System overview

Features

The **Synclavier Digital Audio System** and the **Direct-to-Disk Digital Multitrack Recording System,** used separately or in tandem, provide a flexible, comprehensive music and audio recording and editing facility.

A comprehensive workstation

The Synclavier and the Direct-to-Disk offer the power of digital synthesis and sound sampling. The system features advanced recording and editing capabilities found only in a state-of-the-art recording studio. The Synclavier combines in one workstation the ability to compose, arrange, record, edit, perform and print music. The Direct-to-Disk adds the power to record music, sound effects or dialog live directly to hard disk, and extensive cue editing capabilities.

You have the choice of operating the Synclavier from the keyboard control unit or from the terminal, using the terminal keyboard and trackball. The Direct-to-Disk is operated primarily from the terminal.

The Multichannel Distributor allows you to route any of the 200 sequencer tracks to your console inputs, while your MIDI* option places the Synclavier or Direct-to-Disk into a network of synthesizers, sequencers, drum machines or other audio processing equipment. Both systems can lock to picture and trigger a synchronized sequence.

The Synclavier is also capable of printing publication-quality musical scores.

---

* Musical Instrument Digital Interface

In the recording studio

You can create a musical score with the Synclavier or a Foley effects track with the Direct-to-Disk and lock it to film or video in less than a second using SMPTE* time code. Synchronization is accurate to 1/80th of a frame.

When scenes are altered, you can quickly and precisely edit note by note or mark sections to edit from the computer terminal—eliminating the need to manually cut and splice tape. Because of flexible random access technology, there is no tape rewind time.

With the Direct-to-Disk, you can overdub multiple live vocal or instrumental tracks for up to one hour of continuous recording time per track.

---

* Society of Motion Picture and Television Engineers
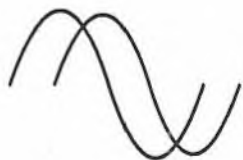
Sound design

The Synclavier offers sophisticated yet easy-to-use **additive synthesis.** A basic waveform, created by setting the amplitude of 24 harmonics, can be further modulated using a six-stage FM envelope.

Instrumental or vocal sound and sound effects can be placed onto the Synclavier keyboard or Direct-to-Disk tracks using high fidelity digital **sampling**. The sampling system uses a 16-bit converter which gives a dynamic range of 96 dB, 6 dB greater than the dynamic range of hearing. The Sample-to-Memory option lets you sample any sound, including the Synclavier, at rates of up to 100 kHz with polyphonic playback.

The computer can determine the harmonic content of a sampled waveform and then duplicate it using the Synclavier's **resynthesis** capability. Volume envelope, vibrato, portamento, stereo and chorus effects can be controlled for any Synclavier sound, whether sampled, synthesized or resynthesized. Any combination of real-time effects can be added to enhance the sound and its expressive qualities.

Combining sounds

With the Synclavier, you can assign a different sample to each note of the keyboard. For example, a complete drum kit can be assembled by assigning a snare sample to one note, a kick drum to another note, a cymbal to another and so on. This technique is also useful for accurately recreating the sounds of instruments whose harmonics change up and down the scale. For example, to recreate the full range of piano sound, a sample of every third note can be patched across the keyboard.

A Synclavier sound can involve as many as four layers, or **partial timbres,** which may include combinations of synthesized or sampled sounds. Each partial timbre corresponds to a single voice, so a system equipped with 96 voices can sound 24 four-layer sounds at once.

By layering partial timbres, you can create a string sound, for example, that consists of one layer of a sharply bowed attack, one of gently bowed swell, one sustained without vibrato and one of general purpose playing. These different layers can be activated by different keyboard articulations so that the sharp attack is heard when the keys are struck with force or the gentle swell is brought out with after-touch pressure.

Keyboard performance

The Synclavier features a completely programmable 76-note **keyboard unit** with weighted action that offers a wide range of real-time effects controllers. These include

- velocity and pressure sensitivity,

- pitch and modulator wheels,

- ribbon controller,

- breath controller,

- foot pedals.

In addition to real-time effects, you can program the keyboard to **repeat** or **arpeggiate** notes or add **chorus** effects. The keyboard can be **tuned** to any scale, including whole tones and microtones. A **decay adjust** feature allows you to increase the decay time of notes as you play lower on the keyboard, while the **keyboard envelope** feature enables you to assign each layer of a sound to a different range of the keyboard.

The sequencer

The **sequencer** can record and play back a series of audio events—musical notes, MIDI data, a sound effect, a Foley effect or dialog—originating from any of the 200 sequencer tracks or up to 16 Direct-to-Disk tracks. During playback, the sequencer triggers each of these events at the appropriate time, assuring precise audio synchronization.

The sequencer can be activated by incoming MIDI data or locked to picture and triggered by incoming time code.

Sequences are stored on disk in special storage areas called sequence files. Eight numbered sequences can be recalled by using the keyboard unit. Any numbered or named sequence can be recalled by using the terminal. The hardware which acts as the sequencer is the **Memory Recorder.**
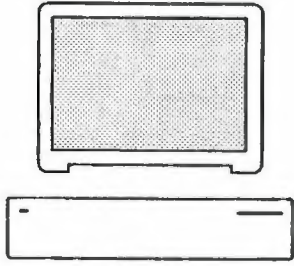
graphics terminal and screen
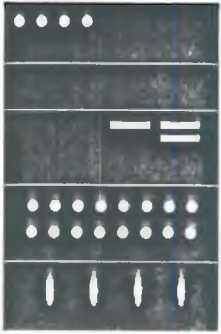
Signal processor

Computer accuracy and flexibility

A high-resolution graphics **terminal** and a hand-operated **trackball** communicate with a computer located in the **signal processor** of the system. These features greatly enhance the system's flexibility. Many of the functions of the Synclavier keyboard unit can be performed by pressing keys on the terminal keyboard or by pressing one of the buttons on the trackball. In many cases, the Synclavier keyboard unit is not required in order to operate the system.

Sounds and sequences can be accessed from terminal directories, and both sampled and synthesized sounds can be graphically displayed and edited at the terminal. You can display and edit multiple tracks of a sequence using either computer music notation or standard music notation. You can also edit a sequence with the Direct-to-Disk Audio Event Editor. MIDI ports and multichannel assignments can also be made from the terminal.

The Direct-to-Disk

The Direct-to-Disk is similar in operation to a digital tape recorder, with the added advantages of improved accuracy, no tape rewind time and no cutting and splicing of tape.

You can record up to 16 live tracks of music, sound effects, Foley effects or dialog on the Direct-to-Disk. Tracks associated with the Direct-to-Disk system are referred to as Direct-to-Disk tracks, or **project tracks,** to distinguish them from the 200 **sequencer tracks**.

A **project** is a reserved work area on all tracks in the Direct-to-Disk system used for recording sound. A **cue** is a designated area of sound originating from Direct-to-Disk tracks. It could be music, sound effects or dialog, such as a three-bar intro, the sound of a car door opening or a live overdub.

Direct-to-Disk cues are nondestructive and can be created, edited, synced to picture, placed in a sequence and triggered by the sequencer without overwriting the original Direct-to-Disk recording. Even when the cues are edited, they remain in sync.
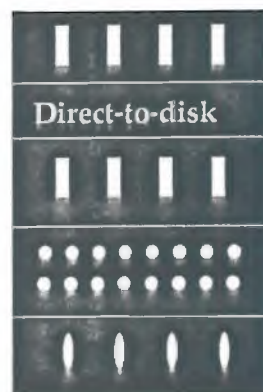
Direct-to-Disk signal processing unit

Features (con't)

Music Printing option

You can transcribe your musical performances from the keyboard or guitar into standard music notation with the Synclavier's **Music Printing** option. A single score page holds up to 64 staves, complete with time signatures, key signatures and standard clef signs. Traditional symbols such as those for chords, bowing, slurs and pedaling are augmented by user-defined symbols of any design.

The Synclavier supports a complete range of printers, including dot matrix for drafts, laser printers for high quality and digital typesetters for engraving quality.

Choeur des Fileuses

How the system works

Synclavier and Direct-to-Disk system components fall into four functional categories:

- input devices,
- signal processors,
- output devices,
- storage devices.

Input devices

The computer receives its information from an **input device**, also called a **control interface**.

The keyboard unit and the graphics terminal are the basic Synclavier and Direct-to-Disk control interfaces. Keys, buttons and a control knob are used on the keyboard unit to send data to the signal processor. The graphics terminal has a keyboard and a trackball for data input.

Other control interfaces are

- another synthesizer or sequencer through a MIDI interface;

- a Roland GR* guitar through the Synclavier digital guitar interface;

- a microphone or tape for placing live sounds, such as dialog, sound effects or instrumental sounds, into the Direct-to-Disk system;

- a modem.

Most of these input devices are designed to receive data from human sources. Some data is the raw material to be processed—sounds, musical performance or text; some consist of control signals telling the computer directly what to do or requesting that certain programs or sets of instructions be followed.

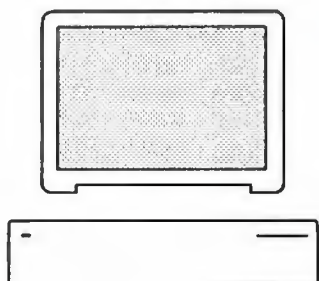* Roland GR is a registered trademark of Roland Corporation, Japan.
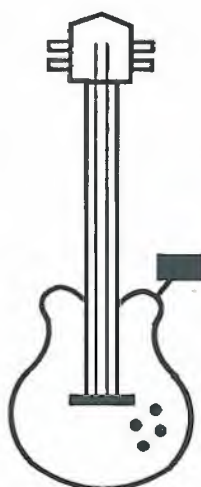
Input devices

MIDI interface

microphone

*graphics terminal
and screen*

digital guitar

modem

*velocity/pressure
sensitive keyboard*

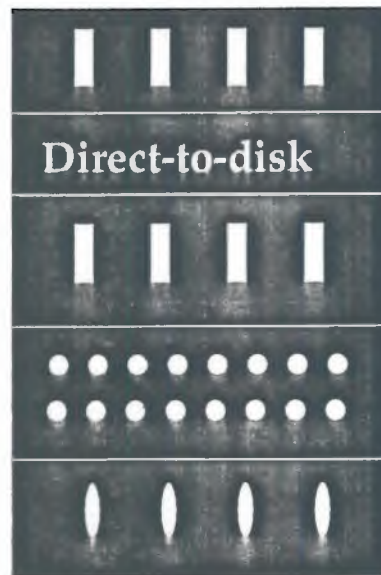## How the
system works
(con't)

Signal processor

The signals or data brought into the system through the
input devices are sent to the **central processing unit**
(CPU) in the **signal processor** where the Able computer
converts them into computer language and places them
into computer memory.

The processed information is then routed to the appro-
priate output or storage device.
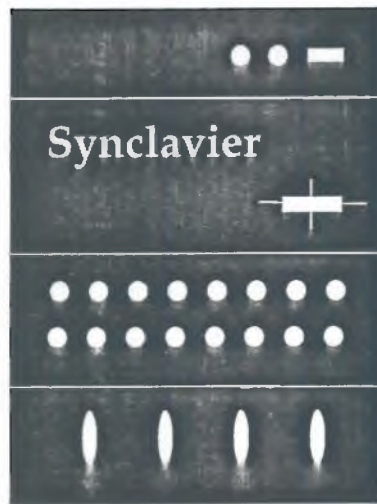
*The Synclavier
signal processor*

*The Direct-to-Disk
signal processor*

How the system works (con't)

Output devices

The information is processed and then converted at the **outputs** into sound signals, visual signals or digital signals.
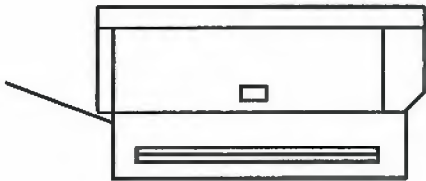
Sound output is produced by voices—sampling voices or synthesizer voices. Visual signals can be terminal displays, lighted buttons on the keyboard unit or the meter bridge, or material printed on a printer. Digital signals are sent directly to another computer component such as **a storage device**.
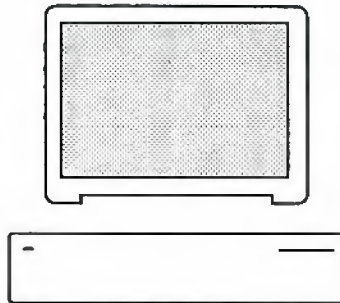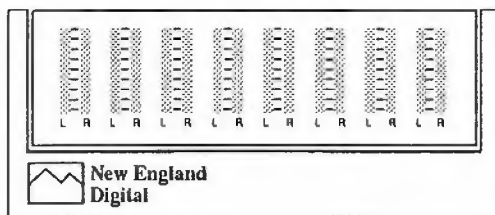
Output devices

sound
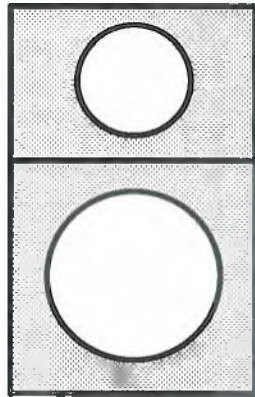
printer

displays

meter bridge

New England
Digital

How the system works (con't)

Storage devices

Data which is in the computer's memory when the power is turned off—sampled sounds, sequences, editing—is lost. For permanent storage, sounds and sequences must be placed onto **storage devices**, such as Winchester disks, floppy disks, optical disks or tape cartridges.

Sound recorded onto Direct-to-Disk tracks is stored automatically to hard disks installed in the Direct-to-Disk signal processing unit. Projects and tracks can be stored permanently on tape cartridges using the optional tape drives installed in the signal processing unit.
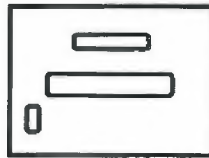
Sampled sounds and sequences recorded on the Synclavier are not automatically stored on disk. As a final step in the recording process, you usually back them up on the Winchester. For archival purposes, sampled sounds can be stored as sound files on an optical disk. Sequences can be stored on tape.
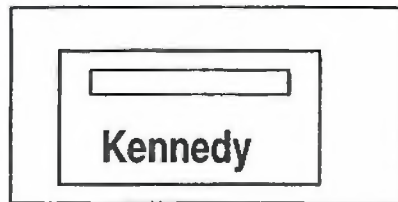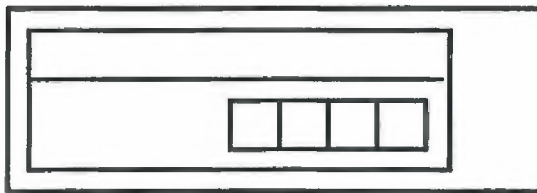
Storage devices
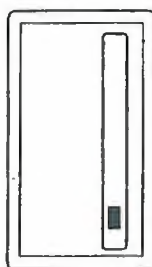
floppy drive

Winchester drive

Kennedy tape drive

optical drive

*Direct-to-Disk
hard disk drive
(left)*

*Direct-to-Disk tape
drive (right)*

System overview **1.19**