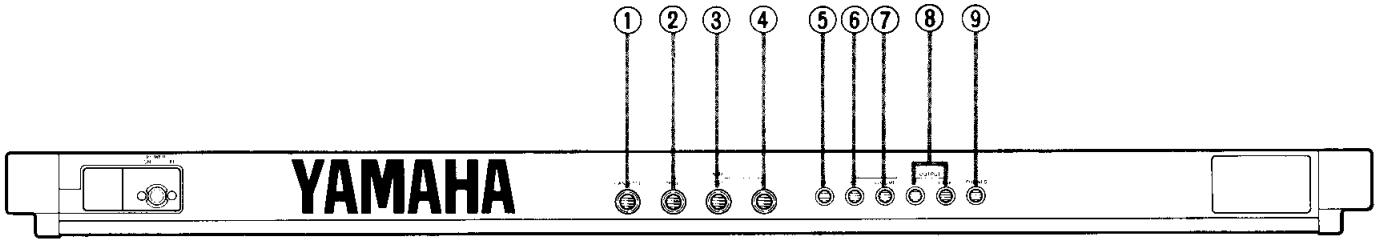
UTILITY: Utility mode has useful functions relating to MIDI, data storage, effects, micro tuning, etc.

M.PROTECT: Before data can be stored in DX-11 internal memory or in a RAM cartridge, Memory Protect must be off.

EDIT: Edit mode is where you modify or create your own voices or performances. While in Edit mode, you can press this key again to Compare the edited data with the original data.

SINGLE: In Single mode the DX-11 can play chords of up to 8 notes with a single voice.

PERFORMANCE: In Performance mode the DX-11 can act as up to 8 independent instruments.



REAR PANEL

① **CASSETTE:** Use the included cassette cable to connect a data cassette recorder for saving and loading DX11 data.

② **MIDI THRU:** All messages received at MIDI IN are re-transmitted unchanged from this terminal.

③ **MIDI OUT:** DX11 bulk data can be sent from this terminal to another DX11 or to a bulk data storage device such as the MDF MIDI Data Recorder.

④ **MIDI IN:** MIDI messages coming into this terminal can control the DX11, and DX11 bulk data can also be received here.

⑤ **FS:** A foot switch such as the FC4 or FC5 connected to this jack can control Sustain or Portamento.

⑥ **FC:** A foot control pedal such as the FC7 or FC9 connected to this jack can control Volume, Pitch Modulation or Amplitude Modulation.

⑦ **VOLUME:** A foot control pedal such as the FC7 or FC9 connected to this jack can control volume in the same way as the front panel volume slider.

⑧ **OUTPUT I/II:** Sound produced by the DX11 is sent from here to an external mixer or amp. Each instrument in a Performance can be assigned to either or both outputs. If only output I is plugged in, it will transmit the combined signal for both outputs.

⑨ **PHONES:** A jack for standard stereo or mono headphones. Using this jack will not affect the rear panel outputs.

INTRODUCING THE DX11

There are two ways to play the DX11: SINGLE mode and PERFORMANCE mode. In Single mode, you can play a single voice (sound) using chords of up to 8 notes. In Performance mode, the 8 tone generators (sound-producing circuits) can act independently as up to 8 different instruments, each assigned to its own section of the keyboard or producing sound in response to incoming MIDI signals.

SINGLE PLAY: Select and play any voice using chords of up to 8 notes.

SINGLE EDIT: Create your own voices or modify an existing voice.

PERFORMANCE PLAY: The DX11 acts as up to 8 independent instruments as specified in the Performance Memory you select. Each instrument can play a different voice over a different section of the keyboard, and can be controlled independently.

PERFORMANCE EDIT: Change the settings of a Performance Memory.

UTILITY: Various useful functions for data storage, micro tuning, effects, etc.

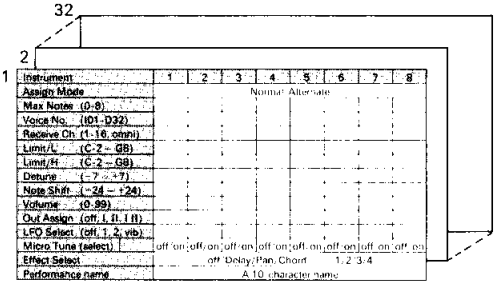
MEMORY

Here are the main types of memory in the DX11.

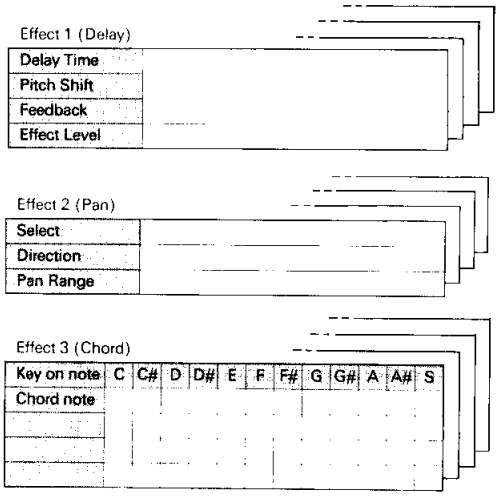
Voice Memory: There are 5 voice memory banks, each with 32 voices. Banks A-D are preset, and cannot be changed. Bank I (internal) is for you to store your own voices in. (For details please see p.6)

BANKS	A	B	C	D	I
VOICES	1-32	1-32	1-32	1-32	1-32

Performance Memory: Each performance memory can set the DX11 to act as up to 8 independent instruments, each on its own area of the keyboard.



Effect Memory: Each performance can use one of three types of effects; Delay, Pan or Chord. (There are four memories for each of the three effects.)

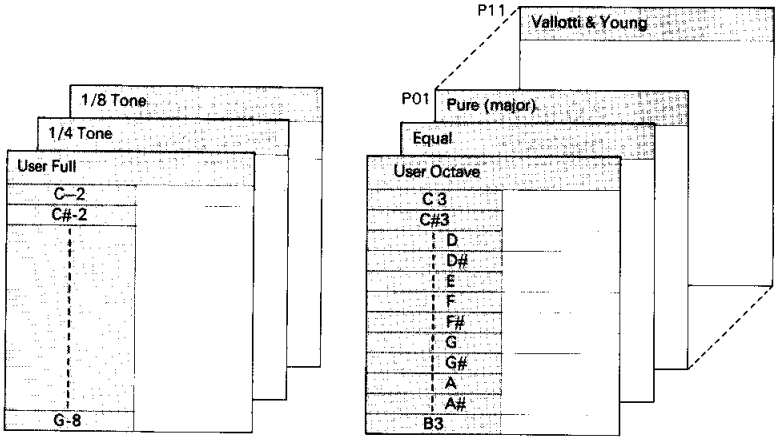


Program Change Table: Incoming program change messages can select voice or performance memories.

Program Change Table

Incoming	Selected
1	B19
2	PF24
3	I07
127	A32
128	C14

Micro Tune: You can use scales other than the standard "equal temperament" found on pianos and organs. P01—P11 are preset, Octave and Full are programmable.



CONNECTIONS

Connect the audio output of the DX11 to an amp/speaker system, or plug in a set of headphones. When you turn the power on, the DX11 will display "**** YAMAHA **** < How are you? >" for a few seconds (this greeting can be changed, see p.24), and then will display whatever function was selected when the power was turned off.

SINGLE PLAY

SELECTING A VOICE

In Single Play mode, you can select and play any voice using chords of up to 8 notes. Bank select switches Banks A - D are internal ROM preset voice banks.

Bank I (internal) and bank C_T (cartridge) are for voices that you create. When you select bank I or C_T, the LCD will change, but the voice will remain until you select a new voice 1 - 32.

1. [SINGLE] Enter Single Play mode
2. [A] – [D] Select a ROM preset voice bank
   or
   [INT] or the internal RAM bank
   or
   [CART] or the cartridge voice bank. (A cartridge must be inserted.)
3. [1] [32] Select and play a voice.

BANK A		BANK B		BANK C		BANK D	
1	Syn.Str 1	1	DX7 EP	1	Strings 1	1	Bass Drum 1
2	Syn.Str 2	2	Old Rose	2	Strings 2	2	Bass Drum 2
3	Sy.Brass 1	3	E.Piano 1	3	Ensemble 1	3	Snare 1
4	Sy.Brass 2	4	E.Piano 2	4	Ensemble 2	4	Snare 2
5	Sy.Brass 3	5	Grand PF	5	Violin 1	5	Tom 1
6	Sy.Brass 4	6	Upright	6	Violin 2	6	Tom 2
7	Sy.Ensem. 1	7	Flamenco	7	Cello 1	7	Tom 3
8	Sy.Ensem. 2	8	A.Guitar	8	Cello 2	8	Tom 4
9	Sy.Ensem. 3	9	F.Guitar	9	Brass 1	9	"Hi!" Hat!
10	Sy.Ensem. 4	10	Banjo	10	Brass 2	10	Cow Bell
11	Sy.Ensem. 5	11	E.Guitar	11	Trumpet 1	11	Agogo Bell
12	Sy.Perc. 1	12	Mute Gtr	12	Trumpet 2	12	Wood Block
13	Sy.Perc. 2	13	Harp 1	13	Trombone	13	Castanet
14	Sy.Perc. 3	14	Harp 2	14	Horn	14	SyBon
15	Sy.Perc. 4	15	Harpsichrd	15	Tuba	15	BoConga
16	Sy.Bass 1	16	Clavi	16	Sax 1	16	Tom-Pany
17	Sy.Bass 2	17	Koto	17	Sax 2	17	SynGameran
18	Sy.Bass 3	18	Syamisen	18	Wood Wind	18	Mouse-Tom
19	Sy.Bass 4	19	Marimba	19	Clarinet 1	19	Carnival!
20	Sy.Bass 5	20	Xylophone	20	Clarinet 2	20	"Air" imba
21	Sy.Organ 1	21	Vibe.	21	Oboe	21	SplashClav
22	Sy.Organ 2	22	Glocken	22	Flute 1	22	BamboBlock
23	Sy.Solo 1	23	Tube Bell	23	Flute 2	23	Terror!
24	Sy.Solo 2	24	Toy Piano	24	Recorder	24	Wind Voice
25	Sy.Solo 3	25	Pizz. 1	25	Harmonica	25	GuiRoach::
26	Sy.Solo 4	26	Pizz. 2	26	E.Organ 1	26	Space BUG?
27	Sy.Voice 1	27	E.Bass 1	27	E.Organ 2	27	Passing By
28	Sy.Voice 2	28	E.Bass 2	28	E.Organ 3	28	Earthquake
29	Sy.Decay 1	29	E.Bass 3	29	E.Organ 4	29	TAP TAP<<<
30	Sy.Decay 2	30	Wood Bass	30	P.Organ 1	30	Space Gong
31	Sy.Sitar	31	Bell	31	P.Organ 2	31	RADIATION?
32	Sy.AftrTch	32	Steel Drum	32	Accordion	32	White Blow

STORING A VOICE

You can store the currently selected voice (edited or not) in bank I (internal). While in SINGLE PLAY mode, hold down the STORE switch and press a switch 1–32 to select the destination memory. To store a voice to bank C_T (cartridge), press CARTRIDGE, then hold down STORE and select the destination 1–32.

MEMORY PROTECT

When Memory Protect is On, you will not be able to store voices or performances, nor will the DX11 be able to receive incoming MIDI bulk data. Press M.PROTECT, move the blinking cursor and use the OFF/ON switches to turn the Internal and Cartridge protect off/on. Memory Protect is reset to On when the power is turned on.

SINGLE EDIT

This is where you create your own voices or edit the preset voices. We will assume that you know something about FM synthesis. If you are new to FM, please turn to page 28 and read "What's FM?" before continuing.

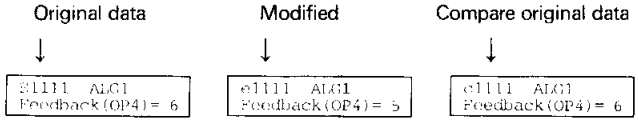
The DX11 has some "Quick Edit" parameters that you can use to easily change the overall character of the sound. See page 13.

THE EDIT BUFFER

When you select a voice, the data is read into a place called the "Edit Buffer," and this data tells the DX11 how to make sound. Changes you make in Edit mode will affect only the data in this buffer, and are not permanent until you Store. (See above on how to Store.)

EDIT/COMPARE

When you first enter Single Edit mode, the LCD will show an "E" in the upper left corner, indicating "Edit". As soon as you modify the data, this will change to "e". Once you have modified the data, you can compare the results of your editing with the original voice. Press EDIT/COMPARE. The LCD will show a "c" in the upper left corner, indicating "Compare". You can select the various parameters to see the original data, but will not be able to modify the settings. To return to Edit mode, press EDIT/COMPARE once more. You cannot leave Compare mode before returning to Edit.



PARAMETERS

A "parameter" is something you can change to affect the sound. Press the 1–30 and 32 switches to select the parameters printed above them. (Some switches have several parameters—press the key repeatedly to access them.) Use the ◄ ► switches to move the blinking cursor, and use the Data Entry slider or −1/+1 switches to change the data.

OPERATOR ON/OFF

When editing, it is often useful to hear only certain operators by themselves. In Single Edit mode you can use the bank select keys A–D to turn operators 1–4 off or on. (This will be indicated in upper left of the LCD. For example, "1101" indicates that operator 3 is off.) Obviously, if all carriers are turned off, there will be no sound.

[1] Algorithm (1-8)

The Algorithm is the "arrangement" of the four operators. The 8 algorithms are printed on the front panel. The LCD will also show a graphic representation of the algorithm.

[2] Feedback (0-7)

In any algorithm, operator 4 can be set to modulate itself on a scale of 0 (no feedback) to 7 (maximum feedback).

LFO Parameters

Keys 4 , 5 and 6 have the LFO parameters. LFO is a Low Frequency Oscillator that sends a continuously changing control signal. This signal, depending on the Sensitivity (p.9) and Controller Parameter (p.12) settings, can affect the output level of the operators or the overall pitch of the voice. As you can see from the diagram below, the Controller Parameter [25] — [28] settings determine how the MIDI Controllers (Modulation Wheel, Foot Controller, Breath Controller and Aftertouch) will regulate the LFO signal going to the operators, and the Sensitivity settings determine how the operators will react to the LFO signal. As you can see from the diagram, the modulation you set in the LFO does not go directly to the operators. The final effect will depend on the LFO Settings, the Controller Parameter settings, the Sensitivity settings, and the position of the MIDI controllers (Modulation Wheel, Foot Controller, Breath Controller and Aftertouch) on your keyboard.

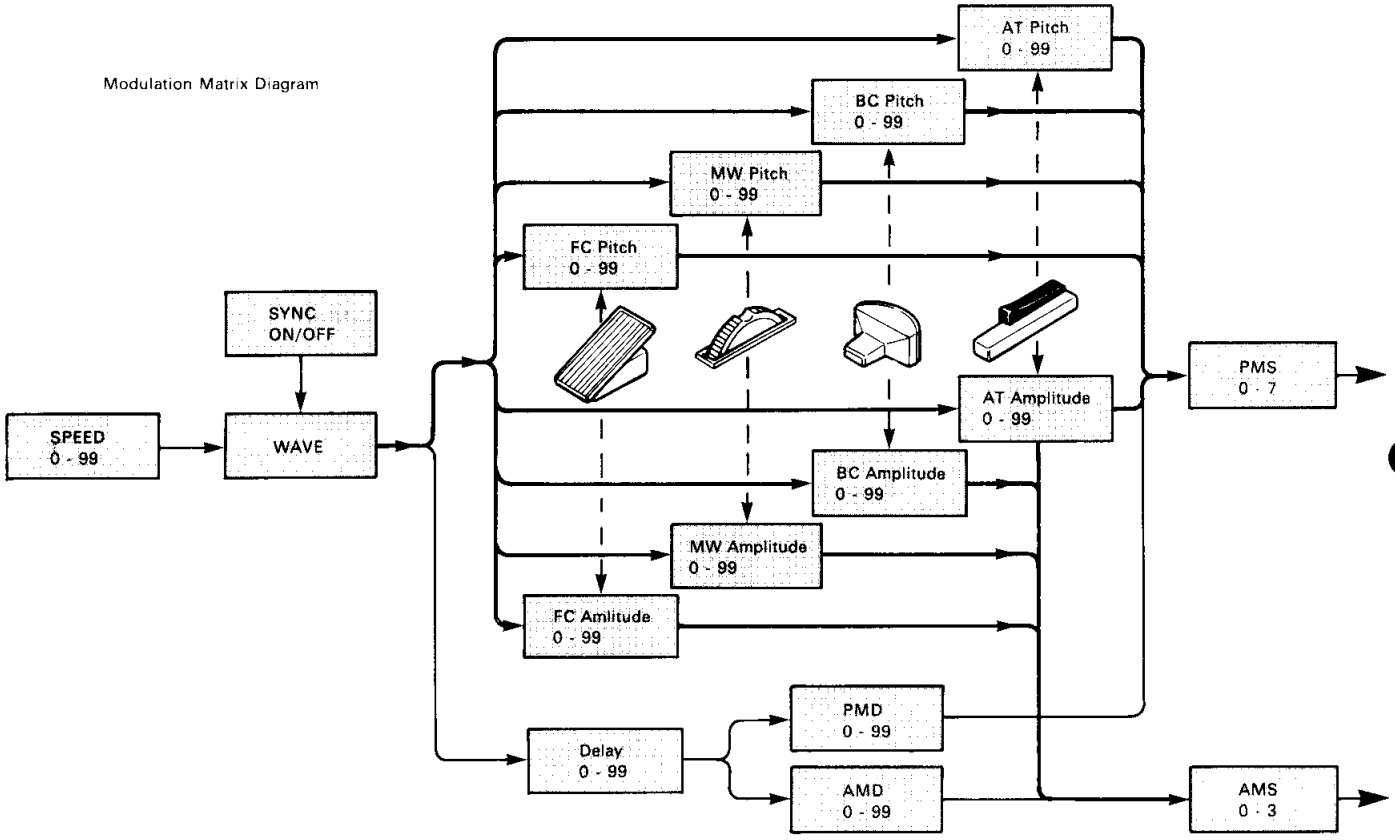
This "modulation matrix" may seem complex, but it gives you total expressive control over your instrument.

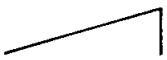
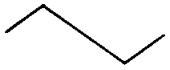
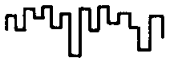
[3] LFO

(1) Wave

The first three waveshapes (saw up, square, triangle) are probably familiar to you. S/Hold stands for Sample And Hold. At periodic intervals determined by the LFO Speed, a random number is sampled, and the LFO is held at that random value until the next sample. This is especially useful in creating sound effects.

Modulation Matrix Diagram



saw up (saw tooth wave)	
square (square wave)	
triangle (triangle wave)	
S/Hold (sample & hold)	

(2) Speed (0—99)

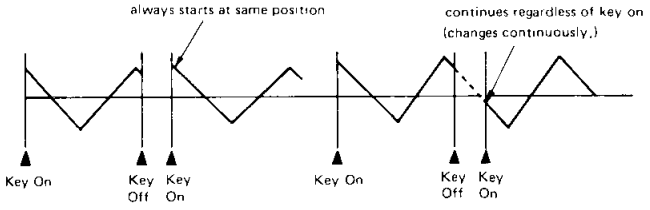
At a setting of 35, the LFO will make 6.7 cycles every second, and at 99, 55 cycles every second.

(3) Delay (0—99)

In many acoustic instruments, the vibrato begins a short time after the note begins sounding. This can be simulated using the LFO Delay, which is adjustable from 0 (no delay) to 99 (about 10 seconds).

(4) Sync (off/on)

When Sync is on, each note will reset the LFO wave to its beginning. For example, the Saw Up wave would begin again from the lowest position at the beginning of the note. When sync is off, the LFO wave will keep repeating regularly, regardless of notes being played.



[4] LFO Depth

(1) Pitch Modulation Depth (0—99)

This controls the amount of Pitch Modulation that will be present regardless of the Function Settings. When this value is above 0, the LFO will always produce some Pitch Modulation, regardless of the position of the Foot Controller, Modulation Wheel, Breath Controller, or Aftertouch.

(2) Amplitude Modulation Depth (0—99)

This controls the amount of Amplitude Modulation that will be sent to each operator regardless of the Function settings. When this value is above 0, the LFO will always send some Amplitude Modulation, regardless of the position of the Foot Controller, Modulation Wheel, Breath Controller, or Aftertouch.

[5] Sensitivity

This is where you set the sensitivity of the voice to LFO Pitch Modulation, and set the sensitivity of each operator to incoming LFO and other control signals.

(1) P Mod Sens. (0—7)

This determines the Pitch Modulation Sensitivity (0—7) of the entire voice. If it is 0, there will be no pitch modulation (vibrato).

(2) AMS (0—3, on/off for each operator)

The overall Amplitude Modulation Sensitivity of the operators is adjustable from 0—3, and each operator can be set to react to LFO Amplitude Modulation (on) or not (off). For example, if the carrier operators were sensitive to LFO amplitude modulation, the LFO would affect the volume of the voice (tremolo). If the modulator operators were sensitive to LFO amplitude modulation, the LFO would affect the tone of the voice (wah-wah).

(3) EBS (0-7 for each operator)

This sets the EG (envelope generator) Bias Sensitivity of each operator. EG Bias is a control signal that directly affects the output level of an operator. (It has nothing to do with the LFO.) The EG Bias you set here can be controlled from a Breath Controller or with Aftertouch.

If a carrier has EBS, the EG Bias signal will affect the volume of the voice. If a modulator has EBS, the EG Bias signal will affect the tone of the voice. When programming wind instruments, it is effective to set the carriers to an EBS of 7 and set BC EG Bias to 99 so that the volume will depend totally on how hard you blow into the Breath Controller (see p.13). Set the modulators to a lower value of sensitivity, so that the tone will become somewhat sharper as you blow harder. Setting EG Bias Sensitivity 1—7 will automatically lower the output of the operator by 0- 96dB in order to give it "somewhere to go" when an EG Bias signal comes in from the Breath Controller or from Aftertouch.

[6] KVS (0—7 for each operator)

This sets the Key Velocity Sensitivity of each operator. Each MIDI Note On message has a Velocity byte that tells how hard the key was struck. If an operator has KVS, it will adjust its output level according to the velocity of the note. If a carrier has KVS, strongly played notes will be louder. If a modulator has KVS, strongly played notes will have a sharper tone. Extremely high KVS settings will make the voice difficult to control, and you will need to play quite strongly to get any sound at all. Setting KVS 1—7 will automatically lower the output of the operator by 7—16dB in order to give it "somewhere to go" when you play strongly.

OSCILLATOR

This is where you set the frequency of each operator. Each operator can be set to Ratio or Fixed mode. In Ratio mode, the frequency will depend on the key you play (ie. the "normal" way). In Fixed mode, the frequency will be the same no matter which key you play. This can be useful for special effects, or for creating "formants" (fixed characteristics of spectral emphasis found in human voices and some instruments). While making Coarse [8] or Fine [9] frequency settings, move the cursor to (xxx) and use −1/+1 to switch between Fix and Ratio modes.

[7] Fix Range

This is where you set the frequency range of an oscillator set to Fixed mode (see below). Repeatedly press 7 to make settings for each operator. A "*" indicates that the operator is set to Ratio mode.

This parameter is effective only when the oscillator mode is set to "Fixed". Think of it as being an "extra coarse" adjustment of a Fixed Frequency.

Select(Hz)	Fix Range (Hz)	One Fine Step (Hz)
255	8—255	1
510	16—510	2
1K	32—1020	4
2K	64—2040	8
4K	128—4080	16
8K	256—8160	32
16K	512—16320	64
32K	1024—32640	128

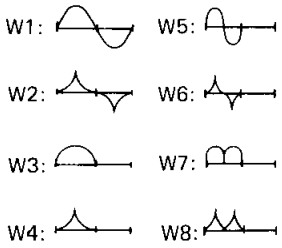
Due to hardware limitations, the very highest frequencies will not actually be output.

[8] [9] Frequency Coarse/Fine

Repeatedly press 8 or 9 to set Frequency Coarse or Fine for each operator 1–4. The "standard" ratio is 1.00; when an operator set to 1.00 frequency ratio it will produce a 440Hz tone for an A3 note (standard pitch). A ratio of 2.00 would be an octave higher, and 4.00 would be two octaves higher.

[10] Oscillator Wave (W1—W8)

The DX11 can perform FM synthesis using non-sinewave waveforms. Each operator can be independently set to one of the following 8 waveforms. The selected waveform will be graphically indicated in the LCD.



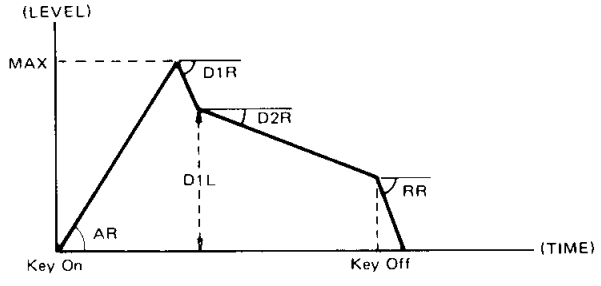
These waveforms can be used as both carriers and modulators. Sine waves (waveform 1) are pure tones. The other seven waveforms have additional harmonics already in them. This allows for complex waveforms to be created from fewer operators. For ideas on how to use the various waveforms, examine the preset voices. The harmonic content of each waveform is described on p.25.

[11] Detune (±3)

The frequency of each operator can be moved slightly higher or lower. By detuning two carriers in opposite directions, you can create a detune- chorus effect. By detuning a modulator and carrier, you can create slightly irregular, "natural-sounding" harmonic structures. The amount of detune will differ over the keyboard. At C3 a setting of ±3 is equivalent to ±2.6 cents.

Envelope Generator

The Envelope Generator (EG) determines how the operator output level changes over time. The EGs in the DX11 have 4 rate (speed) parameters and 1 level parameter. In addition, you can "shift" the range of the entire envelope by a specified amount, so that there will be some operator output even when a note is not being pressed.



[12] EG Rate

Repeatedly press 12 to set the four rates.

(1) AR (0—31)

Attack Rate determines how quickly the level will rise up to maximum level. When AR is 0, the rate is infinitely slow (ie. it never changes), and when AR is 31, the attack is fastest.

(2) D1R (0—31)

1st Decay Rate determines how quickly the level will decay from maximum to the 1st Decay Level. Obviously, if the 1st Decay Level is 15 (max), the 1st Decay Rate will have no effect

(3) D2R (0—31)

2nd Decay Rate determines how quickly the level will decay from the 1st Decay Level down to 0. If the 2nd Decay Rate is set to 0, the sound will continue as long as the note is held.

(4) RR (1—15)

Release Rate determines how quickly the level will decay from the level at the time the note is released down to 0.

[13] EG Level

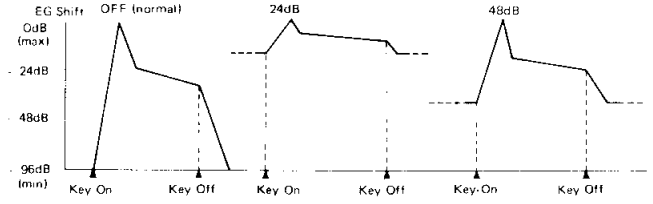
Repeatedly press 13 to set the 1st Decay Level and the EG Shift value.

(1) D1L (0—15)

1st Decay Level is the point where the 2nd Decay Rate begins.

(2) EGS (off, 48, 24, 12)

EG Shift sets the range of the envelope. When "off" is selected, the EG will change the operator output level over a range of 0 to -96dB (the full range). However, when 12, 24 or 48 is selected, the EG range is "compressed" to the specified range. For example, if EG Shift is 24, the EG will change the operator output level over a range of 0 to −24dB, and the operator output level will be at −24dB even before the note is pressed.



This can be used to limit the EG range of a modulator for very subtle changes in tone, or used on a carrier to create an instantaneous attack or effects that will sound even when a key is not being pressed. The EGS setting will not affect the time the envelope takes, even though the "distance" of the level change may be different (i.e., "rates" are automatically compensated).

EGS cannot be set for operator 1. It is fixed at "off".

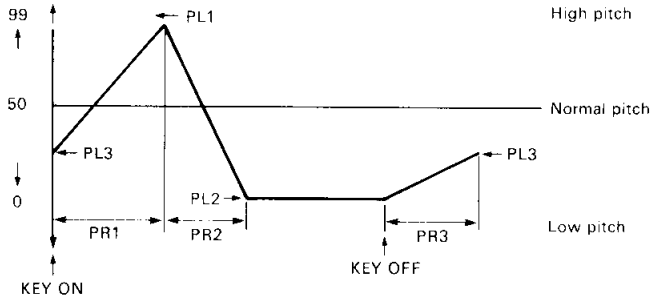
EG Copy

When trying to imitate an acoustic instrument sound, it is usually a good idea to first program the carrier envelope (volume envelope) and copy it to the modulating operators. (You will probably need to make fine adjustments later by ear.) Usually, as the volume of a sound increases (or decreases), the tone also gets brighter (or softer), so the modulator envelopes will resemble the carrier envelopes.

To copy an envelope while in Single Edit mode, press and hold the STORE switch. Move the blinking cursor and use the OPERATOR ON/OFF switches to select the source and destination operators. The envelope (AR, D1R, D1L, D2R, RR) and scaling parameters (LS, RS) will be copied.

[14], [15] Pitch EG

The Pitch Envelope Generator lets you change the pitch of the sound over time. 14 sets the Rate (speed) of change and 15 sets the pitch Level to make a pitch envelope as shown in the diagram.

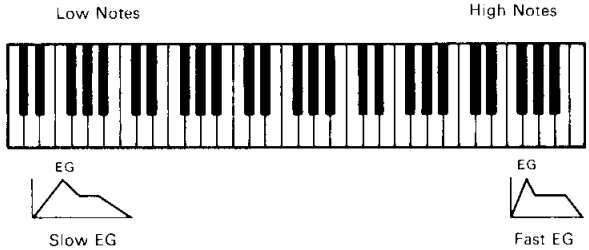


[16] Operator Out Level (0—99)

This sets the output level of each operator. The output level of a carrier will affect the volume, and the output level of a modulator will affect the tone. If you set output levels of over 90, the output will be distorted slightly. Sometimes this may be desirable to create a thicker sound. What the human ear interprets as loudness is closely related to timbral complexity (tone), and raising the level of a modulator will often increase the "loudness" as well.

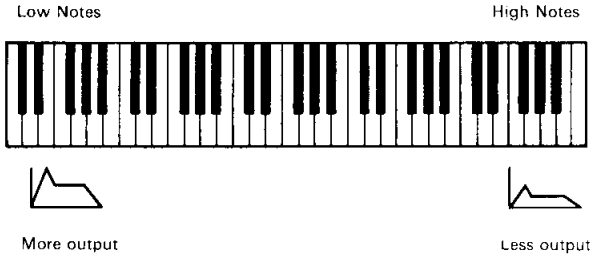
[17] Rate Scaling (0—3)

On an acoustic instrument, high notes usually have a faster attack and decay than low notes. Rate Scaling simulates this. When RS is 3, high notes will have a much shorter EG. (Even when RS is 0, high notes will be slightly shorter.)



[18] Level Scaling (0—99)

High notes on an acoustic instrument tend to have a less complex tone than low notes. You can use Level Scaling to simulate this by decreasing the output level of a modulator as you play up the keyboard. (Level Scaling operates on a curve starting from about C_1.) When LS is 0, the operator output level will be the same for all notes. When LS is 99, the output level will have dropped to 0 by the time you get to the top of the keyboard.



[19] Transpose (±24)

The voice can be transposed up or down 2 octaves in steps of a semitone. The next key you press after selecting this parameter will be the new transpose point (within 2 octaves of middle C). You may also use the Data Entry slider to set the transpose point. The display indicates the note that will actually be sounded when the middle C key is pressed.

[20] Poly/Mono

Poly Mode: In SINGLE mode, the voice will play up to 8 notes simultaneously; and in PERFORMANCE mode, the voice will play as many notes as permitted in the "Max Notes" setting for that instrument (p.16). If there are not enough notes available, the oldest note will be turned off to 'make room' for the newly played note. See EG Damp, p.23)

Mono Mode: Only the most recent note you press will be sounded. This can be desirable when playing solos. Also, Mono Mode gives you a choice of portamento (see **[22] Portamento Mode**).

A Max Notes (p.18) setting of 1 is not quite the same as Mono mode. In Mono mode, a note played before the previous one is released will not re-trigger the envelope, and the decay will continue from the previous note. However in Poly mode, each note starts its envelope from the beginning even if the previous note has not been released. Thus, if you want to have only one note sounding at a time, but want each note to re-trigger the envelope, use Poly mode and set Max Notes to 1.

Note: If you play a note in Mono Mode without releasing the previous note, and then release the second note, the sound will "jump back" to the previous note. In SINGLE mode, up to 8 of these previous notes will be remembered (as long as you continue pressing them), and in PERFORMANCE mode, up to 5 notes will be remembered.

[21] Pitch Bend Range (0—12)

This determines the range (0 12 semitones) of the pitch bend effect. When set to 12, the Pitch wheel will have a maximum effect of one octave up or down. When set to 0, the Pitch wheel will have no effect.

[22] Portamento Mode

There are two modes of Portamento (the "glide" between notes), but you have a choice only in Mono Mode. If Poly Mode is selected, this will always be "Full Time Portamento".

Fingered Portamento: Portamento is applied only if you press a note before releasing the previous one. Fingered Portamento cannot be switched off. If you don't want to have Portamento, set the Portamento Time to 0 (see below).

Full Time Portamento: Portamento is applied between all notes. This can be turned on or off by a footswitch connected to the rear panel FS jack.

[23] Portamento Time (0—99)

This sets the speed of the "glide" effect between notes. When Portamento Time is at 99, a three-octave glide will take about 30 seconds. Portamento Time of 1 is the fastest glide. When Portamento Time is at 0, there will be no glide. If you don't want a voice to have portamento, set the Portamento Time to 0.

[24] Foot Switch Assign

A on/off type controller (FC4 or FC5) plugged into the rear panel FS jack can control either Sustain On/Off or Portamento On/Off for the voice.

In Performance mode, the first voice in the performance memory will determine the Foot Switch assignment.

CONTROLLER PARAMETERS

Parameters 25—28 allow you to regulate the amount of LFO modulation using continuous-type controllers connected (or built into) the DX11. The diagram on p.8 explains how these control LFO modulation. Each parameter can be set between 0 and 99. When it is set to 0, the position of the controller will have no effect on the amount of LFO modulation.

For example, when the FC Volume setting is at 99, the volume of the voice will be regulated completely by the Foot Controller. Thus, when the Foot Controller pedal is at minimum position, there will be no sound, and when the FC Volume setting is at some middle value such as 50, there will

be some sound even when the Foot Controller pedal is at minimum position.

Volume: The controller will affect the overall volume of the voice.

Pitch: The controller will affect the amount of Pitch Modulation.

Amplitude: The controller will affect the amount of Amplitude Modulation.

Pitch Bias: The controller will directly control the pitch. (This is a "pitch-bending" effect, and has nothing to do with the LFO.) When BC Pitch Bias is set at 0 (the normal value), the controller will not affect the pitch. Settings of +1 — +50 will allow the controller to raise the pitch, and settings of −1 — −50 will allow the controller to lower the pitch. The further away from 0, the greater the effect.

EG Bias: The controller will directly control the output level of the operators. The amount of control will depend on the EG Bias Sensitivity for each operator (see p.9).

[25] Foot Control

A continuous-type controller (FC7 or FC9) connected to the rear panel FC jack can control the voice.

(1) FC Volume
(2) FC Pitch
(3) FC Amplitude

[26] Modulation Wheel

The front panel Modulation Wheel can control the voice.

(1) MW Pitch
(2) MW Amplitude

[27] Breath Controller

A Breath Controller (BC1 or BC2) connected to the front panel jack can control the voice.

(1) BC Pitch
(2) BC Amplitude
(3) BC Pitch Bias
(4) BC EG Bias

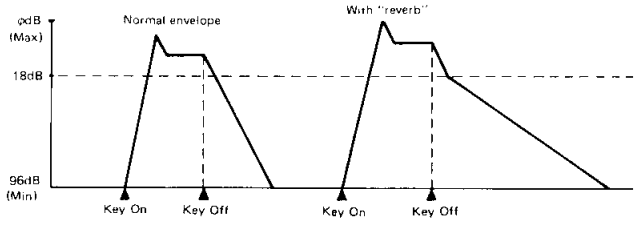
[28] After Touch

Pressing down on the keyboard after you play the note can control the voice. (i.e., "Aftertouch" as opposed to the "Initial touch" or velocity.) Aftertouch is common to the whole keyboard—the strongest pressure on any key will apply to all notes.

(1) AT Pitch
(2) AT Amplitude
(3) AT Pitch Bias
(4) AT EG Bias

[29] Reverb Rate (off, 1-7)

This is a "pseudo-reverb" effect created by slowing the EG release rates after a certain point. It depends on the OP1 EG. (OP1 on/off or OP1 output level does not matter.) When the OP EG level descends to −18dB, this "pseudo-reverb" is triggered, and the Release Rates of all operators will be slowed down to the Reverb Rate, producing a lingering effect characteristic of reverb.



Rev. Rate	Effect
off	No effect
1	EG-Release Rate = 1 (long "reverb")
7	EG-Release Rate = 7 (short "reverb")

Note that if the OP1 EG Attack Rate is 0, the OP1 EG level will stay below the reverb threshold, and all EG rates will be lengthened, causing the note to sound 'slow'. Also, if the EG Release Rate is already less than the Reverb Rate, there will be no effect. This "pseudo-reverb" must be programmed with the other voice parameters in mind.

[30] Voice Name (10 characters)

You can name your newly created voice (or rename a preset voice). Use the CURSOR switches to move the blinking cursor, and use the DATA ENTRY switches to step through the characters shown below.

```
Space ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 :
; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
[ \ ] ^ _ ` a b c d e f g h i j k l m n o p q r s t u v w x y z
{ | } ~ -
```

[32] Quick Edit

These Quick Edit parameters let you make overall adjustments in the sound. Attack and Release adjust the attack (and D1 rate) and release rates of all operators equally. Volume adjusts the output level of all carriers. Brilliance adjusts the output level (and first decay rate) of all modulators. Whenever you enter this parameter, the Quick Edit Setting "+" will be at the middle position.

(1) Attack
(2) Release
(3) Volume
(4) Brilliance

PERFORMANCE PLAY

In performance mode, you can use the DX11 as up to eight independent instruments, and specify the maximum number notes, note limit, MIDI reception channel, voice number, etc. for each instrument. The DX11 will remember 32 of these "Performances".
Switches 1—32 will select performances. The upper line of the LCD will show the Performance Name, and the lower line will show the voice numbers for each instrument. (Move the cursor to the right to see the voice numbers for instruments 5–8.) If the "Max Notes" setting of an instrument is 0, the voice number will show a "*", indicating an inactive instrument.

Performance number and name

Instruments 1–4 ◁ Instruments 5—8 ▷

Each Performance Memory (1-32) contains the following data.

Instrument	1	2	3	4	5	6	7	8
Assign Mode	Normal / Alternate							
Max Notes (0-8)								
Voice No. (101-D32)								
Receive Ch. (1-16, omni)								
Limit/L (C-2 – G8)								
Limit/H (C-2 – G8)								
Inst Detune (−7 — +7)								
Note Shift (−24 — +24)								
Volume (0-99)								
Out Assign (off, I, II, I II)								
LFO Select (off, 1, 2, vib)								
Micro Tune (select)	off/on	off/on	off/on	off/on	off/on	off/on	off/on	off/on
Effect Select	off/Delay/Pan/Chord 1/2/3/4							
Performance name								

There is a blank Performance Memory chart on p.31 that you may copy and use as a memo for your own settings.

SELECTING A PERFORMANCE

To select a performance,

1. [PERF] Enter Performance Play mode.
2. [1] [32] Select and play a performance setting.

STORING A PERFORMANCE

You can store the currently selected performance (edited or not) in any performance memory 1—32. While in PLAY PERFORMANCE mode, press and hold the STORE switch, and press a key 1–32 to select the destination. The current performance will be stored into the selected memory. (Memory Protect must be off. See p.7.) To store a performance to cartridge, press CARTRIDGE, then hold down STORE and select the destination 1–32. If the performance uses Internal voices (bank I), they will be changed to Cartridge voices (bank C1). For the reason why, see **[3] Voice Number** on p.16.

Note: When the DX11 is shipped, the performance memories contain data which you may want to save before storing your own performances. See pages 19–20 for instructions on how to save the full set of 32 performances to cassette tape or cartridge.

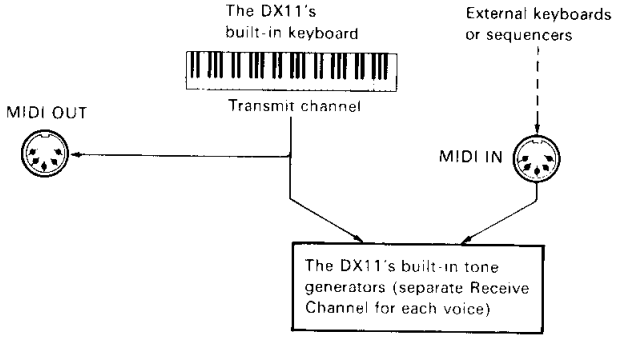
FACTORY-SET PERFORMANCE DATA

When the DX11 is shipped, the performance memories contain the following data.

1.	BRASS NO1!	A03 Sy.Brass 1 doubled.
2.	Tight BASS	A16 synth bass doubled, B28 electric bass doubled.
3.	Glocken	Glocken with pitch shift delay effect, rising in perfect 4ths.
4.	Analog Str	Press down on the keyboard to move the stereo image.
5.	Hit 1 Key!	A four-note chord for each note, in two banks---one using the chord effect, and the other using note shift.
6.	Power Rap	Noisy drums arranged across the keyboard.
7.	EP/Flute	Electric piano (6-notes) and flute (2-notes), split at G3.
8.	Wind Band	This uses alternate assign mode. Various wind instruments alternate.
9.	PROGRESSIV	Horn and synth strings (octave down)
10.	Syn Lead	Single voice layered for solos. Uses short delay effect.
11.	LyricSplit	Classic guitar and oboe split at G3.
12.	Church	Two pipe organs layered.
13.	Rotary Str	Strings with pan effect.
14.	Sax Solo	Two types of sax, two of each layered on each key. 2-note polyphonic.
15.	Floating?	Pan effect. Nice for sequencer arpeggios.
16.	Brastrings	Brass and strings.
17.	Rich Str	Smooth strings.
18.	Orchestra	"Orchestra hit" with brass, strings and timpani. Single-note only.
19.	FolkGuitar	Dual acoustic guitars.
20.	Synth BASS	Two types of synth bass, four of each on every note. Single-note only.
21.	Latin Perc	Various latin percussion arranged over the keyboard.
22.	Rich Horns	Stacked and detuned horns.
23.	Magic Slam	Delay effect. Try the aftertouch.
24.	Tension	Chord effect, with high-tension chord.
25.	Honky Tonk	Alternate assign to mistune alternate notes.
26.	B(R)ASS	Brass or Bass?
27.	"Fantasy"	Synth strings with white noise as you raise the modulation wheel.
28.	Power Solo	Short delay effect. 2-note polyphonic.
29.	HeavyBrass	Stacked voices for depth.
30.	Blues Time	C1-F2 has normally tuned bass. White keys G2-C6 play the blues scale. Black keys above F2 play a jazzy chord C,F,G.
31.	Brass Band	Trumpet and trombone.
32.	I'm ZOMBI	Sound effects and percussion arranged across the keyboard.

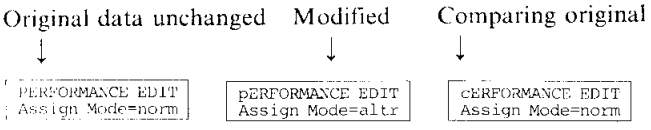
TRANSMIT CHANNEL/RECEIVE CHANNEL

Each of the up to eight instruments in a performance can have its own Receive Channel 1-16. (see p.16). Thus, messages coming into MIDI IN on eight different channels can control each instrument independently. In the same way, the keyboard built into the DX11 has its own Transmit Channel (see p.18), and in Performance mode, will control only the instruments that have a matching Receive Channel. See the diagram at right.



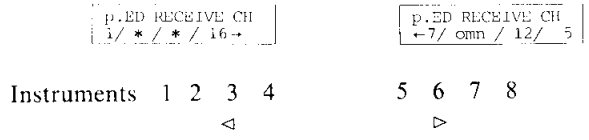
PERFORMANCE EDIT

In PERFORMANCE mode, press EDIT. The LCD will show the previously edited parameter. When you first enter Edit Performance mode, the upper left character of the LCD will be a "P", but as soon as you make a change, this will change to "p", indicating that the performance data has been modified. As in Single Edit mode, you can Compare the results of your editing with the original data by pressing COMPARE. The upper left character will change to "c" to indicate this. You cannot leave Compare mode before returning to Edit.



EDITING PROCEDURE

Press the 1–14 switches to select the parameters. Most Performance Parameters have independent settings for instruments 1-8. The LCD has space to show only four instruments at once, so an arrow on the edge of the lower line indicates that there is more data to be seen. Move the cursor to set the data for instruments 5–8. Use the DATA ENTRY slider and switches to change the data value at the blinking cursor. If the Max Notes setting (see **[2] Maximum Notes**) of an instrument is 0, that instrument is inactive, and its data will be indicated by a "*". (You can not edit an inactive instrument.) In the example below, instruments 2 and 3 are inactive.



THE PERFORMANCE EDIT BUFFER

When you select a Performance Memory, the data is loaded into the Performance Edit Buffer, and this data tells the DX11 how to behave. Changes you make in Edit mode affect this buffer, and are not permanent until Stored into one of the Performance Memories 1–32. (See Storing A Performance, p.14.)

[1] Assign Mode

There are two Key Assign Modes.

Normal mode: Incoming MIDI Note On messages (or the keyboard) will play the instrument that has a matching Receive Channel (see **[2] Maximum Notes**).

Alternate mode: This is rather special. Only instrument 1 is used, but the voice data used will depend on how many notes are already sounding. Function settings (channel, note limit, portamento, etc.) will always be the settings of instrument 1. Each sucessive note will alternate through the instruments. Setting each instrument to a slightly different voice can be quite effective.

[2] Maximum Notes (0—8)

This sets the maximum number of notes that an instrument can produce. The DX11 can produce a total of up to 8 notes at once. These 8 notes must be divided among 8 instruments. If one instrument is to play chords of up to 8 notes, the Max Notes setting for the other 7 instruments must be 0. Any combination is possible. If Max Notes is set to 0, that instrument will be inactive. When editing other Performance Parameters, a "*" will appear in place of an inactive instrument's data, and you will not be able to edit it. A Max Notes setting of 1 is not exactly the same as setting the voice to Mono mode. See p.12.

[3] Voice Number

Select the voice number for each instrument. Use the Data Entry slider to step through voices. The upper line of the LCD will show the Voice Name for the instrument indicated by the blinking cursor. If the Performance was selected from a cartridge, you will not be able to select voices from bank I (internal). The idea is that cartridge performances should use cartridge (or ROM) voices, since different voices may be in bank I next time you use the cartridge.

[4] MIDI Receive Channel

Select the MIDI reception channel (1 – 16 or omni) for each instrument. Remember that the keyboard will play only the voices which are receiving the same channel as the Keyboard Transmit channel (p.18). When set to "omni", messages on any channel (1 – 16) will be received.

For details on how each instrument receives incoming MIDI messages, see **[18] MIDI Channel Information** and **[19] Program Change** on p.18.

[5], [6] Note Limit Low/High

Each instrument can be limited to a certain range. Incoming notes outside of this range will be ignored.

You can use the Low and High note limits to create a "split" effect. One instrument could play notes below C3, and another instrument (set to a different voice) play notes above D#3. You can set the Low limit above the High limit, in which case the instrument would play notes at the ends of the keyboard and not in the middle range. You can overlap the range of several instruments to create complex sounds.

[7] Instrument Detune (±7)

Each instrument can be tuned independently over a range of ±7. Two slightly detuned instruments can be played together to create a thick, rich sound.

[8] MIDI Note Shift (±24)

Incoming notes can be transposed independently for each instrument in steps of a semitone. A setting of -24 is two octaves down, and +24 is two octaves up.

[9] Volume (0—99)

The volume of each instrument can be set independently (0—99). A vertical bar beside each number graphically indicates the volume.

Note When a Performance Memory is selected, the instruments will be set to these volume levels. However when an instrument receives a MIDI Control Change Bn.07.xx (volume), or when you move the Volume pedal, this setting will be defeated, i.e., MIDI will set the volume regardless of this setting. If you want to set the volume of an instrument so that MIDI (or the Volume pedal) will control the volume of several instruments while preserving the balance between voices, set the operator output levels of the carriers (p.11) in the voice data.

[10] Output Assign

The output of each instrument can be assigned to either, both or neither of the rear panel outputs.

[11] LFO Select

This selects the source of LFO modulation for each instrument. Amplitude Modulation can be taken from either the first or second instrument. Pitch Modulation (vibrato) can be taken from the instrument's own settings.

off: The instrument will use neither Amplitude modulation nor Pitch modulation.

vib: The instrument will use the LFO settings from its own currently selected voice memory, but there will be no Amplitude modulation. (Thus, if you need only Pitch modulation, each instrument can have its own independent vibrato generator.) The LFO waveform will be fixed at Triangle, and a PMS setting equivalent to 5 will be used.

1 / 2: If an instrument is to use Amplitude modulation, it must share the LFO of either the first or second instrument in the performance (not counting instruments with Max Notes = 0). The display will indicate the instrument number (1–8) of the LFO that will be used. If only one instrument is active, "---" will be displayed instead of the second instrument number.

In the display below, instrument 1 is inactive (its Max Notes setting is 0), so instrument 2 is the "first" instrument. Set as shown, instrument 2 will use its own LFO (with Amplitude modulation), instrument 3 will use its own LFO (without Amplitude modulation), and instrument 4 will use the LFO of instrument 3 (with Amplitude modulation).

```
P.ED LFO SELECT
* / 2 /vib/ 3 ·   1
```

off, (first),(second),vib

[12] Micro Tuning Select

The DX11 has 13 Microtone Tables (see p.22) in its memory; 11 are preset and the other two (one Octave and one Full) can be edited. You can select one of these tables for use in a performance, and specify whether or not (on/off) each instrument 1—8 will use the selected Microtone Table. When Micro Tune is on, that instrument will produce the pitch indicated by the data in the selected Microtone Table. When Micro Tune is off, that instrument will play the normal (equal tempered) scale. For preset tunings 2 - 5, you may also specify the key of the scale. In the example below, instruments 2 and 3 will use the preset no.2 scale in the key of Db.

Oct. / Full / 1 – 11

```
P.ED MICTUN=2 Db
off/ on/ on/off→
```

on/off

When a Performance memory is selected from cartridge, the cartridge Micro Tuning data will be used.

[13] Effect Select

The DX11 can store four settings for each of the three types of effect; Delay, Pan and Chord (page 21). Each performance can use one of these twelve effects. However, the Delay and Chord effects will use only the first instrument of the performance. The Pan effect will use only the instruments which are assigned to output I or II (not both).

When a Performance memory is selected from cartridge, the cartridge Effect data will be used.

[14] Performance Name

You can give a Performance Memory a 10-character name as explained in **[30] Voice Name** on page 13.

UTILITY

This is where you save and load data to external devices, and perform various other useful functions. These settings are not part of a Performance Memory. They are set for the entire DX11. To enter Utility mode, press the UTILITY switch. Then press switches 17–32 to access the functions printed under the switches.

[17] Master Tune

This is the master tune for the entire DX11, adjustable –64 +63. Use it to tune the DX11 to other instruments. The tuning range is one semitone (100 cents) below and above standard pitch (A3 = 440Hz).

[18] MIDI Channel Information

(1) MIDI on/off

When this is Off, the DX11 will neither transmit nor receive from the rear panel MIDI terminals. When it is On, continue pressing 18 to cycle through the following MIDI settings.

(2) Basic Receive Channel

This is the MIDI channel (1–16 or omni) on which the DX11 will be controlled when in Single Play mode. (In Performance mode, each instrument has its own receive channel number.) When this is set to "omni", all channels will be received.

Incoming exclusive data (see p.19) on this channel will be received.

(3) Transmit Channel

This is the MIDI channel (1–16) on which the keyboard will transmit. To play an instrument in Performance mode, this Transmit Channel must match the receive channel of the instrument.

This is also the Transmit Channel for exclusive data (see p.19).

(4) MIDI Local

When Local is Off, the DX11 keyboard will continue to send MIDI signals, but will be disconnected from the internal tone generators. For example, a sequencer connected to DX11 MIDI IN could play the DX11 tone generators while the DX11 keyboard played another tone generator connected to DX11 MIDI OUT.

(5) Control Change

(6) Aftertouch

(7) Pitch Bend

Reception of these three incoming MIDI messages can be set as follows. In Performance mode, these settings will affect transmission as well.

Off: Control Change messages (MIDI messages Bn.xx.yy) will be ignored. This includes messages such as Modulation Wheel, Breath Controller, etc. Sustain pedal on/off will always be received.

Norm: Control change message are received normally by each channel.

G1-16: You can specify a "Global MIDI Channel" for control change messages. In PERFORMANCE mode when a control change arrives on this channel, it will affect all instruments regardless of their channel setting. For example, if a MIDI guitar transmitted Note On messages with a different channel for each string, a Modulation Wheel on the guitar could control all channels simultaneously.

(8) Note

This determines how incoming MIDI notes are received.

All: All notes are received (the normal mode).

Even: Even notes are received.

Odd: Odd notes are received.

By using two DX11s together (or connecting a TX81Z) and setting one to Even and the other to Odd, you can effectively raise the simultaneous-note capacity to 16 notes.

(9) Data Entry Assign

You may specify a MIDI Control message (0–31) to be sent when you move the front panel Data Entry slider while in Play mode. The usual definition of each is displayed along with the number (1. Mod Wheel, 2. Breath Controller, etc.).

[19] Program Change

These settings determine what incoming MIDI Program Change messages will do.

(1) Program Change

This determines how the DX11 will react to incoming Program Change messages.

Off: Ignore program change messages. This also turns off Program Change transmission.

Common: Look up the corresponding Voice Number or Performance Number in the Program Change Table (see below).

Individual: Each instrument receives program changes separately and looks up its Voice Number from the table. If the table entry is a Performance Number, it is ignored.

(2) Program Change Table Initialize

When you press YES, the Program Change Table (see below) will be initialized as follows.

Incoming Program Change	will select
PGM 1	I01
PGM 2	I02
...	...
PGM 32	I32
PGM 33	A01
...	...
PGM 128	C32

(3) Edit Program Change Table

The Program Change Table determines what DX11 memory is selected in response to each incoming Program Change message. To edit the table, answer YES. Use the PRESET C and PRESET D switches to step through the incoming PGM 1 PGM 128, and use the DATA ENTRY switches to select a Internal Voice I01--D32, Internal Performance P01--P32, Cartridge Voice 1-32 or Cartridge Performance 1--32. (Cartridge memories are indicated by a "C_T".)

[20] Exclusive

(1) Exclusive off/on

When this is Off, all incoming System Exclusive messages (bulk data) will be ignored. When it is on, you can repeatedly press 20 to select the following jobs. When you press YES, the selected bulk data will be transmitted from MIDI OUT.

This transmitted data can be received by another DX11, a TX81Z or a DX21/27/100 (or any data storage device such as the MDF1) if the Memory Protect (p.7) is Off, its Exclusive is On, and its Receive Channel matches the Transmit Channel (p.18). For details, see the notes on data compability on page 28.

(2) Voice Transmit

Press YES to transmit 32 voices. (Press NO to select banks I/A/B/C/D.)

(3) Performance Transmit

Press YES to transmit 32 performances.

(4) Setup Transmit

Press YES to transmit the selected data. (Press NO to select AL,SY,EF,MC.)

AL: PC + EF + MC (see below)

SY: System data. The settings for Combine, Memory Protect (int, crt), Receive Channel, Transmit Channel, PgmChange, Cont.Change, Exclusive, Tune, PB, Note, ID, MIDI, Local, Aftertouch, Data Entry Assign, Cartridge Bank, Controller Reset, Fixed Velocity, and EG Forced Damp.

PC: Program Change Table

EF: Effect data (three types, four of each)

MC: The two user-programmable micro tuning scales

[21] Cartridge

Cartridge Save

1. [21] Press 21 to get the "Cartridge Bank" display.
2.  Use the data entry slider to select a cartridge bank 1A--16B.
3. [21] Press 21 again to get the "Cartridge Save" display.
4. [NO] Repeatedly press NO to select the type of data to save.
5. [YES] Press YES to save the selected data to cartridge.

(CRT memory protect and the protect switch on the cartridge must be off.)

Cartridge Load

1. [21] Press 21 to get the "Cartridge Bank" display.
2.  Use the data entry slider to select a cartridge bank 1A--16B.
3. [21] (twice) Press 21 twice to get the "Cartridge Load" display.
4. [NO] Repeatedly press NO to select the type of data to load.
5. [YES] Press YES to load the selected data to DX11 internal memory.

(INT memory protect must be off.)

Cartridge Format

1. [21] (4 times) Press 21 four times to get the "Cartridge Format" display.
2.  Use the data entry slider to select a cartridge bank 1A--16B.
3. [YES] Press YES to format the selected cartridge bank.

(CRT memory protect and the protect switch on the cartridge must be off.)

Details of each operation are given below.

Various data can be stored in a RAM cartridge (sold separately). Repeatedly press 21 to step through the four jobs.

(1) Cartridge Bank Select

The RAM4 data cartridge has only a single bank. However, future data cartridges may have up to 16 banks, each of which can contain a different type of data. An entire set of DX11 data (32 Voices, 32 Performances, Effects, Program Change Table and System data) occupies only half of a cartridge bank--A or B. Thus, a single cartridge could contain up to 32 independent sets of DX11 data. Use the Data Entry slider to select bank 1A 16B.

(2) Cartridge Save

Repeatedly press NO to select the type of data you want to save. You have the following choices.

all: 32 voices and 32 performances, Program Change Table settings, Effect data, Micro Tune data, System Setup data.

setAL: Program Change Table, Effect data, Micro Tune data.

setSY: System data (the settings for Combine, Memory Protect, Receive Channel, Transmit Channel, Program Change, Control Change, and Exclusive etc.).

setPC: Program Change Table (p.18).

setEF: Data for the three effects (four settings each) (p.21).

setMC: The two user-programmable Micro Tunings (p.22).

Press YES to save the selected data to a cartridge inserted in the front panel Cartridge Slot. (The memory protect switch on the cartridge must be off.)

(3) Cartridge Load

You can load data into the DX11 from a cartridge. Press NO to select the type of data (as described above) that you wish to load. Press YES and the data will be loaded into the DX11. (DX11 memory protect must be off. See page 7.)

(4) Cartridge Format

Before a cartridge can be used, it must be Formatted to accept DX11 data. Use the Data Entry slider to select the bank to be formatted (1A—16B) and press YES. (This will erase whatever data was previously in that bank of the cartridge.) Formatting either bank 1A or 1B will format both. The format type will be "VD".

[22] Cassette Control

Save / Verify / Load 32 Voice

Save

1.	[22]	Press 22 to get the "Save 32 Voice" display.
2.	[NO]	Repeatedly press NO to select VD, DX or TX format.
3.	[YES]	Press YES to get the "Save ready" display.
4.	REC	Start the tape recorder.
5.	[YES]	Press YES to begin saving to cassette.
6.	STOP	When you see the "Verify 32 Voice" display, stop the tape.

Verify

7.	REWIND	Rewind the tape to the beginning of the data.
8.	[YES]	Press YES to get the "Verify ready" display.
9.	[YES]	Press YES again.
10.	PLAY	Start the tape.
11.	STOP	When you see the "Verify Completed" display, stop the tape.

(If there has been an error, try Saving and Verifying again.)

Load

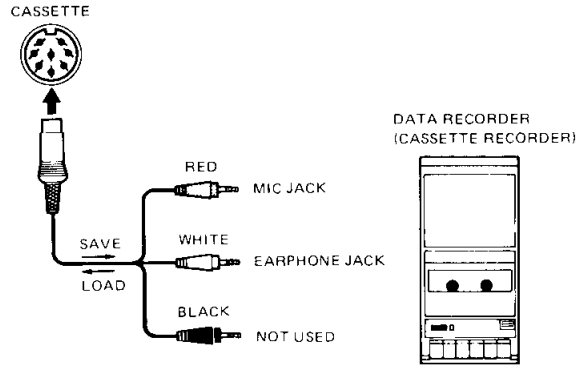
12.	[22]	Press 22 to get the "Load 32 Voice" display.
13.	REWIND	Rewind the tape to the beginning of the data.
14.	[YES]	Press YES to get the "Load all ready" display.
15.	[YES]	Press YES again.
16.	PLAY	Start the tape.
17.	STOP	When you see the "Load Completed" display, stop the tape.

(If there has been an error, try again.)

To Save / Verify / Load Performance data, press 22 five times in step 1.
To Save / Verify / Load Setup data, press 22 nine times in step 1.

Details of each operation are given below.

This is where you save and load data to and from a cassette. Repeatedly press 22 to select the jobs. Connect the DX11 to a data cassette recorder using the cassette cable included with the DX11 (DIN-jack → DX11 rear panel, white plug → earphone jack, red plug → microphone jack). The black plug is not used. It is best to use a cassette recorder and tape especially designed for personal computer data storage. Also try to use the same recorder for both saving and loading.



If you change your mind while saving, verifying or loading, press any front panel switch to quit.

(1) Save 32 Voice? (VD, TX, DX)

This will save the 32 voices from the internal memory (bank I) to a cassette tape. You can save the data in VD, TX or DX format. If you will be re-loading the voice data to a DX100/21/27/27S, press NO to select DX format. (The DX11 has some parameters that the DX100/21/27/27S does not, and these will be deleted.) If re-loading to a TX81Z, select TX format, and if re-loading to a DX11, select VD format.

Press YES, and the LCD will show "Save ready?". Start RECORD on the tape recorder and press YES again. The LCD will show "INT xx to Tape" and display the voice number 1-32 that it is currently saving. When saving is complete, the DX11 will go on to the next job "Verify 32 Voice?".

(2) Verify 32 Voice?

You can check to see whether data was correctly saved to tape. Press YES, and the LCD will read "Verify Ready?". Rewind the tape to the beginning of the data.

press YES and start the cassette playback. If the data on tape matches the data in the DX11, the LCD will show "Verify Completed". If not, the LCD will show "ERR".

(3) Load 32 Voice?

This loads 32 voices from tape into the DX11 voice memory bank I. Make sure that INT Memory Protect (p.9) is off, and press YES. The LCD will show "Load all ready?" so press YES again and start the tape playback. The LCD will show "Tape to INT 1" and display the voice number 1-32 currently being loaded. When finished, it will display "Load Completed". If the data from tape is incorrect, it will display "ERR".

(4) Load 1 Voice?

You can choose any voice (1-32) to load from tape into the voice edit buffer of the DX11. Press YES. The LCD will show "Tape ?? to BUFF?". Press 1–32 to select the tape data (1-32) you want. Then press YES again and start the cassette playback. The LCD will show "Search Tape xx" and wait for the selected voice data. When the data arrives, the LCD will show "Load Completed". The voice data will be in the edit buffer, so you will need to Store it into a DX11 voice memory (see p.7). In "Load 1 Voice" mode, you may fast-forward or rewind the tape to get to the voice data you want. (This will not work for any other tape load mode.)

(5) Save 32 Performance
(6) Verify 32 Performance
(7) Load 32 Performance
(8) Load 1 Performance
(9) Save Setup
(10) Verify Setup
(11) Load Setup

These jobs let you save and load performance and setup data to and from cassette tape. (For Setup data, press NO to select the type of data, as explained in **[21] Cartridge.**) Operation is the same as saving and loading voices, as explained above.

During Load, Verify or Load 1, the format number of the data being read will be shown in the upper right of the LCD. Data of an undesired format will be skipped.

[23] Combine

Each voice memory includes settings to determine how the voice will be affected by controllers (wheels, breath controller, etc.) and incoming MIDI control messages —i.e., 'Controller' parameters. When Combine is On, each newly selected voice uses its own settings. By setting Combine Off, you can preserve the current settings, meaning that each selected voice will be controlled in the same way. Combine off/on affects the voice parameters set using front panel switches 20–29. When power is turned on, Combine will be On.

Effects

Three types of effects are available, and four settings for each effect can be memorized. A Performance Memory can use any one of these 12 effects.

While editing an Effect, you can copy data from an Effect memory 1–4 to another Effect memory 1–4. Hold down STORE, and use switches A–D to select memories.

[24] Delay

This is a transposed delay effect. When this effect is used in a Performance, it will affect only the first instrument. Repeatedly press 24 to select Delay 1–4. Then press YES, and repeatedly press 24 to step through the four Delay parameters. (You will then cycle back to selecting Delay 1–4).

This Delay effect is made by producing additional notes while reducing the output of the operators until the level of the voice is –60dB. There will be a naturally decreasing delay effect whether or not the voice has KVS, but if the KVS of the voice is 7, the first delayed note may be louder than the original note. (You can adjust this with (4) Effect Level.) Up to four delay notes can be sounding simultaneously. When the fifth delay note is played, the first delay note will be turned off.

(1) Delay Time (0.01–1.28s)

This is the time between echoes, displayed in seconds.

(2) Pitch Shift (–24–+24)

You can transpose each delayed note up or down by semitones. –24 is two octaves down, and +24 is two octaves up. However, the DX11 note range is limited to about 8 octaves, and notes falling outside of this range will be "folded back."

(3) Feedback (0–7)

This regulates how the Velocity of each echo is decreased, and indirectly determines the number of echoes. If you play a note strongly (high velocity), there will be more repeats before the velocity drops to 0.

(4) Effect Level (0–99)

This determines the Velocity of the first echo. When set to 99, the first echo will have the same velocity as the note you play. As with Feedback, this will indirectly determine the number of echoes.

[25] Pan

This effect automatically moves the sound between outputs I and II. You can use it in a performance when 2 instruments are active. Press YES, and use the PARAMETER switches to select the three Pan parameters. Repeatedly press 25 to select Pan 1–4. Then press YES, and repeatedly press 25 to step through the three Pan parameters. (You will then cycle back to selecting Pan 1–4).

This pan effect is produced by varying the balance of two instruments assigned to outputs I and II (not I+II). Thus, to create a natural panning effect, both instruments should be using the same voice. When editing Pan in UTILITY mode, the DX11 will automatically act as two identical instruments (one assigned to output I, the other to output II), each playing up to four notes. When Pan is used in a performance, you need to make sure that the two instruments are assigned to different outputs.

(1) Select

This determines the source of the movement.

LFO: The sound will be panned back and forth at the LFO speed (p.9)

Velocity: Notes with low velocity (softly played) will be panned toward output I, and notes with high velocity (strongly played) will be panned toward output II. (This will be reversed if you select "Direction:II-I".)

Note: Low notes (to the left of the keyboard) will be panned toward output I, and high notes toward output II. (This will be reversed if you select "Direction:II-I".)

(2) Direction

This determines the direction of the panning movement, from output I → II or the reverse.

(3) Range (0-99)

This determines the range of the pan effect. At low settings the sound will barely move, and at high settings the sound will be panned completely from one output to the other.

[26] Chord Set

This effect allows you to produce up to four simultaneous notes when you play a certain key. When this is selected for a performance, only the first instrument in the performance will be used. Repeatedly press 26 to select Chord Set 1–4. Then press YES, and repeatedly press 26 to step through the 12 notes of the octave. (You will then cycle back to selecting Chord Set 1–4). When you have selected the Key On note, press YES, and the chord notes currently selected for that note will be displayed.

Now press up to four notes on the keyboard. When you release all the notes, the new chord notes will be displayed. If less than four notes are pressed, a "*" fills the empty space. You may also move the blinking cursor and use the Data Entry slider (or the −1/+1 keys) to change the notes in the chord.

In this way, you can specify up to 12 notes and a four-note chord for each. The DX11 can contain four independent sets of Chord Set data (1–4).

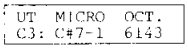
[27] Micro Tuning

The DX11 has 13 microtonal scales (11 preset and 2 user-programmable), one of which can be selected for use in a performance (p.17). This is where you edit the two user-programmable scales. Repeatedly press 27 to cycle through the four jobs.

(1) Edit Octave ?

Here you can edit the 12 notes of the user-programmable octave. The tuning of each note will be repeated in steps of 1200 cents (one octave) up and down the keyboard. Press YES. Use the PRESET C and PRESET D keys to select C3-B3 and use the Data Entry slider (−1/+1) to change the tuning for each note. (Move the blinking cursor and set the note C#−1–C7 and fine tuning −31–+32.)

As you change the tuning, the absolute pitch is calculated and displayed at in steps of about 1.56 cents, ranging from 0 (C#−1+0) to 6143 (C#7–1). This covers the entire range of the DX11's sound- producing capability.



Played Sounded Absolute pitch

(2) Init Octave ?

Here you can initialize the user-programmable octave to one of the 11 preset scales. When creating your own scale, it may be faster to start with one of these preset scales. Press YES and press [27] to select preset scales 1-11. Press YES again to initialize to the selected scale. (Press NO to escape.) For Pure, Mean Tone and Pythagorean scales, you can also choose the tonic (first note) of the scale. Move the cursor to the "key" area and select C-B using [27]. (No matter what tonic you select, A3 will always be 440Hz.)

1: Equal	7: Kirnberger
2: Pure(major) C–B	8: Vallotti&Young
3: Pure(minor) A–G#	9: 1/4 Shift eql
4: Mean tone C–B	10: 1/4 Tone
5: Pythagorean C–B	11: 1/8 Tone
6: Werckmeister	

Booklets with detailed data on these tunings are available from Yamaha. 1/4 Shifted Equal Temperament (scale 9) is the normal scale shifted up 50 cents. When 1/4 Tone (scale 10) is used, each key produces an interval of 50 cents (i.e., play 24 keys to move one octave). When 1/8 Tone (scale 11) is used, each key produces an interval of 25 cents (ie. play 48 keys to move one octave). When 1/4 tone or 1/8 tone are used, the C2 key will produce the pitch of normal C3.

(3) Edit Full Kbd ?

Here you can edit the tuning of each note in the scale from C#-1 to C7 (the full range of the DX11's sound producing capability). Change the tuning for each note as explained above in "Edit Octave". You can also select the note to edit by pressing the key while holding PRESET C or PRESET D.

(4) Init Full Kbd ?

Here you can initialize the user-programmable full scale to one of the 11 preset scales as described above in "Init Octave".

[28] Initialize

When creating a voice or performance from scratch, it is often useful to start from an initialized setting rather than having to reset all the parameters by hand. Press YES. The LCD will ask "Are you sure?" so press YES again. The edit buffer will be set to the data shown below, and you will automatically enter Edit Mode.

Repeatedly press 28 to select Voice or Performance.

(1) Voice

Press YES to initialize the voice edit buffer to the following data.

INITIAL VOICE DATA CHART				
ALG	=1	OUT	=90	OP1
FBL	=0		=0	OP2
LW	=triangl		=0	OP3
LFS	=35		=0	OP4
LFD	=0	RS	=0	
PMD	=0	LS	=0	
AMD	=0	Poly mode		
L SYNC	:off	PBR		=4
PMS	=6	Full t.porta		
AMS	=0	Porta time		=0
AME	:off	FC vol		=40
EBS	=0	MW pitch		=50
KVS	=0	MW ampli		=0
F	=1.00	BC pitch		=0
RATIO	mode	BC ampli		=0
DET	=0	BC p bias		=50
AR	=31	Middle C		=C3
D1R	=31	Rev. rate		:off
D1L	=15	Init voice		
D2R	=0	FC pitch		=0
RR	=15	FC ampli		=0

(2) Performance

Press NO to select the performance data you want to initialize to. Then press YES to initialize the performance edit buffer.

single: A single voice in 8-note polyphony
dual: Two voices in 4-note polyphony
split: Two voices split over the keyboard
mono8: Eight voices, each monophonic
poly4: Four voices, each in 2-note polyphony

[29] Recall

This recalls the last edited data (voice or performance) into the edit buffer. For example, if you are editing a voice (or performance) and accidently go back to Play mode and select a memory, then data from memory will be loaded into the edit buffer and your edited settings will be lost. By using this "Recall Edit" function, you can restore the data you were editing.

If you entered this function from Voice mode, it will recall the Voice data. If you entered from Performance mode, it will recall the Performance data.

When you press YES, the data you were editing will be loaded into the edit buffer, and you will automatically enter Edit mode.

[30] Voice Edit

This is especially handy when you want to edit one of the voices in a performance.

Use the cursor switches to select the instrument that is using the voice you want to edit, and then press YES. You will jump to Single Edit mode with the selected voice in the edit buffer.

When used from single mode, this simply enters Edit mode.

[31] Controller Reset

This determines whether the controllers (Wheels, Foot Controller, Breath Controller, etc.) will be reset to their normal position when you select a new Voice or Performance. Use −1/+1 to set whether to "hold" or "reset" controllers.

[32] Fixed Velocity

Repeatedly press 32 to cycle through the two jobs.

(1) Fix Velocity

You may select a fixed velocity for the keyboard to transmit. No matter how softly or strongly you play, the specified velocity 1–127 will be used. When 'off' is selected, the keyboard will be velocity sensitive the normal setting.

(2) EG Damp

The DX11 can produce up to 8 notes at a time. If a key is pressed while all 8 notes are sounding, the oldest note will be turned off to make way for the new one.

EG Damp is the speed with which the old note is turned off. Faster settings will mean quicker response, but may produce click noise. Select from very slow, slow, medium and fast.

OTHER FUNCTIONS

GREETING MESSAGE

When you turn the DX11 power on, it displays a greeting message, initially set to "< How are you ? >". You can change this by turning the power on while pressing STORE. Use the CURSOR switches to move the blinking cursor and use −1/+1 or use the Data Entry slider to select characters. (The character table is on p.13.) When you are finished, press EDIT, SINGLE or PERFORM to return to normal operation. The next time you turn the power on, your new message will be displayed.

PROGRAM CHANGE TRANSMISSION

In Play mode, you can transmit a Program Change message from MIDI OUT. This is sometimes useful when you want to switch a tone generator (connected to the DX11 MIDI OUT) to another memory without changing the DX11's own memory.

If in Single Play mode, press and hold SINGLE. If in Performance Play mode, press and hold PERFORMANCE. Then use the 1 10 switches to enter a three-digit program number 1--128. A MIDI Program Change message will be transmitted on the keyboard's Transmit Channel (p.18). (Only when MIDI is On, see p.18).

Do not confuse the above function with the MIDI Program Change message that is normally transmitted when you select a voice or performance (when MIDI is On, p.20).

IDEAS AND SUGGESTIONS

The DX11 can be used in any number of ways. Here are some ideas.

HEAVY MONOPHONIC

If your solo is going to be monophonic, how about playing eight DX11 instruments in unison? Set each instrument to receive the same MIDI channel, and assign different voices (and different detunings) to each. Setting a slightly different Portamento Time (or Pitch Bend Range) for each instrument is also effective. This will give you the thickest, richest, most powerful solo sound you have ever heard; one that will "out-analog" the analog synthesizers(!).

HUMAN EXPRESSION

In a variation of the above, use several different voices to synthesize a different component of an acoustic instrument sound, in essence using the DX11 as a single 32-operator FM synthesizer. For example, a saxophone sound consists of many different elements, one of which is the breathy wind-noise. An entire DX11 instrument could be devoted to producing this wind-noise. By appropriate settings of the Voice Functions, each component can be controlled independently by Foot Controller, Breath Controller, Modulation Wheel, Aftertouch and Key Velocity.

MICROTONAL DETUNE BY AREA

A microtonal scale can be selected for use with specified instruments in a Performance. Set up the DX11 as two 4-note polyphonic instruments, and set one of them to use the user-programmable Full Keyboard microtonal scale. Set the microtonal scale so that it is identical to the equal tempered (normal) scale, and detune just the notes where you want the detuned chorus effect.

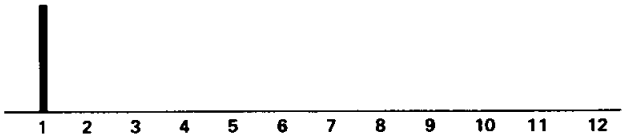
COMPLEX SPLIT KEYBOARD

Assign instruments to overlapping sections of the keyboard so that the sound mixture changes as you play in different areas.

WAVEFORM HARMONIC CONTENT

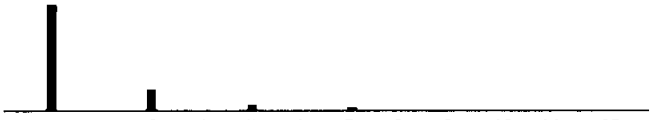
In addition to sinewaves (pure tones), the DX11 operators can use 7 more complex waveforms. These waveforms are not modeled after any "real" instrument, but are mathematical transformations of sinewaves.
Here is the harmonic content of each waveform. The amplitude (volume) of each harmonic partial is given as a percentage of the fundamental.

W1
Sine wave. Only fundamental.



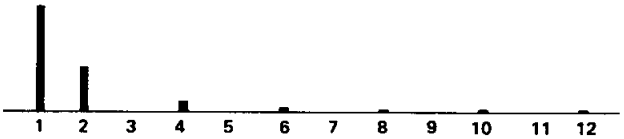
1	2	3	4	5	6	7	8	9	10	11	12
100	0	0	0	0	0	0	0	0	0	0	0

W2
Odd partials somewhat like a square wave



1	2	3	4	5	6	7	8	9	10	11	12
100	0	19	9	3	0	1	0	0	0	0	0

W3
Even partials.

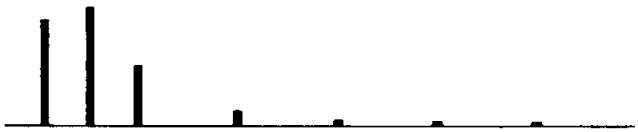


1	2	3	4	5	6	7	8	9	10	11	12
100	39	0	8	0	4	0	2	0	1	0	1

W4
Partials 2, 3, 5, 7,.....

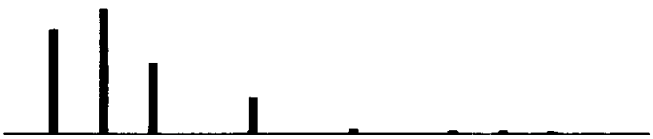
1	2	3	4	5	6	7	8	9	10	11	12
100	55	18	0	3	0	1	0	0	0	0	0

W5
Partials 2, 3, 5, 7, 9,... (stronger partials that W4)
Second partial is stronger than fundamental.



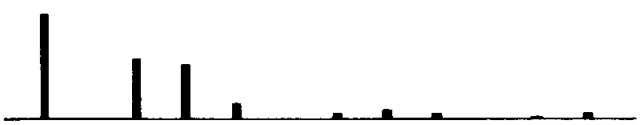
1	2	3	4	5	6	7	8	9	10	11	12
100	109	58	0	15	0	6	0	4	0	2	0

W6
Partials 2, 3, 5, 6, 7, 9, 10, 11,... (no 4,8,...)
Second partial is stronger than fundamental.



1	2	3	4	5	6	7	8	9	10	11	12
100	116	66	0	34	25	6	0	3	4	1	0

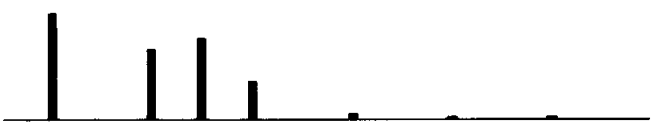
W7
Partials 3, 4, 5, 7, 8, 9,... (no 2, 6, 10,...)



1	2	3	4	5	6	7	8	9	10	11	12
100	0	56	50	15	0	6	9	4	0	2	4

W8

Partials 3, 4, 5, 7, 8, 11,... (no 2, 6, 8, 10...)



1	2	3	4	5	6	7	8	9	10	11	12
100	0	66	74	34	0	6	0	3	0	1	0

ERROR MESSAGES

The DX11 will sometimes display one of the following messages to indicate an unexpected event or a completed operation.

Cartridge Errors:

Insert cartridge	You tried to select/save/load a cartridge voice or performance when there was no cartridge inserted.
Cart verify err	You tried to save/load/format a cartridge, but the cartridge and internal memory contained different data.
Memory Protected	You tried to save/load to/from internal/cartridge, but memory protect was on. (Either the INT/CRT memory protect on the DX11, or the switch on the cartridge.)
Cart format err	You tried to save/load to/from cartridge, but it contained data not meant for the DX11.
CartBank unavail	You tried to save/load/format/store to or from a cartridge bank that did not exist. (The RAM4 cartridge has only one bank, but future cartridges will have more.)

Cartridge Messages:

> Completed! <	Cartridge save/load/format has been executed normally.

MIDI Errors:

Midi Buffer Full	Bulk data has been received at MIDI IN more quickly that the DX11 can handle it. If you are using a bulk data storage device to transmit data to the DX11, set it for a time wait between bulks.
Memory Protected	32 voice, 32 performance, or setup bulk data has been received, but the DX11 INT memory protect is on.
Midi Data Error	Faulty MIDI data has been received. Perhaps a MIDI cable was pulled out during reception.
Midi CSUM Error	Bulk data has been received, but the contents may be faulty. (Check sum error.)

MIDI Messages:

Midi Received	Bulk data has been received normally.

Cassette Errors:

Memory Protected	You tried to load from cassette, but INT protect was on.
Tape to INT ERR	When loading from cassette, the data on cassette was faulty.
Verify Tape ERR	When verifying cassette data, the tape data did not match the data in DX11 memory.
Search Tape ERR	When loading 1 voice/performance from tape, the tape data was faulty.

Cassette Messages:

Load Completed	Cassette load has been executed normally.
Verify Completed	After verifying, the tape data matches the data in DX11 memory.

Store Errors:

Memory Protected	You tried to store a voice/performance to cartridge or internal memory, but memory protect was on. (Either the INT/CRT memory protect on the DX11, or the switch on the cartridge.)

Low Battery Error:

Cng RAM Battery!	If the internal data backup battery is low, the DX11 will flash this message once when power is turned on.

DATA COMPATIBILITY

The DX11 uses the same 4-operator, 8-algorithm FM synthesis as the TX81Z, DX21, DX27, DX27S and DX100, and voice data can be transmitted and received between them. However, there are a number of diffrences.

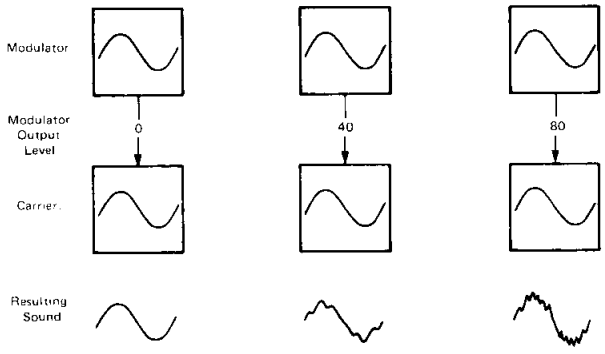
* The Frequency CRS(RATIO) adjustment (p.10) is equivalent to the values programmable in the DX21/27/27S/100. The FIN(RATIO) adjustment is additional precision available in the DX11 and TX81Z. Also, the DX21/27/27S/100 operators have no FIX mode.
* The DX21/27/27S/100 operators produce only sinewaves. When a DX11 voice that uses non-sinewave operators (p.10) is loaded into a DX21/27/27S/100, it will not sound the same.
* EG RR. The Envelope Generator Release Rate on the DX21/27/27S/100 can be set to 0, whereas the DX11 and TX81Z EG-RR minimum setting is 1. When voice data is received from a DX21/27/27S/100, any EG release rates of 0 are set to 1.
* EG-EG Shift is not a parameter on the DX21/27/27S/100, and will be ignored by them.
* Parameters that the DX11 does not have (chorus) will be set to Off or 0.
* The DX11 BC Pitch Bias of −50 to +50 (p.13) corresponds to the DX27/100 BC Pitch Bias of 0—99. However, the curve is different. (Exponential, not linear.)
* The TX81Z has no PEG or Aftertouch parameters.
* The TX81Z has only one setting for each of the three effects.

WHAT'S FM?

A complete discussion of FM Synthesis is beyond the scope of this manual. Here we will cover the basic ideas of FM, and briefly explain some of the DX11 voice parameters. For a more detailed study, see "FM Theory & Applications: By Musicians for Musicians", by Dr. John Chowning and David Bristow, published 1986 by Yamaha Music Foundation. Other booklets covering various aspects of electronic music are also available from Yamaha.

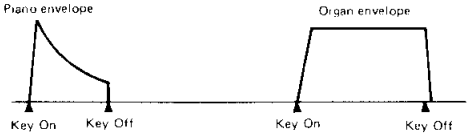
FREQUENCY MODULATION

FM stands for Frequency Modulation. In FM, one waveform modulates another waveform, creating a new, complex waveform, as shown below. So, to do FM synthesis, we need two oscillators. The upper one is called the "Modulator" and the lower one (which goes directly to the output of the synthesizer) is called the "Carrier". The complexity or "brightness" of the resulting waveform will depend on the output level of the Modulator.



EG (Envelope Generator)

By varying the output level of the modulator, we can produce all kinds of sounds. However, sounds in the real world usually change as time goes by. This "shape in time" is called the Envelope. If the output level of the modulator changes, the tone will change. If the output level of the carrier changes, the volume will change.



OPERATOR

In Yamaha FM synthesizers, each oscillator has its own Envelope Generator (EG) to vary its output level over time. This "package" is called an Operator. An operator can be either a modulator or carrier. The only difference is how it is used.

ALGORITHM

To do simple FM, you need only two operators, but the DX11 has four, and these four operators can be arranged in 8 different ways. Each arrangement is called an Algorithm. The eight algorithms are shown on the DX11 front panel. Take a look at them. Algorithm 1 has only one carrier. The other three operators are all used as modulators. In algorithm 6, one modulator modulates three carriers. Algorithm 8 has four carriers and no modulators.

FEEDBACK

In the algorithm chart, you will also notice that operator 4 has its output connected to its input. This means that it can modulate itself, a bit like having an additional operator.

RATIO FREQUENCY

The basic frequency of each operator can be set independently. When an operator is in Ratio mode, it will produce a frequency corresponding to the key that was pressed. If the frequency ratio of the carrier:modulator is 1:1, the resulting sound will contain all the harmonic partials. For example, if the fundamental (the "basic pitch") is 100hz, harmonics of 200hz, 300hz, 400hz ... will be generated. If the frequency ratio is 1:2, the odd-numbered harmonic partials will be generated (100hz, 300hz, 500hz creating a hollow, reedy sound. Irregular ratios (such as 1:1.37) will generate non-harmonic spectra typical of clashing, metallic sounds.

FIXED FREQUENCY

An operator can also be set to Fixed mode, when it will produce the same frequency regardless of what key is pressed. In Fixed mode, the frequency is displayed in Hz (cycles per second) or kHz (1000 cycles per second). If the carrier is in Ratio mode and the modulator is in Fixed, the harmonic structure of the sound will change depending on the key you press.

WAVE

The DX11 operators give you a choice of 8 different waveforms (sine and 7 others) for each operator. A sine wave is a pure tone (no overtones) whereas the other waves have some overtones already present. It may help you to look through the factory preset voices to see how they use the different waveforms.

LFO

The LFO (Low Frequency Oscillator) produces a slow (about 0.001Hz to 53Hz) vibration that can be used to create vibrato, tremolo or other effects. If the LFO is affecting the output level of a carrier, the result will be Tremolo (rapid variation in volume), and if it is affecting the output level of a modulator, the result will be periodic changes in tone. The LFO can also control the pitch of the operators, producing Vibrato (rapid variation in pitch).

SENSITIVITY

Acoustic intruments produce different sounds when played softly or loudly. Not only the loudness, but also the tone changes. A softly played note is usally softer in tone as well. FM synthesis provides an easy way to simulate this. Each operator can be "Velocity Sensitive", and adjust its output level according to how hard a key was struck (key velocity). If a carrier is velocity sensitive, the volume will depend on the key velocity. If a modulator is velocity sensitive, the tone will depend on the key velocity.

DETUNE

The harmonic structure of actual acoustic sounds is usually somewhat "irregular". This makes them sound interesting and lifelike. By slightly Detuning each operator, you can create this type of naturally irregular harmonic structure.

SCALING

The tonal characteristics of an instrument generally change from note to note.

For example, high notes on a piano have a simpler harmonic structure than the bass notes. By Scaling the output level of a modulator to decrease as you play up the keyboard, you can simulate this.

LEARNING FM SYNTHESIS

It is rather time-consuming to create a voice from the initial setting, since you would have to set most (or all) of the 89 parameters that make up each voice. The best way to learn is to get inside the factory preset voices and see how they work. Turn each operator off one by one, and see how each operator affects the sound. Make small changes in operator output level or EG rates. Try starting from a preset voice that is fairly close to what you have in mind, and edit it to your liking.

PERFORMANCE MEMO CHART

Performance name								
Instrument	1	2	3	4	5	6	7	8
Assign Mode	Normal/Alternate							
Max Notes (0-8)								
Voice No. (I01-D32)								
Receive Ch. (1-16, omni)								
Limit/L (C-2 — G8)								
Limit/H (C-2 — G8)								
Detune (−7 — +7)								
Note Shift (−24 — +24)								
Volume (0-99)								
Out Assign (off, I, II, I II)								
LFO Select (off, 1, 2, vib)								
Micro Tune (select)	off/on	off/on	off/on	off/on	off/on	off/on	off/on	off/on
Effect Select	off/Delay/Pan/Chord 1/2/3/4							

Performance name								
Instrument	1	2	3	4	5	6	7	8
Assign Mode	Normal/Alternate							
Max Notes (0-8)								
Voice No. (I01-D32)								
Receive Ch. (1-16, omni)								
Limit/L (C-2 — G8)								
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Detune (−7 — +7)								
Note Shift (−24 — +24)								
Volume (0-99)								
Out Assign (off, I, II, I II)								
LFO Select (off, 1, 2, vib)								
Micro Tune (select)	off/on	off/on	off/on	off/on	off/on	off/on	off/on	off/on
Effect Select	off/Delay/Pan/Chord 1/2/3/4							

VOICE MEMO CHART

YAMAHA DX11 VOICE DATA CHART						
OPERATOR		1	2	3	4	
ALGORITHM SELECT						
FEEDBACK LEVEL						
LFO	WAVE					
	SPEED					
	DELAY					
	SYNC					
	P MOD DEPTH					
	A MOD DEPTH					
SENSITIVITY	P MOD SENS					
	A MOD SENS					
	EG BIAS SENS					
	KEY VELOCITY					
OSCILLATOR	MODE					
	FIX RANGE					
	FREQUENCY					
	WAVEFORM					
	DETUNE					
ENVELOPE GENERATOR	AR					
	D1R					
	D2R					
	RR					
	D1L					
	SHIFT					
PITCH ENVELOPE GENERATOR	PR1					
	PR2					
	PR3					
	PL1					
	PL2					
	PL3					
OUTPUT LEVEL						
KEYBOARD SCALING	RS					
	LS					
TRANSPOSE						

VOICE NAME		
POLY/MONO MODE		
PITCH BEND RANGE		
PORTAMENTO	MODE	
	TIME	
FOOT SW ASSIGN		
FOOT CONTROL	VOLUME	
	PITCH	
	AMPLITUDE	
MODULATION WHEEL	PITCH	
	AMPLITUDE	
BREATH CONTROL	PITCH	
	AMPLITUDE	
	PITCH BIAS	
	EG BIAS	
AFTER TOUCH	PITCH	
	AMPLITUDE	
	PITCH BIAS	
	EG BIAS	
REVERB RATE		

[Digital Programmable Algorithm Synthesizer] Date :10/7, 1987
Model DX11 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)	sgl mode only
	Altered	**********	x	
Note Number		36 - 96	0 - 127	
	True voice	**********	13 - 108	
Velocity	Note ON	o 9nH,v=1-127	o v=1-127	
	Note OFF	x 9nH,v=0	x	
After Touch	Key's	x	x	
	Ch's	o *3	o *3	
Pitch Bender		o *2	o 0-12 semi *2	7 bit resolution
Control Change	1	o *1	o *1	Modulation wheel
	2	o *1	o *1	Breath control
	4	o *1	o *1	Foot control
	5	x	o (sgl only) *1	Portamento time
	6	o *1	x	Data entry knob
	7	o *1	o *1	Volume
	10	x	o (pfm only) *1	Pan(1,1+11,11)
	64	o	o	Sustain
	65	o *1	o *1	Portamento
	96	o *1	x	Data entry +1
	97	o *1	x	Data entry -1
	0 - 31	o *1		Data entry knob in play mode
Prog Change	True #	o 0 - 127 *4 **********	o 0 - 127 0 - 255	if pgm cng sw is on.(assignable)
System Exclusive		o *5	o *5	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)	126,127 sgl only
	Active Sense	o	o	
	Reset	x	x	

Notes: *1 = transmit/receive if control change sw is on.
*2 = transmit/receive if pitch bend sw is on.
*3 = transmit/receive if after touch sw is on.
*4 = transmit if pgm change sw is on and exclusive sw is off.
*5 = transmit/receive if exclusive sw is on.

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

INDEX

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