Roland

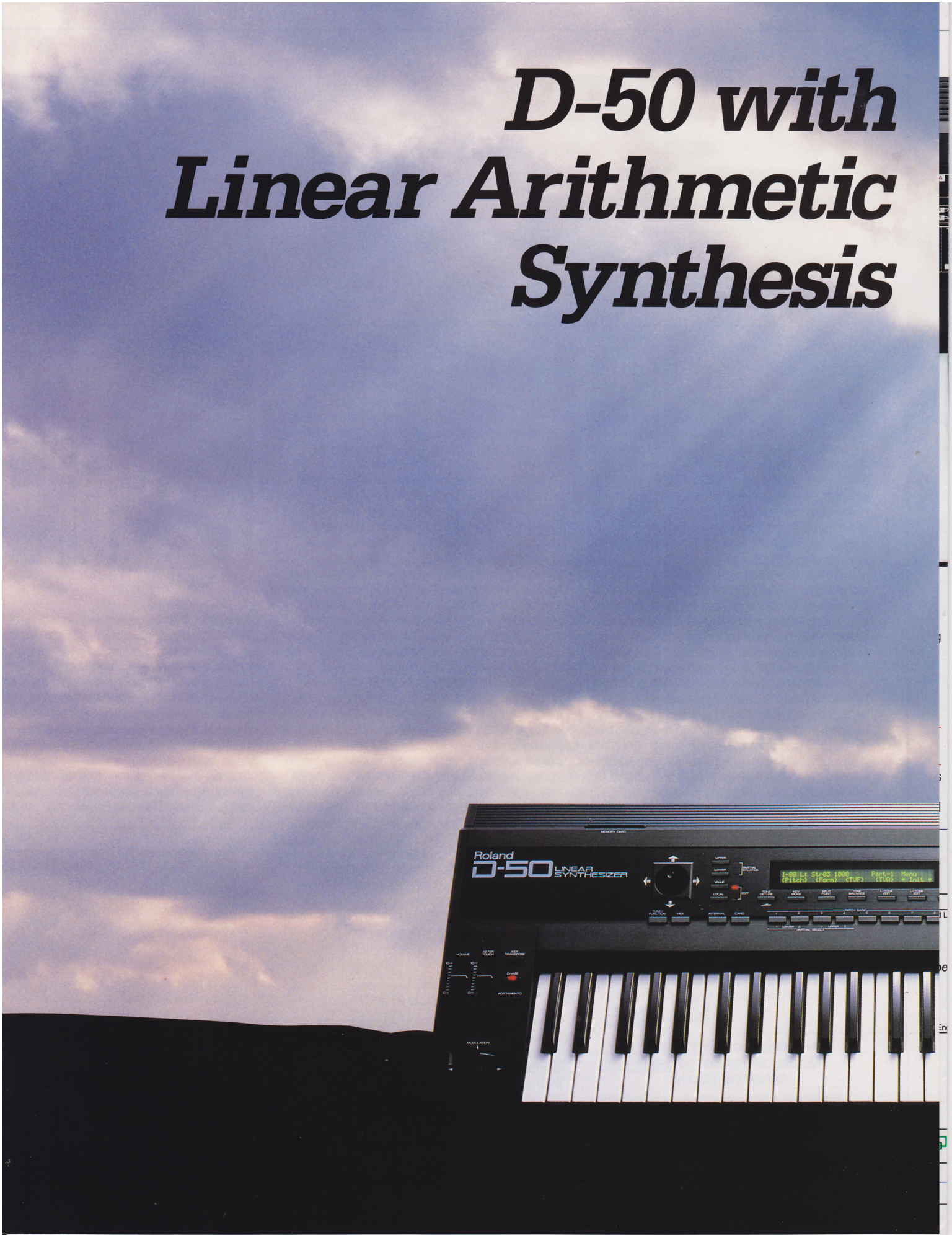
D-50

LINEAR DIGITAL SYNTHESIZER



ELECTRONIC MUSICAL INSTRUMENTS

D-50 with Linear Arithmetic Synthesis



An Exciting New Synthesizer for a New Age!
Discover a new world of creative expression.

Celebrate the dawning of a new era in sound synthesis. A Sound Tbol for Prediction, Planning, Analysis, and Control guarantees the perfect relationship between you and your instrument.

Breathtaking Sound and High Performance: An Unforgettable Encounter with Expressiveness.

At last—realize the true potential of quality digital synthesis combining ultra realistic tonalities and state-of-the-art sound processing—the exciting D-50!

Expand your horizons with a new breed of super-powerful digital synthesis-the D-50 Linear Synthesizer. Let Roland's exclusive LA digital synthesis technology free your creativity from the bonds of conventional synthesis forevermore.

Watch out world! It's the visionary sound and expressive power of advanced technologies from Roland!



D-50
LINEAR DIGITAL SYNTHESIZER



Your Invitation to Explore a New Uncharted World of Digital Sound with LA Synthesis

The synthesizer is a totally unique instrument which allows us to give voice to our magnificent musical imagination. The exceptional expressiveness possible from a synthesizer, combining in a single unit the concepts of unlimited sound creation and unparalleled performance, is realized as never before in the Roland D-50 through the implementation of LA (Linear Arithmetic) technology. For the musician, the end result is the highly rewarding experience of previously unrealized freedom in the exercise of your creative potential to the fullest.

The crucial element that makes this exciting technological development possible is Roland's proprietary "linear" approach to digital synthesis. Unlike conventional (non-linear) digital synthesizers which produce sound by a process that warps sine waves using non-linear algorithmic synthesis, the D-50 uses an entirely new approach to digital sound creation based on the high-level computational techniques of linear arithmetic, normally used for solving complex mathematical problems in scientific research.

Roland's commitment to research and development culminated in the discovery of the following key steps which have been utilized to produce the D-50's amazingly realistic sound; (1) prediction used to create an initial sound image; (2) planning, namely determining how to map the synthesizer parameters to the elements of a desired sound; (3) analysis, to achieve a complete understanding of the particular details which define a unique sound, such as how the pitch may be variably modulated over time; and (4) control, which is the actual operation of the synthesizer, the user interface. The resulting approach to creating sounds with the D-50 is extremely straightforward, promising the musical imagination with easy access to a wide range of exceptional and natural sounding timbres.

A New Generation Synthesizer that Expands the Boundaries of Natural Sound

No longer limiting itself to the conventional digital approach to synthesis, development of the D-50 began with an extensive analysis of numerous acoustic instruments and other natural sounds with the goal of achieving a realism previously unobtainable by other methods of synthesis. Armed with a detailed understanding of these findings, Roland engineers sought to create an electronic instrument that would produce sounds more beautiful and realistic than ever possible from previous generations of synthesizers and with greater expressiveness.

Look closely at the waveform of an actual vibraphone sound shown in Figure 1-A. Note how a number of waveforms are especially concentrated at the beginning of the sound. Extracting these waveforms according to their type gives us the percussive waveform of Figure 1-B, the fundamental waveform of Figure 1-C, and the non-integer waveform shown in Figure 1-D. The fundamental waveform is clearly regular, while the percussive waveform is almost completely irregular. The non-integer harmonic waveform is complex but regular. You can easily see from this example how a simple sound produced by a single instrument is comprised of several constituent sound elements, or partials.

Furthermore, the harmonics of these constituent elements change over time and have their own individual fluctuations. These unique fluctuations form the timbral vibrancies that define the essential nature of a sound, distinguishing different acoustic instruments one from another. Slight changes in the pitch and phase of these constituent elements can create vibrato-like modulations and timbral alterations that, when combined with reverb or resonance effects and other acoustical factors, create sounds with a richness we find pleasurable to our ears. A person's hearing can sense any miniscule change in a sound instantly, easily recognizing changes in such characteristics as source, position, environment, and emotional expression. From this microscopic analysis of sound, we can better understand the technological breakthrough in sound synthesis that has made possible the development of the amazing D-50.

The Heart-Partials and Structure

Sound is composed of a number of partials. Based upon this fact, the heart of the D-50 is a total of 32 partials. Each of these partials is complex and provides more individual potential than an entire conventional synthesizer.
The structure of a sound is determined by the dual system Wave Generator shown in Figure 2. In addition to the Synthesizer Sound Generator which is best for producing integer harmonic waves, there's a PCM Sound Generator with a capacity of 4 megabits for producing complex waveforms that are otherwise unobtainable. This PCM Wave Table Memory provides a st of 100 "sound components" which are avail for you to use in generating sounds. These based on a selection of processed samples have proven successful for a wide range of general-purpose applications. The structure shown in Figure 5 determine the various wa the Synthesizer Sound Generator and the P Wave Table Memory can be combined whe creating sounds. There are seven different structures available as partial combination patterns, and these can be roughly divided

Fig. 1-A

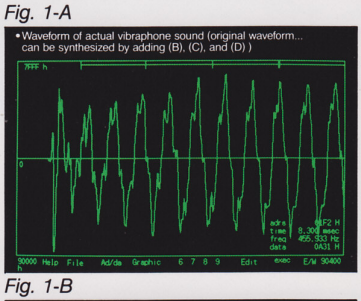
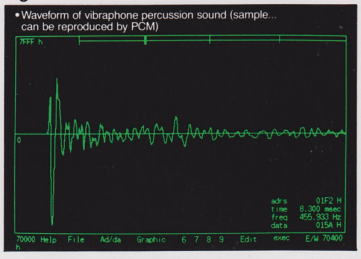


Fig. 1-B





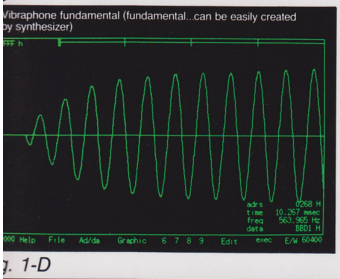
into those that mix two partials directly (shown in Figure 3), and those that mix partials using a Ring Modulator to create sounds with more complex harmonics (shown in Figure 4).

Having come this far, we can see how these differently modulated partials correspond to the various constituent elements of a sound we identified earlier on. In the context of the D-50's system of partials and structure, the irregular and complex waveform shown in Figure 1-B would be generated using the PCM Wave Table Memory. The regular waveform, shown in Figure 1-C, would be generated by the Synthesizer Sound Generator. Finally, the regular waveform consisting of non-integer harmonics, shown in Figure 1-D, would be produced using the Ring Modulator. As a result, you can now see how the D-50 makes it possible as never before to synthesize the waveform of a realistic sound, such as the one shown in Figure 1-A. To ensure full realism in the reproduction of a sound with all its characteristic timbral elements, each of the partials in the D-50 is provided with Time Variant Filters (TVF), Time Variant Amplifiers (TVA), and three types of Low Frequency Oscillators (LFO) for the most delicate changes in harmonics as well as precise and subtle control of pitch and phase. Distinctive harmonic modulations, rivaling those of natural and acoustic sound sources, can be splendidly simulated using the D-50's advanced technology to create sounds full of emotion and expressive nuance.

From Sound Generation to Acoustics: Built-In Digital Effects

The exhaustive range of synthesizer features provided by the D-50 is completed with the built-in digital equalizer, digital chorus, and digital

g. 1-C



g. 1-D

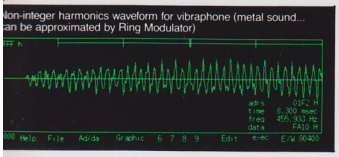


Fig. 2: Configuration of Partial

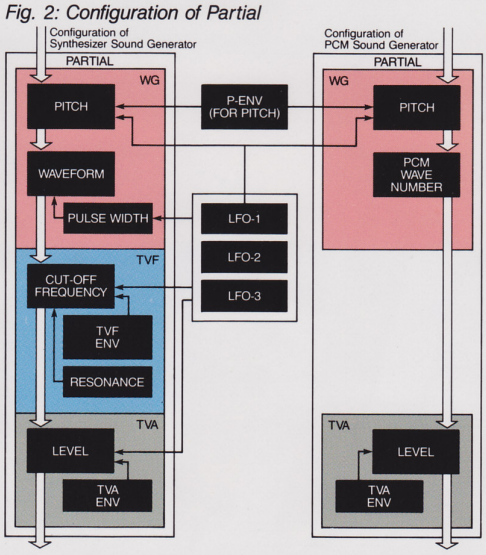
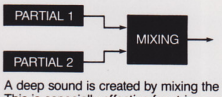


Fig. 3: Mixing by Structure



A deep sound is created by mixing the two sounds. This is especially effective for strings and organ voices, etc.

Fig. 4: Mixing with the Addition of Ring Modulator



The Ring Modulator multiplies the two sounds by each other to create tones with complex harmonics. This is especially useful for creating metallic voices, etc.

Fig. 6: 10 Parameter Pitch Envelope

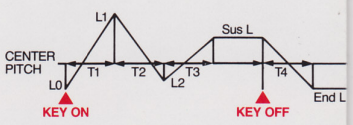


Fig. 7: 9 Parameter TVF (TVA) Envelope

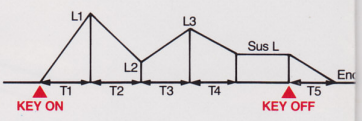
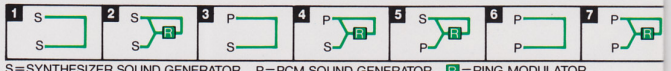
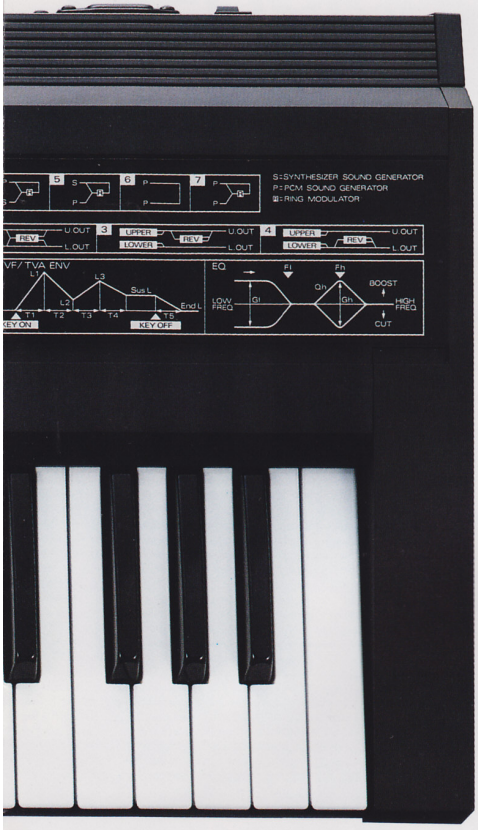


Fig. 5: Structure Patterns



S=SYNTHESIZER SOUND GENERATOR P=PCM SOUND GENERATOR R=RING MODULATOR



reverb. The addition of these crucial effects represents the crowning achievement in this outstanding instrument. By confidently delivering the highest quality acoustical processing available in any synthesizer, the D-50 becomes the ultimate creative tool to meet the demands of today's musicians. The built-in equalizer has a five parameter configuration. In addition to mid and low range control, the equalizer is a parametric type which allows Q control in the mid and high ranges. The chorus can be selected from eight different chorus modes, including a flanger effect and tremolo effect.

Fig. 8: Configuration of Tone

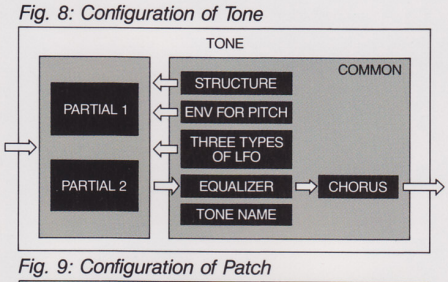
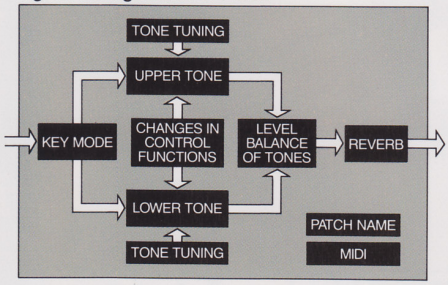


Fig. 9: Configuration of Patch



The rate and depth can be controlled and the volume can be balanced between the original sound and the effect sound. In addition, there is a wide assortment of thirty-two reverb types. The reverb level can be freely adjusted and the output pattern routed to the output jack can be selected among four types (see Table 1).

Table 1: Reverb & Output Modes

1	Stereo reverb is applied to the sound created by mixing the two tones. The two mixed tones are output in stereo.
2	The direct sound is split into upper and lower and then output. The reverb sound consists of the mixed upper and lower output to which stereo reverb has been applied.
3	Reverb is applied to only the upper tone and the output to the output jacks is split into upper and lower.
4	Reverb is applied to only the lower tone and the output to the output jacks is split into upper and lower.

Patch Program Storage and Instant Function Response

In the D-50, the sounds created by partials combined together in structures are called Tones, which can be assigned as upper or lower. In addition to combinations of upper and lower Tones, a maximum of sixty-four patch programs containing all the settings needed for a performance can be stored in the D-50's on-board memory. These settings include key mode (a total of nine modes as shown in Table 2), tuning and bender functions for each tone, key transpose, chase play, aftertouch, dynamics, effect settings, and MIDI control information. Using an optional memory card another sixty-four patch programs are also available for instant switching between 128 patch programs. Since these 128 programs may contain up to 256 different tones, the D-50 promises musicians the luxury of a range of expression unavailable before now.

Table 2: Key Mode Variations

DISPLAY	VOICING
WHOLE	Up to 16 notes of the upper tone can be voiced simultaneously.
DUAL	Both upper and lower tones are voiced when key is pressed. Up to 8 notes can be voiced simultaneously.
SPLIT	Upper and lower tones are divided at any point on the keyboard (split point). The split point is displayed next to the key mode. The upper tone is voiced on the keys to the right of and including the split point, and the lower tone on the keys to the left. Up to 8 notes can be voiced simultaneously for each tone. (Middle C is C4)
SEP	The upper tone is controlled by the D-50 and the lower tone by the external MIDI instrument connected to MIDI IN. Up to 8 notes can be voiced simultaneously for each tone.
WHOL-S	The upper tone is voiced monophonically.
DUAL-S	The upper and lower tones are voiced monophonically when a key is pressed.
SPL-US	The keyboard is split and the upper tone is voiced monophonically. Up to 8 notes can be voiced simultaneously for the lower tone.
SPL-LS	The keyboard is split and the lower tone is voiced monophonically. Up to 8 notes can be voiced simultaneously for the upper tone.
SEP-S	The upper tone is controlled by the D-50 and the lower tone by the external MIDI instrument connected to MIDI IN. The D-50 controlled upper tone is monophonic and up to 8 notes can be voiced simultaneously for the lower tone controlled by the external MIDI instrument.

The Ultimate in Sound Quality and Full Digital Processing

An instrument as sophisticated as the D-50 also delivers top-quality performance standards to complement its advanced sound generation capabilities. To achieve this, a highly integrated digital bus system has been specially devised to connect all sound processing circuitry—from the thirty-two wave generators, each of which is comparable to an individual synthesizer, to the filtering circuits, modulation circuits, digital effect circuits—with easy access control over all functions. In addition to full digitization in all areas, the D-50 sets a new standard by featuring 28 bit signal processing and 20 bit D/A conversion—a first for an electronic musical instrument. Surpassing the standard for CD players (which normally offer 16 bit D/A conversion), the D-50 promises discerning musicians the widest possible dynamic range with a state-of-the-art sound that is unprecedented.

Unsurpassed Man-Machine Interface

Ushering in a new era in digital synthesis, the D-50 is surprisingly simple to operate, providing musicians an unsurpassed performance with almost limitless powers of expression. This is immediately apparent to anyone even slightly familiar with a synthesizer. The D-50 has been designed to enable you to take full advantage of your knowledge of analog synthesizers for the creation of sounds digitally. For example, by simply substituting the D-50's WG, TVF, and TVA for the conventional concepts of DCO, VCF, and VCA, you can immediately begin to explore the exciting possibilities of digital sound synthesis. An optional PG-1000 programmer (sold separately) will have you creating your own sounds just as spontaneously as you would with the switches and sliders on the panel of an analog synth. The D-50 is also equipped with new features for easier editing, such as a back-lit LCD display showing two lines of forty characters, and a handy joy stick which enables you to alter the partial balance and various parameter values, either individually or several at once, while programming a sound. As you can see, the functions and parameters for each patch are well organized on easy-to-read menus. These menus are also shown by function type on the menu screen, and patch editing efficiency is enhanced by the logical way in which they have been arranged. A desired sound can be obtained quickly with a minimum of programming effort. Whether playing live on stage or in another performance context, you'll appreciate the D-50's intelligently designed user interface which closes the gap between man and machine while linking ever more closely player and instrument.

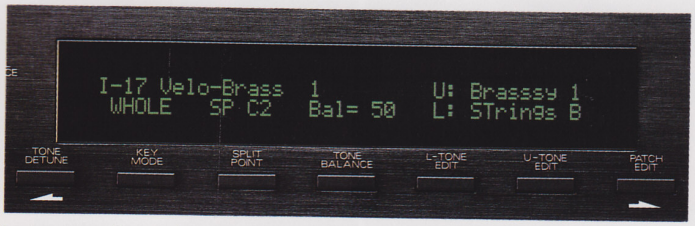
Full Function Design

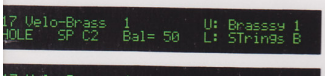
The true potential of the D-50 reaches far beyond the impressive list of features we've enumerated for you here. The magnificence of this instrument lies in its overall performance and power which you must experience first-hand to really understand. The moment you discover how easy it is to use the D-50 to

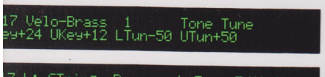
ansform the sounds you hear in your nagination into reality, you'll realize just how markable this unit is and why the D-50 truly the new generation of digital synthesizers. Dynamic response ensures the desired notional expressiveness by altering timbre nd level in a highly natural manner according the amount of pressure placed on the keys. Changes in timbre and level can be precisely dited using the velocity range and velocity llow of the WG, TVF, and TVA. ●Pitch, orato, timbre, and level can be controlled sing aftertouch, which alters the sound by essing firmly on the keys after the initial tack. ●A chase play function sounds the oper tone immediately when a key is pressed llowed by the lower (or upper) tone after a ght delay for effects such as delay or sound- -sound. ●The chase pattern can be selected cording to key mode as Upper-Lower, oper-Lower-Lower, or Upper-Lower-Upper for wide variety in repeated sounds, even for the me pattern. In addition, the chase edit nction can be used to set the delay between unds from 0 to 100, and the level of the layed tone in relation to the initial tone can so be set between 0 and 100. ●The D-50 es a pressure sensitive bender renown for its ayability. The pitch is altered when the lever is oved laterally; the modulation is altered when moved up and down for a vibrato effect. The key transpose function enables the key nge to be shifted in semitone steps for rformance in different keys than the ones ing played. ●The upper/lower tones can be ely selected and the partial balance can be freely controlled throughout the editing process as well as during a live performance. This can be highly effective for creating dramatic sound effects live, as changing the mixture of the two partials that comprise a tone causes a major shift in the timbre. ●The tone detune function enables you to set the pitches of the upper and lower tones separately, creating "thicker" sounds with more presence. ●The tone detune range is +/−2 octaves. This means that even when different tones are assigned to the left and right sections of the keyboard respectively in split mode, they can be set to the same pitch for performance. ●A key follow function provides natural and smooth timbre and level changes characteristic of acoustic instruments as notes are played across the entire range of the keyboard. ●The key follow function also enables you to alter the pitch arrangement of keys from the usual semitone steps to any of seventeen different pitch arrangement patterns. ●While editing partials, the partial parameter select function enables you to display for comparison the same parameters for partials other than the one you're currently editing. ●A partial mute function enables you to mute any of the partials that comprise the two tones for clear confirmation of the particular partial being edited. ●A local edit function enables you to simultaneously change the values of neighboring parameters on the display using the joy stick. This is effective for adjusting parameters that are interrelated. ●A comparison function optimizes the sound editing process by enabling you to instantly recall for comparison the sound previously edited. ●An undo function enables you to restore any parameter setting to its original value before it was edited. ●A tone copy function enables you to transfer tones contained in the D-50's on-board memory or in the memory card to any patch. ●For more efficient editing, a parameter copy function enables you to transfer parameter setting values in blocks between upper and lower tones within the same patch. For example, copy only the values for all the WG data of partial 1; or copy only the values for all the TVF data of partial 2; etc. ●The naming function enables you to select the tone names and patch names of original and edited sounds using the joy stick. ●Besides full MIDI implementation, the D-50 also provides varied MIDI system play. ●The MIDI transmit and receive channel can be set between 1 and 16. The transmit channel can also be set individually for each patch. ●External MIDI instruments can be controlled from the D-50 by connecting a pedal switch or external control pedal. ●For advanced performance combinations, upper and lower tones can be set to separate MIDI channels by selecting "Separate" as the key mode. ●A jack is provided for connection of an optional expression pedal (EV-5, sold separately) to control level. ●Another jack is provided for connection of an optional EV-5 pedal to control either the tone level balance, aftertouch sensitivity, or vibrato. ●A pedal switch jack is provided for connection of an optional pedal switch (DP-2 or DP-6, sold separately) to control on/off of the hold effect. ●Another pedal switch jack is provided for connection of an optional DP-2 or DP-6 to select portamento, chase play, or patch shift.

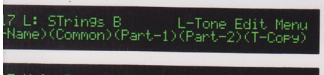
An Ergonomic Design for Musicians

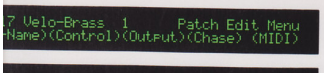
Your ease of access to the many functions of the D-50 is enhanced by ogical and well considered switch layout and many helpful display menus. itch between the display menus instantly using the five select buttons d scroll buttons on the left and right. Return to the performance menu by pressing the exit button. The following shows some typical menus of unit. The amount of information contained on these menus will surprise —it's almost like talking directly to the D-50! These menus have a ded structure that makes them very easy to understand. Roland's lligently designed user interface is just another benefit of this unique instrument that strives to be the ideal partner in the creative relationship between musician and machine.

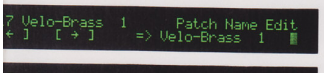


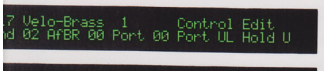


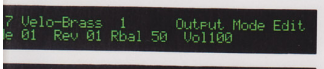


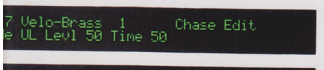


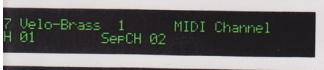


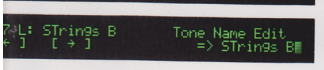


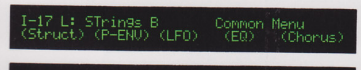


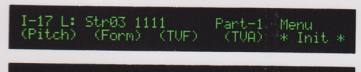


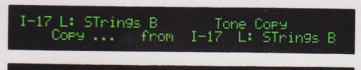


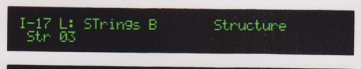


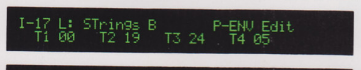




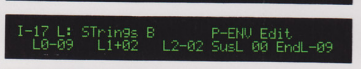


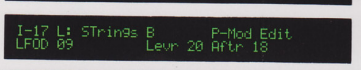


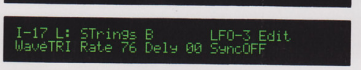


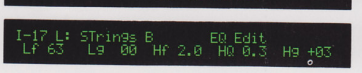




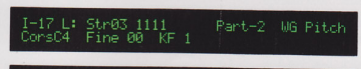




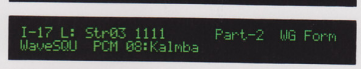


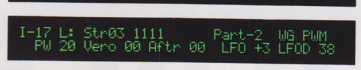


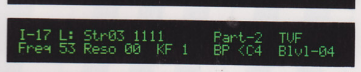


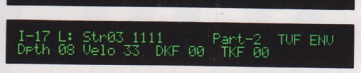


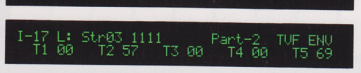


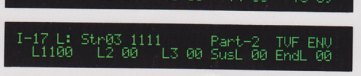


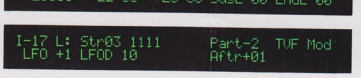


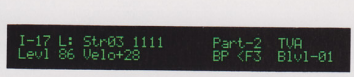


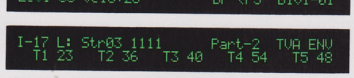


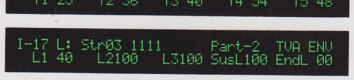


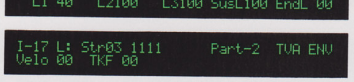


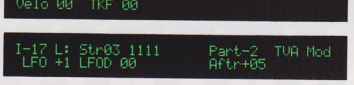


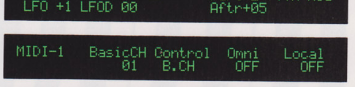


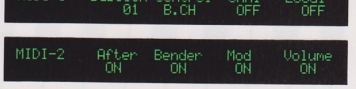


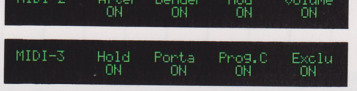


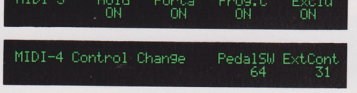








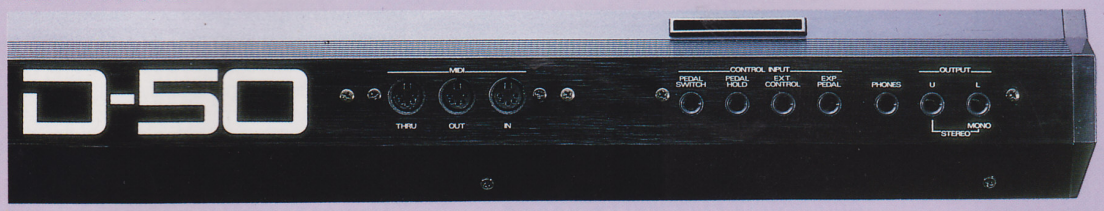




SPECIFICATIONS

- Keyboard: 61 Keys (C_2 to C_7, Velocity and Pressure-Sensitive)
- Synthesis Method: LA Synthesis (32 Partials, 7 Structures)
- Built-In Digital Effects: Equalizer (2-Band Parametric Equalizer × 2), Chorus (Stereo Chorus × 2), Reverb
- Key Modes: Whole, Split, Dual, Separate
- Memory: Internal Memory (64 Patches), Memory Card (64 Patches)
- Buttons: Patch Group Select (Internal, Card), Patch Bank Select (1 to 8), Patch Number Select (1 to 8), Tune/Function, MIDI, Stick Mode (Partial Balance Upper, Partial Balance Lower, Edit Value, Edit Local), Edit Menu Select (Key Mode, Split Point, Balance, Lower Tone, Upper Tone, Tone Tune, Patch Edit), →/Edit, Recall, Copy, Undo, Exit, Data Transfer, Write, Increment, Decrement, Numerical Keys (0 to 9, Shift, Enter), Portamento, Chase, Key Transpose
- Controls: Bender/Modulation Lever, Joy Stick, Volume, Aftertouch Sensitivity
- Display: Illuminated, 80-Character LCD (40 characters in each of 2 lines)
- Rear Panel: Jacks (Upper Output, Lower Output, Headphones, Expression Pedal, External Control Input, Hold Pedal, Pedal Switch), MIDI Connectors (In, Out, Thru), Power Switch
- Dimensions: 974(W) × 332(D) × 94(H) mm (38-3/8″ × 13-1/16″ × 3-11/16″)
- Weight: Approx. 11.4 kg (25 lb. 2 oz.)
- Accessories: IC Card (ROM), Edit Map
- Options: PG-1000 Programmer, IC Card (RAM), KS-8 Stand, AB-D50 Carrying Case

REAR PANEL



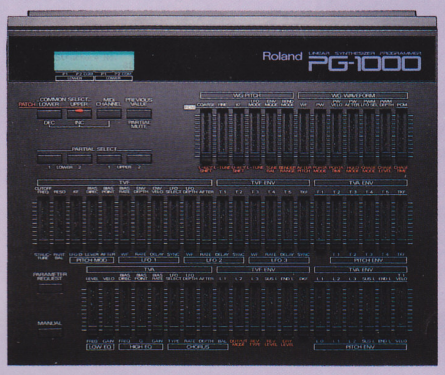
OPTIONS





M-256D MEMORY CARD

The new memory card for the D-50 is a state-of-the-art storage medium that's thin, compact, and promises high reliability. Each memory card is capable of storing the sixty-four patch programs of the D-50. ROM cards containing programs can only be read by the unit, while RAM cards can be both written to and read. The ROM card supplied with the D-50 contains the synthesizer's preset patch programs as a backup. The separately sold M-256D is used for storing original sounds that you create. In addition, a high quality ROM card library offering a wide variety of exciting sounds will soon be available.



PG-1000 PROGRAMMER

This is a dedicated programmer which makes editing and tone creation on the D-50 even easier. ●Equipped with 56 editing knobs. Divisible into 6 blocks for 4 partials and 2 common. Simultaneous editing of multiple partials and common is possible. ●The parameter values of the D-50 can be displayed on the PG-1000 by connecting the PARAMETER IN of the PG-1000 to the MIDI OUT terminal of the D-50. ●Signal from an external MIDI instrument connected to MIDI IN can be mixed with the parameter values set by the PG-1000 and sent to the D-50. ●Equipped with a previous value/partial mute button for displaying the parameter values which existed prior to editing.

- Terminals: MIDI IN/OUT/THRU, Parameter IN, AC Adaptor
- Dimensions: 318(W) × 268(D) × 53(H) mm (12-1/2″ × 10-9/16″ × 2-1/16″)
- Weight: 1.6 kg (3 lb. 9 oz.)

Specifications and appearance subject to change without notice.

Printed in Japan RAM-696 '87 MAY E-4 AVS

Roland