

YAMAHA



DIGITAL PROGRAMMABLE
ALGORITHM SYNTHESIZER



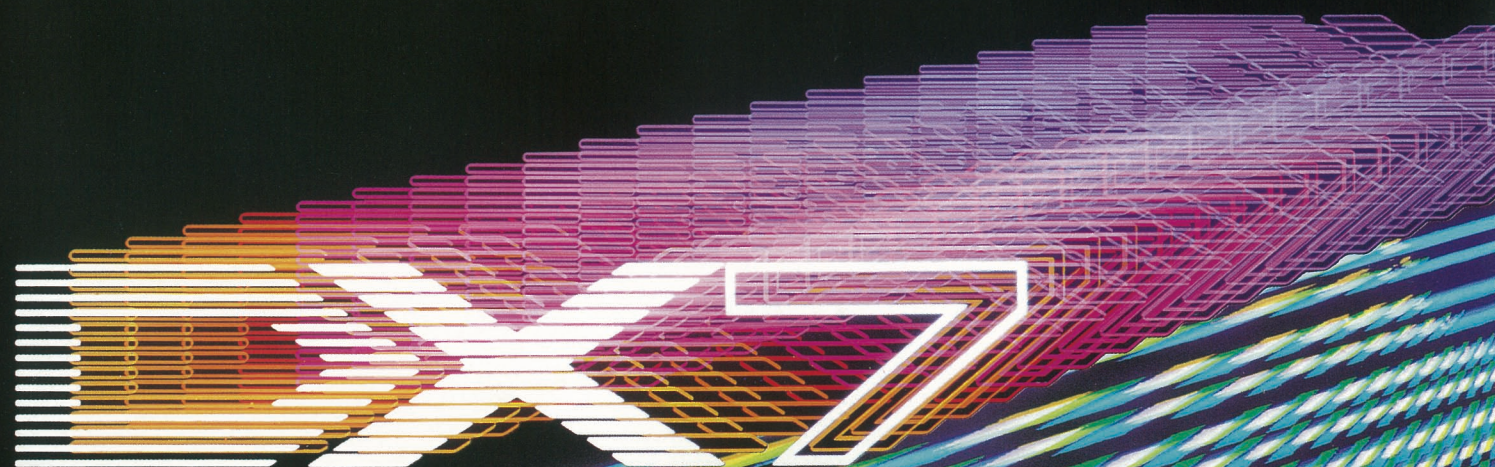
**DEBUT OF THE DX7 DIGITAL PROGRAMMABLE ALGORITHM SYNTHESIZER:
AN HISTORIC MOMENT IN THE REFINEMENT OF SYNTHESIZED SOUND**

The word "synthesizer" is not free from the electronic implications and associations that have grown up around it. The reason for this is simple. Until recently there has been nothing in synthesizer technology that could generate voices that are anything more than synthetic-sounding. But times change. A few years ago the first digital synthesizers began to appear, creating a minor revolution in music with their extraordinary simulations of acoustic instruments and percussive sounds. Leading this trend were the Yamaha GS1 and GS2 FM digital keyboards, now world renowned for their unmatched professional versatility and

realism on stage and in the studio. Not long after, the Yamaha CE series made its debut, also becoming an outstanding international success. Yet whatever these instruments signified in that revolution of less than a decade ago, what is about to happen now has no real precedent.

The world's first fully user-programmable and preset digital keyboard instruments are here: the new Yamaha DX Series Digital Programmable Algorithm Synthesizers—instruments that are about to alter the whole conception of how synthesized sound should and can sound.

We proudly present the new Yamaha DX7 Digital Programmable Algorithm Synthesizer; an instrumental figure in the revolution that is about to be.



The Yamaha DX7: Th

A Totally New Approach to Synthesis

If you're used to conventional synthesizers, one look at the DX7 will tell you that something unique has happened.

There are no knobs. Just two linear controls (one for volume), a small liquid-crystal digital display panel, and a number of flat panel touch switches.

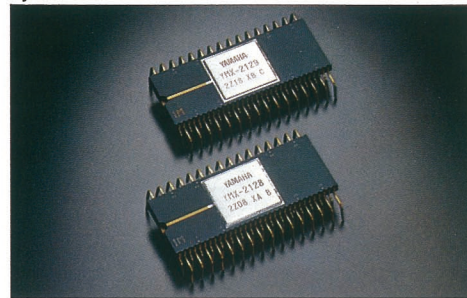
You might also be surprised to learn that there are no VCOs, VCAs, VCFs or EGs, in the conventional sense. But this is precisely why the DX7 can do what it does. It generates sound in a totally unique way to provide the richest, most naturally expressive sound available in any electronic keyboard. This special sound generation technology is called FM Digital Synthesis, and it simply has to be heard to be believed. But if you haven't heard it yet, take it from us—nothing before in the evolution of electronic music technology can match the eerie realism it gives to an array of acoustic sounds, as well as sounds that have never been heard before yet are undeniably "acoustic."

The DX7 demands that musicians reorder their approach to programming and playing a synthesizer, but the rewards in expressive capability are certainly worth it. Musicians in the vanguard of today's contemporary popular music are already there at the point of recognition. In the wake of digital synthesis others will soon follow. Rooted in the wonder of FM Digital Synthesis, the new DX7 is yet another Yamaha pathfinder.

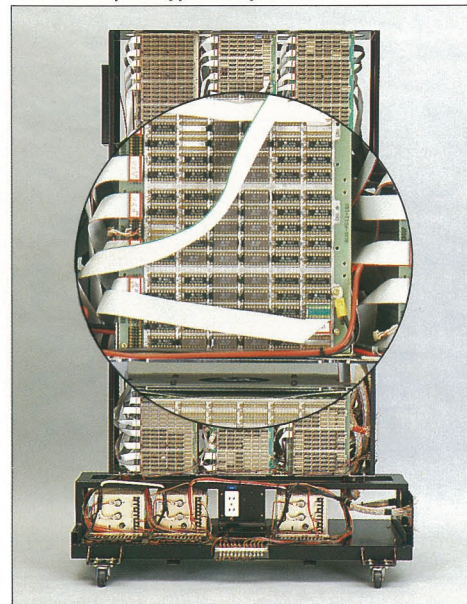
Inside the DX7

When the new DX Series Synthesizers were in the prototype stage of their design and development, our engineers were faced with a colossal problem of proportions—how to squeeze the micro-circuitry in two huge racks of circuit boards into a compact, portable keyboard. The DX7, after all, weighs only 14.2 kilograms (31.2 lbs.) and can fit comfortably just about anywhere you'd want to play. Yamaha technology prevailed, of course, and the entire electronic system has been reduced to two LSI (Large Scale Integration) chips that would easily fit in the palm of your hand. That's what you can do when you have your own semiconductor production facilities. Without these LSIs (and the millions of transistors they represent) the DX7 would not only not fit into your station wagon; it wouldn't fit into your budget, either. You benefit from a tremendous amount of technology and research, and you get it inexpensively thanks to the cost reductions possible with advanced circuit integration techniques.

Yamaha 2 original LSIs are the "heart" of the DX system



Part of the prototype DX system



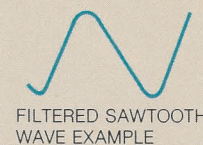
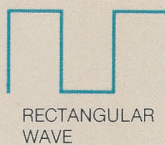
Operators and Algorithms

Instead of VCOs, VCAs and VCFs, the DX7 uses "operators" to generate sound. An operator is basically a digital sine

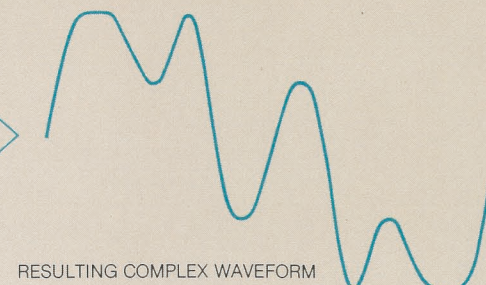
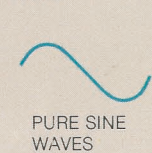
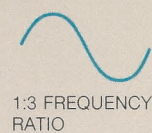
wave generator that can be used alone or in combination with other operators. A combination of operators is called an "algorithm," and this is what the little diagrams with blocks (the operators) connected in various ways on the DX7 panel represent. Each diagram represents one possible combination of operators available to you. The DX7 has 6 operators and 32 algorithms. Within each algorithm, however, you can turn certain operators on or off, effectively providing countless possibilities. The operators are either connected "horizontally" so that each contributes its own unique pitch to the sound—somewhat like a conventional electronic organ—or "vertically". In vertically configurations, the upper operator modulates the lower operator at a controllable frequency ratio, resulting in highly complex music waveforms that are the true key to this system's incredible sound—thus, FM (Frequency Modulation) Digital Synthesis. More than one operator can be connected vertically so that the modulated operator then modulates the next operator (the "carrier", the operator doing the modulating is the "modulator") resulting in even greater waveform complexity. Operators can even be modulated directly by more than one operator. As you can see, the possibilities are vast, and each is capable of producing a tremendously vast range of sounds in itself. Furthermore, each operator has a built-in envelope generator that is much more complex than the conventional ADSR types, so that each operator can be made to behave in a carefully controlled manner.

Choosing which Operators and Algorithms to use when programming a new voice is the prerogative of you, the musician. You

In conventional synthesizers, basic waveforms like these are filtered to create different sounds. The result is simply a variation on the basic waveform shape.



By modulating one pure sine wave with another, an endless variety of complex waveforms can be generated.

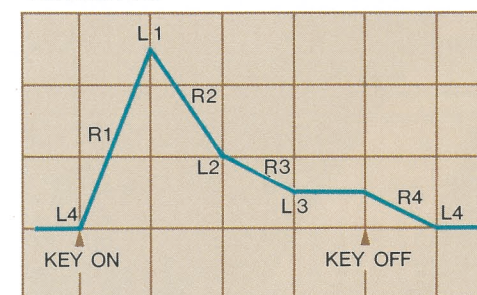


make your own decisions regarding which envelopes or frequency ratios to use. That is, unless you want to rely on the pre-programmed voices provided. And since voices in the DX7 are first built up in digitized form by mathematically combining digitized pure frequencies and creating complex harmonic structures or timbres which are then converted into audio signals, the musician benefits from improved audio quality and greater overall control over voices. And what it means for any audience is a spectacle of sound hard to trace back to one lone instrument.

Yamaha EGs: Another Key to Rich, Clean Acoustic Sound

Because they are so critical in "shaping" and controlling sound, our engineers have spent years perfecting the unique Yamaha envelope generators that go into the DX7's operators. In conventional ADSR EGs, the attack time, decay time, sustain level and release time can be controlled to some extent. In the DX7's envelope generators, however, you have complete control over four levels and four rates that form the envelope (see envelope diagram). This offers unprecedented control, and each parameter can be set in 100 discrete increments to ensure precision and repeatability.

EG/PITCH EG

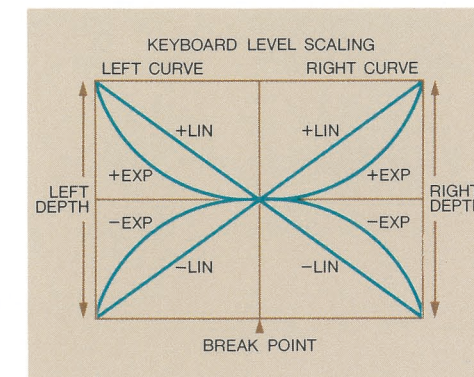


And having created a specific envelope for an operator, you can easily copy it to others as is or edit it as needed. The DX7 even has independent Pitch Envelope Generators that can be used to vary pitch over an 8-octave range! Such detailed control of sound characteristics was never possible before and is another reason why acoustic voices in the DX7 can sound so real. Everything is available at the touch of a few buttons.

Extensive Keyboard Scaling Control

It's not surprising that the DX7 offers more keyboard scaling control than conventional synthesizers. This feature makes it possible to "balance" the volume levels of the notes throughout the keyboard range to precisely mimic acoustic instruments or simply to create a desired effect. Many

synthesizers have a keyboard follower control that permits raising or lowering the level of the keyboard's high-range notes. The DX7, however, offers a choice of four different level scaling curves, and the depth of each curve can be set over a broad range. Further, the "break point" of the curve can be set at any key on the keyboard.



There's also a rate scaling function that permits wide-range adjustment of the EG rate of the high-range notes in relation to the low-range notes. The higher strings on an acoustic piano, for example, sustain much shorter than the low notes. These capabilities greatly add to the DX7's ability to create remarkably natural reproductions of conventional instruments, while making it possible to create wildly original sounds.

FM Digital vs. Analog Synthesis

You know the marvelous things an analog synthesizer can do. You've heard it. So it's fair to wonder about a digitally-synthesized instrument like the DX7. How much better can it be? Lots. What is so important about FM digital technology is the superior control it allows the musician in handling the constantly shifting harmonic structure of any sound. In analog synthesizers, everything depends on filters. They have to be manipulated to control harmonics. With FM Digital Synthesis there is never a need for them. Everything is calculated mathematically. Operators produce a sound that is digitally coded—numerical representations of what analog synthesizers produce as waveforms. In addition to filters, this system also eliminates the need of having special voltage-controlled amplifiers and independent envelope generators to process the sound. The DX7's operators have built-in envelope generators that respond to digitized commands. By eliminating the various stages of processing a sound in analog synthesis (i.e., filtering it, amplifying it, passing it through an EG) FM Digital Synthesis succeeds in

reducing noise and distortion in a way that conventional synthesis never can. Only after a sound has been created in digital form in the DX7 will it then pass through a digital-to-analog converter from which it emerges as a pure audio signal without distortion. This is one of the many benefits of FM Tone Generation—a sound that is rich because it is clean and pure.

The Value of Digital Control

Why is it best to have a user-programmable electronic computer/keyboard before you when creating and processing sounds? Simple arithmetic. Digital control makes it possible to generate enormously complex harmonic structures that only a mammoth analog synthesizer could even approach. It may even be feasible to generate voices similar to those of the DX7 with such an enormous analog machine, but the time and effort required would be formidable. Without digital control you're working alone, building up a sound by passing it and yourself through a harrowing number of complex programming procedures. You might be able to reach the sound you're looking for by combining harmonics at precisely the proper levels and frequencies; you may be able to create more notes and combine them; you might even be able to make it all work polyphonically. If you're lucky, that is. Considering the time and energy involved, however, the analog approach in creating anything but conventional synthesizer type voices is totally impractical.

Certainly you'll have to adjust to thinking in digital terms in order to program the DX7, but when you compare the results with what you'd get from a conventional synthesizer with equivalent effort, the true value of digital control will become happily apparent.

You Don't Have To Program To Play

So you can benefit from FM digital synthesis without having to program your own voices, the DX7 comes with 32 voices programmed into the internal memory that are ready to play at the touch of their selector buttons. These presets can be played outright in their supplied form, or they can be edited and updated to create hundreds of new sounds that are as accessible to the musician as the switches that control them. The DX7 also accepts plug-in cartridges that are loaded with even more preprogrammed sounds. With the internal voices and the external cartridges (the DX7 is supplied with two ROM cartridges, each containing 64 voices) you have 128 voices at your fingertips without programming a single one.

the Synthesizer Redefined



What sets the DX7 apart from ordinary digital synthesizers, however, is its unprecedented versatility in programming. This, of course, is the other remarkable option it gives you. You approach it like a computer, but you don't need to be a programming wizard to understand and soon benefit from all it can do for you. As everyone who has grappled with con-

ventional analog synthesizers knows, this is something new indeed.

Creating Your Own Voices

The beauty of DX FM Digital Synthesis is that programming complexity will not get in the way of music and the musician. The advanced circuitry in the DX7 was designed to make programming more versatile, and at the same time easier than ever.

The parameters that can be programmed generally fall into two broad categories—voice parameters and performance parameters. Voice parameters include all features of sound that relate to its internal structure—harmonics, tonality, envelopes. Performance parameters affect, for example, the way the thumbwheel controller affects the sound. The DX7 has 23 programmable performance parameters and 145 voice parameters. And each parameter can be controlled with precision by specifying a digital value using the data entry

controls and the liquid crystal display. Sitting down with the DX7 is the best way to get to know it. Perhaps at first you'll want to explore the range of preset voices available. Each one can be called up at the touch of a button, and you can begin editing them immediately. Or you may wish to be even more improvisational and invent a new sound "from scratch." Why not? In a matter of minutes you can be creating, editing, and storing your own sounds in the internal memory. A special backup system maintains the internal memory even when the instrument is unplugged, and your "masterpiece" voices can be stored in an optional external EEPROM (Electrically Erasable Programmable Read Only Memory) cartridge. (RAM-1)

16 Note Polyphonic Multi Function Keyboard

The DX7 is highly responsive to player expression. The harder or faster a key is played, the louder the initial attack of the

note—just like a piano. But unlike a piano the degree of response can be digitally programmed in the DX7. But once a key is pressed it's expressive capability isn't finished. Every key has the added feature of "after touch response" which allows for greater variation in tonality and vibrato control by varying pressure on the keys after they are initially played. Further, the DX7 keyboard is 16-note polyphonic, and it even has fully polyphonic portamento and glissando capability. The expressive capabilities latent in every key will open up a new world of creative possibilities in music for you.

MIDI Compatibility

MIDI stands for Musical Instrument Digital Interface, and is the new universally adopted standard for data transmission between digital electronic music instruments. The MIDI terminal on the DX7 permits controlling the DX7 from another keyboard or even via a computer music interface. The DX7



can also be used to control other instruments that are compatible with the MIDI system. A variety of computer-based control systems are already appearing, and Yamaha, of course, will not be left behind.

The MIDI system opens up a whole new world of possibilities for digital synthesizer control.

The DX7: A Whole New Way of Programming and Playing Music

The DX7 and FM digital tone generation herald a new era of electronic music synthesis. When discussing the voices produced by this technique, words like "uncanny", and "magical" are often used. Years of thinking that the sound of a tuba should come out of a great, oversized

brass instrument has got a lot to do with it. That is what we mean when we say that encountering this new technological process not only involves hearing a different sort of sound, it also means hearing in a different sort of way—listening with a new ear, with a mental picture of sound not framed in traditional ways. When it comes to music the final test of what is good depends on sound, not words. The only way to fully appreciate the tremendous versatility of the new Yamaha DX7 is to hear it perform. Better yet—make it perform. Waiting to be created at your fingertips are whole new worlds of sound. The DX7 represents the musical experience musicians have been anticipating for years. Now the waiting is over. Time for the music to begin.



DX7 SPECIFICATIONS

Keyboard	61 keys, C ₁ ~ C ₆ (Initial & After touch sensitive)
Sound Source	FM Tone Generator: 6 operators, 32 algorithms
Simultaneous Output Notes	POLY mode: 16 notes MONO mode: 1 note
Internal RAM Memory	32 Bank (32 Memory)
External ROM Memory	32 Bank x 2 (64 Memory)
External RAM Memory	32 Bank (32 Memory)
Mode Selectors	STORE, MEMORY PROTECT (INTERNAL, CARTRIDGE), OPERATOR SELECT, EDIT/COMPARE, PLAY-MEMORY SELECT (INTERNAL, CARTRIDGE), FUNCTION
Controls	VOLUME, DATA ENTRY [lever, switch: YES (ON)/NO (OFF)], PITCH WHEEL, MODULATION WHEEL, OPERATOR ON-OFF, EG COPY
Voice Parameters	ALGORITHM, FEED BACK, LFO (WAVE, SPEED, DELAY, PMD, AMD, SYNC), MOD SENSITIVITY (PITCH, AMPLITUDE), OSCILLATOR (MODE/SYNC, FREQUENCY COARSE, FREQUENCY FINE, DETUNE), EG (RATE, LEVEL), KEYBOARD LEVEL SCALING (BREAK POINT, CURVE, DEPTH), KEYBOARD RATE SCALING, OPERATOR (OUTPUT LEVEL, KEY VELOCITY SENSITIVITY), PITCH EG (RATE, LEVEL), KEY TRANSPOSE, VOICE NAME
Function Parameters	MASTER TUNE ADJ, POLY/MONO, PITCH BEND (RANGE, STEP), PORTAMENTO (MODE, GLISSANDO, TIME), EDIT RECALL, VOICE INIT, BATTERY CHECK, CARTRIDGE (SAVE, LOAD), MODULATION WHEEL (RANGE, PITCH, AMPLITUDE, EG BIAS), FOOT CONTROL (RANGE, PITCH, AMPLITUDE, EG BIAS), BREATH CONTROL (RANGE, PITCH, AMPLITUDE, EG BIAS), AFTER TOUCH (RANGE, PITCH, AMPLITUDE, EG BIAS)
Connecting Terminal	OUTPUT, PHONES
Control Terminal	FOOT SWITCH (SUSTAIN, PORTAMENTO), FOOT CONTROL (VOLUME, MODULATION), BREATH CONTROL, MIDI (IN, OUT, THRU)
Others	LCD DISPLAY, CARTRIDGE INTERFACE
Dimensions/Weight	101.8(W) x 10.2(H) x 32.9(D) cm (40" x 4" x 13")/14.2 kg (31.2 lbs.)
Power consumption	40 W
Accessories	Music Stand, ROM cartridge x 2 (64 voices x 2)

**Specifications and design are subject to change without notice for improvement.*



DX9 Digital Programmable Algorithm Synthesizer

The DX9 has the same superb FM digital sound generation capability as the DX7, but with 4 operators and a choice of 8 algorithms. The DX9 has a 16-note polyphonic keyboard and is supplied with 120 pre-programmed voices on an external data cassette tape. Newly programmed voices can be saved on cassette tape to build up a personal voice library. Of course, the DX9 is more economical than the DX7, making FM digital synthesis available to a broad spectrum of keyboard enthusiasts.



KX1 Remote Keyboard

The KX1 connects to the MIDI terminal on either the DX7 or DX9 permitting remote control of either synthesizer's performance functions. Great for players who like to "move" on stage. The KX1 is battery operated and is supplied with a 15-meter MIDI connection cable.



LC-7S
Carrying Case for DX7 and DX9

For details please contact:

SINCE 1887



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