System overview

IN-01-0990

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** combined with advanced recording and editing capabilities found only in a state-of-the-art recording studio. With the Synclavier, you can compose, arrange, record, edit, perform and print music. The Direct-to-Disk adds the power to record live music, sound effects or dialog directly to hard disk, as well as extensive cue editing capabilities.

You can operate the Synclavier from either the **keyboard control unit** or the **terminal** using the terminal keyboard and trackball. The Direct-to-Disk is operated primarily from the terminal. The optional **DESC** also controls many functions of the Synclavier and Direct-to-Disk.

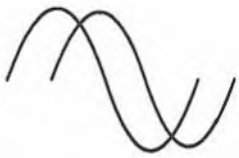
The **Multichannel Distributor** lets you route any of the 200 sequencer tracks to your console inputs, while your **MIDI** (Musical Instrument Digital Interface) option places the Synclavier or Direct-to-Disk into a network of synthesizers, sequencers, drum machines or other audio processing equipment.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

You can create either 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** (Society of Motion Picture and Television Engineers) time code. Synchronization is accurate to 1/80th of a frame.

When scenes are altered, you can quickly and precisely edit not by note or mark sections to edit from the computer terminal—eliminating the need to manually cut and splice tape. You can also lengthen or shorten any speech or musical program material without pitch change or distortion. Because of flexible random access technology, there is no tape rewind time.

The Direct-to-Disk is compatible with other studio equipment. You can transfer audio to and from Sony, Mitsubishi and AES/EBU-format digital recorders with no loss of quality.

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.

With high fidelity digital **sampling,** you can place instrumental or vocal sound and sound effects onto the Synclavier keyboard or Direct-to-Disk tracks. 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 itself, at rates of up to 100 kHz with polyphonic playback.

The Synclavier's **resynthesis** programanalyzes and duplicates the harmonic content of a sampled waveform. You can control volume envelope, vibrato, portamento, stereo and chorus effects 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.

With the Synclavier, you can **patch** 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, 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.** These may include combinations of synthesized or sampled sounds. Each partial timbre corresponds to a single voice, so a Synclavier 9600 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.

Multitrack recording

The Direct-to-Disk is similar in operation to a digital tape recorder, with the added advantages of improved accurracy, no tape rewind time and no cutting and splicing of tape. You can record up to 16 live tracks of music, sound effects, or dialog on the Direct-to-Disk.

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, placed in a sequence and triggered in sync with the picture without overwriting the original Direct-to-Disk recording. Even when the cues are edited, they remain in sync.

The **sequencer** can record and play back a series of audio events—musical notes, MIDI data, sound effects, Foley effects 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 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.

Synclavier 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, including

- 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.

Music Printing option

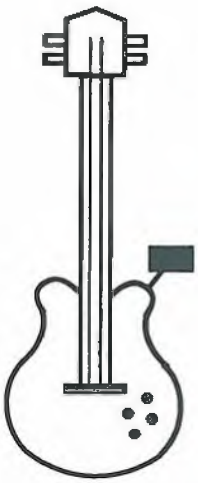
You can transcribe your musical performances from the keyboard or guitar into standard music notation with the Synclavier's **Music Printing** option. A single score page holds up to 64 staves, complete with time signatures, key signatures and standard clef signs. Traditional symbols such as those for 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.

System components

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**.

A Synclavier or MIDI keyboard and the computer terminal are the basic Synclavier and Direct-to-Disk control interfaces. Keys and controllers on the keyboards are used to send data to the signal processor. The computer also includes a trackball for data input.

Other control interfaces are

- the DESC controller/editor/locator
- digital input through the UDIO module
- another synthesizer or sequencer through a MIDI interface
- a Roland GR* guitar through the Synclavier digital guitar interface
- a microphone or tape for recording 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 consists 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.

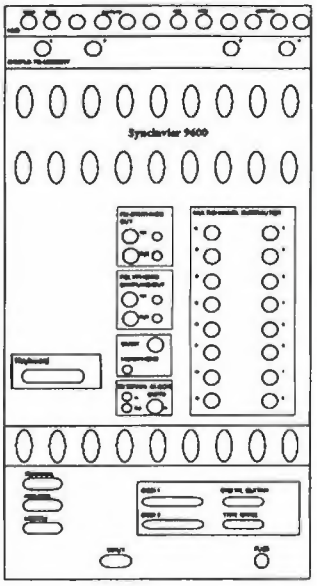
Signal processor

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.

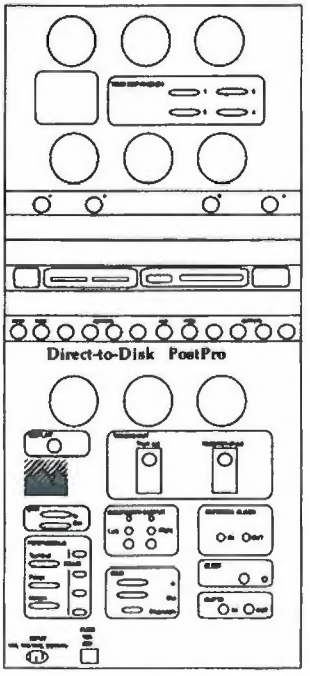
The processed information is then routed to the appropriate output or storage device.

The signal processor is located in the Synclavier or Direct-to-Disk **control unit**.

The Synclavier control unit



The Direct-to-Disk control unit



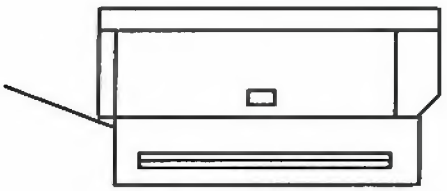
System components (con't)

Output devices

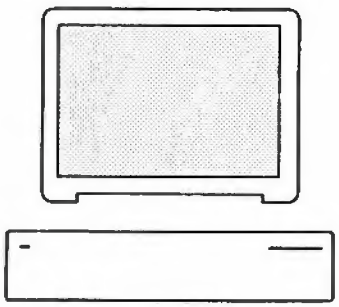
The information is processed and then converted at the **outputs** into sound signals, visual signals or digital signals.

Sound output is produced by sampling voices. Visual signals can be terminal displays, lighted buttons on the Synclavier keyboard, lighted displays on the meter bridge, or material printed on a printer. Digital signals can be sent directly to another computer component such as a **storage device** or to another digital device using the UDIO module.

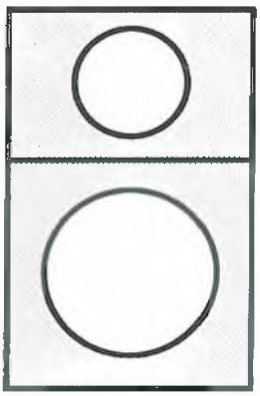
printer



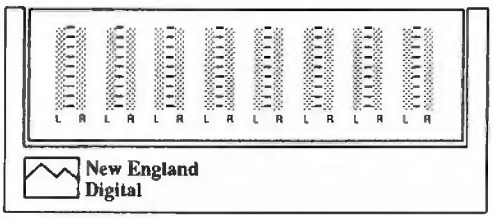
terminal displays



sound



Direct-to-Disk meter bridge



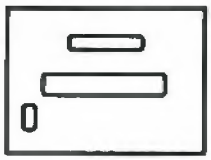
Storage devices

Data 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 digital tape.

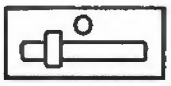
Sound recorded onto Direct-to-Disk tracks is stored automatically to hard disks installed in the Direct-to-Disk signal processor. For archival purposes, projects and tracks can be stored permanently on tape cartridges using the optional tape drives installed in the signal processor or on a digital tape machine using the UDIO module.

Sampled sounds and sequences recorded on the Synclavier are not automatically stored on disk. As a final step in the recording process, you usually save them on the Winchester. For archival purposes, sampled sounds can be stored as sound files on an optical disk. Sequences can be stored on tape.

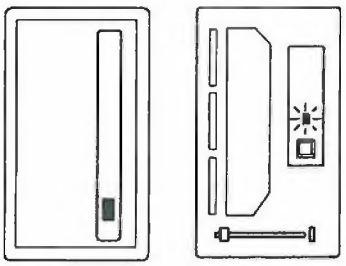
Winchester drive



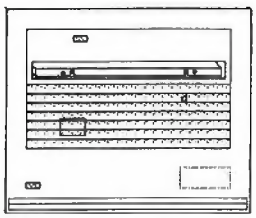
floppy drive



Direct-to-Disk hard disk drive and tape drive



optical drive



Basic hardware components

There are certain hardware components which are basic to the operation of the system. Many of these can be optionally expanded for greater system capacity and flexibility.

The Synclavier keyboard unit

The **keyboard unit** includes a **Synclavier keyboard** with 76 velocity- and pressure-sensitive keys, a ribbon controller, and pitch and mod wheels. Above the keys is the **keyboard control panel** which contains banks of buttons, a display window and a control knob. On the back of the unit are additional jacks for pedal inputs, a breath controller or other studio equipment.

The keyboard unit is connected to a power source and to the Synclavier signal processor with a large flat cable. Other keyboards can be connected to either the Synclavier or Direct-to-Disk signal processor using the MIDI interface.

Synclavier keyboard unit

Graphics terminal, screen, terminal keyboard and trackball

The **graphics terminal**, a Macintosh II, acts as a communication link with the New England Digital ABLE computer. It is connected to a cathode ray tube (CRT) screen with 1024 x 768 pixel display resolution. There are contrast and brilliance controls on the screen.

The terminal keyboard has 105 keys, 3 visual indicator lights and an audio tone generator. In addition to the standard typewriter keyboard, there are **function keys (F1, F2,** etc.) and a **numeric keypad** for special uses.

The **trackball unit** is a hand-operated device that has three components. The trackball is used to move the cursor and other items on the screen. The buttons on the trackball unit are used to activate commands, select screen items or scroll through options.

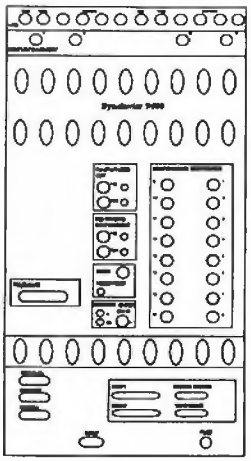
These four components are integrated with customized furniture to provide a coordinated graphics workstation.

The Synclavier control unit

The Synclavier control unit contains the New England Digital **ABLE computer.** In addition to the signal processor, the unit contains memory boards for storing information and voice cards for playing back sounds.

The unit has connectors for the keyboard, Winchester and floppy drives, the terminal and a printer. Other connectors are used for polyphonic sampling, FM synthesis and synchronization.

Depending on the configuration of your system, the control unit also may include the Sample-to-Memory module, MIDI and SMPTE interfaces, the Multichannel Distributor and the digital transfer module.



Synclavier control unit

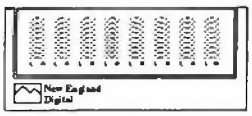
The Direct-to-Disk control unit and meter bridge

The Direct-to-Disk control unit has its own New England Digital ABLE computer. In addition to the signal processor, the unit contains Sample-to-Memory modules for analog input, Winchester hard disk drives for storing information and digital-to-analog converters for playing back sounds.

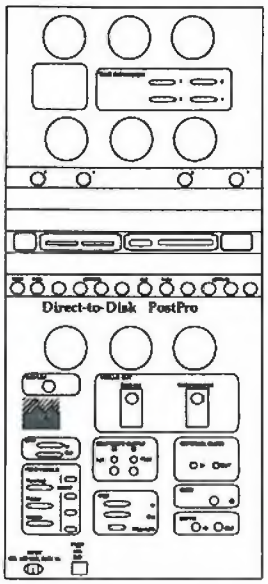
Depending on the configuration of your system, the control unit also may include MIDI and SMPTE interfaces, connectors for the terminal and a printer and the digital transfer module.

When the Synclavier and Direct-to-Disk systems are used together, the Direct-to-Disk follows the Synclavier in a master-slave relationship.

The **meter bridge** is a remote unit that has an LED display module with columns of 18-segment peak program meters (PPM). The meter bridge indicates the recording mode and signal level for each Direct-to-Disk track. The maximum signal sensed is +19 dBm.



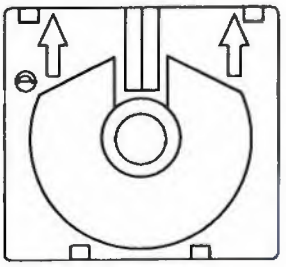
meter bridge



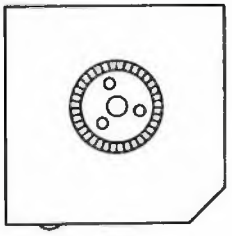
DTD control unit

Basic hardware components (con't)

floppy disk



optical disk cartridge



Direct-to Disk tape cartridge

Synclavier storage devices

Sounds and sequences can be stored on a 5.25" high density (HD) **floppy disk, on a hard disk or on an optical disk cartridge.** The drive for each storage device is a separate unit connected to a power source and to the signal processor. A Synclavier system must have at least one floppy drive and one hard drive to operate; two floppy drives and up to eight hard drives can be attached for additional storage.

Up to 1.2 megabytes of data can be stored on each floppy disk inserted into a floppy drive. Since these disks are removable, they can be used to build a portable library of sounds and sequences.

External hard disks come in a variety of storage capacities. Up to four can be chained together to form a single storage space. Two chains of hard disks can be attached to the signal processor for a total external hard disk storage capacity of 1 gigabyte.

An optical disk inserted into an external optical drive holds up to one gigabyte of sound on each side. The transfer rate of the optical disk drive is approximately twice real time.

Direct-to-Disk storage devices

Recorded signals from the Direct-to-Disk tracks are stored on **hard disk drives** mounted inside the Direct-to-Disk control unit. Each hard drive can store sound from two Direct-to-Disk tracks or, with the track expansion option, four tracks per drive. Up to eight hard drives, storing sound for 16 tracks, may be installed.

High-speed **tape drives** using tape cartridges can be installed in the Direct-to-Disk signal processor for permanent data storage. Each drive provides backup for two tracks. Up to eight backup drives can be installed.

Direct-to-Disk sounds also can be sent to digital tape using the digital transfer module.

MIDI, SMPTE and VITC interfaces

MIDI places the Synclavier or Direct-to-Disk into a network of synthesizers, sequencers, rhythm machines and other audio processing equipment.

MIDI keyboard

A MIDI module consists of one **MIDI INPUT**, four **MIDI OUTPUTS** and one **MIDI THRU** connection, expandable to 32 outputs. With an 8-output configuration you can select an auxiliary input for receiving MIDI sync signals. Each MIDI OUT port can carry messages on any or all of 16 channels.

The system can also send and receive MIDI **program change** signals and **song pointers.**

The Synclavier and Direct-to-Disk can read **SMPTE time code,** making it possible to synchronize music, dialog and sound effects with film or video. You can also use SMPTE to synchronize several recording devices, allowing them to act as one unit with multiple audio channels.

The Synclavier can generate SMPTE time code in any one of four formats.

- drop-frame
- 30-frame (non-drop)
- 25-frame
- 24-frame

With the **VITC** option installed, the systems can accurately track the output of any device which can receive a signal and convert it to longitudinal time code.

DESC

DESC, a remote controller/editor/locator for the Synclavier and Direct-to-Disk systems, is a hands-on interface that can be used to

- arm tracks
- auto-locate
- solo and mute tracks
- assign input and output routing
- record on Synclavier or Direct-to-Disk tracks
- edit cues
- place cues in a sequence
- set synchronization parameters
- scrub audio

Many Synclavier and Direct-to-Disk operations can be performed using DESC's buttons and displays, without referring to the terminal screen.

Other options

The **Sample-to-Memory** option of the Synclavier provides audio inputs for recording monophonic or stereophonic sounds at rates of up to 100 kHz. Each module has four inputs, and up to four modules can be installed.

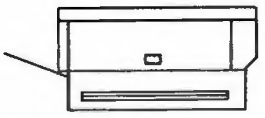
A **printer** can be connected to the Synclavier signal processor and to a power source. Many graphics, non-graphics and laser printers or digital linotype machines are suitable.

The **Multichannel Distributor** option for the Synclavier provides separate outputs for up to thirty-two channels programmed from the Multichannel Display.

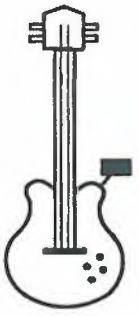
The Synclavier **digital guitar** option allows you to play and record Synclavier sounds with a Roland GR guitar, either as a solo or as a duet with a keyboardist. The special input hardware for the option includes a Roland GR guitar, the Synclavier digital guitar control unit and a special guitar button panel.

The **UDIO** module allows you to transfer digital audio between the Direct-to-Disk and another digital device without losing the original recorded quality or leaving the digital domain.

The **time scale modification** option lets you compress or expand the duration of a sound file or cue without changing its pitch.



printer



digital guitar

Basic software components

You operate the Synclavier and the Direct-to-Disk systems using a set of inter-related software modules.

The Real-Time Performance system

Many sound creation and editing features of the Synclavier and Direct-to-Disk are performed in the Real-Time Performance (RTP) system. This software can be operated from the keyboard control panel or from displays on the terminal screen.

The computer enters the RTP system when you press the load button on the floppy drive (F0:). A Welcome Menu tells you when the software is ready. You can start by selecting one of the displays on the menu, or you can go directly to the Main Menu which shows all of the RTP displays.

Quick Tours for both the Synclavier and the Direct-to-Disk introduce you to the RTP system.

The new software

The latest software modules are designed around the Macintosh operating system. These include

- EditView
- MIDInet
- Autoconform

You operate these modules in conjunction with the Real-Time Performance System.

Instructions for using the new software modules is in the *New Software* manual.

The Monitor

A separate software module, the Monitor, can be used to perform a host of file management tasks, including copying and storing files on hard disk and tape. You can also use it to rearrange storage space on the hard disk or to recover damaged files.

From the Monitor, you can access **utility programs** for copying files, formatting blank user disks and customizing system disks, as well as **diagnostic programs**, for preliminary diagnosis of system hardware malfunctioning. The diagnostic programs are designed to be used in consultation with N.E.D. Customer Service.

Instructions for using the Monitor software are in the *Organizing and Storing Sounds* manual.

The Screen Editor

The Screen Editor is a word processing program with a complete set of commands for creating, managing and editing text files on the terminal screen. It includes facilities for making global changes, copying or deleting sections of text, moving text from one file to another and many other word processing features.

You use the Screen Editor for creating Monitor command files, processing text files, editing Script compositions or writing XPL programs.

Instructions for using the Screen Editor are in the *Organizing and Storing Sounds* manual.

Release software

Periodically, New England Digital releases new software which includes new features or enhancements to the system. Customers who buy release software maintain the newest in New England Digital technology.

Complete documentation on how to install and use the new software is included with each release.

The NED StartUp window

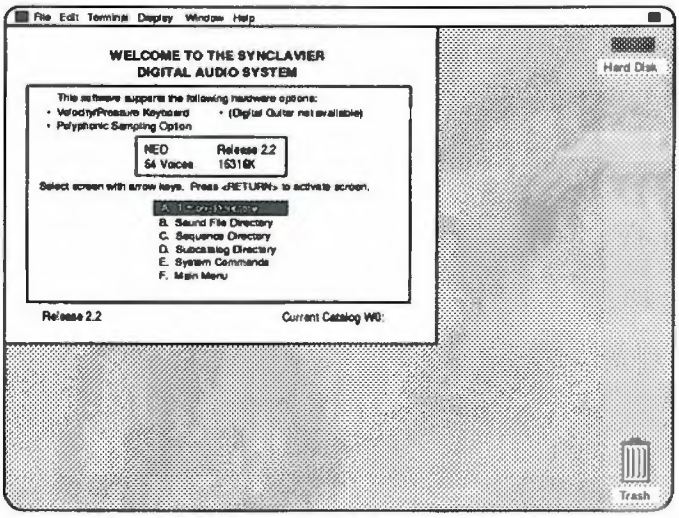
The NED StartUp is the software that drives the entire system. You start with the NED StartUp; all Real-Time Performance menus and displays appear in the NED StartUp window.

To open the NED StartUp window, double-click the NED StartUp icon from the Finder. The NED StartUp window always appears just below the horizontal menu bar at the top of the screen.

When the NED StartUp window is active, a set of pulldown menus appear in the menu bar at the top of the screen. You can pull down any menu to view the commands available from that menu.

Some commands can be executed directly from the keyboard without pulling down the menu. The key equivalents of these commands appear in the menu after the commands.

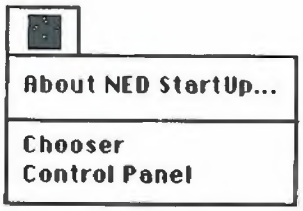
When you are at the Finder, you can use the Set StartUp... command under the Special pulldown menu to specify whether or not the NED StartUp window opens automatically whenever you restart the Macintosh. See your Macintosh User's Guide for instructions.



The Welcome Menu in the NED StartUp window

NED menu

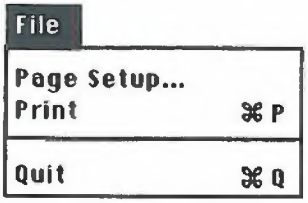
Menu item	Function
About NED Startup	Shows the company address and copyright information. When you are finished with this window, click anywhere in the window.
Chooser	Desk accessory from which you select a printer.
Control Panel	Desk accessory from which you set monitor controls such as color or speaker volume.



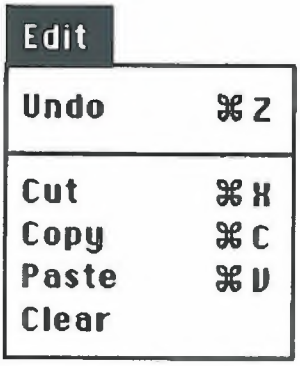
Note: All current desk accessories are listed on the NED menu. You can install other desk accessories using the Font/DA Mover found on the Apple System Utilities disk. See your Macintosh manual.

File menu

Menu item	Key equivalent	Function
Page Setup		Lets you set up the page size, orientation and other options for printing.
Print	⌘P	Allows you to print the current display from the Macintosh. For best results when printing a full-sized screen, use the landscape setting at 70%.
Quit	⌘Q	Quits the NED Startup program and returns you to the Finder.



Note: Laser printer models must be LaserWriter II or QMS PS800+ or later. Be sure the printer is connected to the Macintosh (not the Synclavier or Direct-to-Disk) and that the printer is selected from the Chooser.

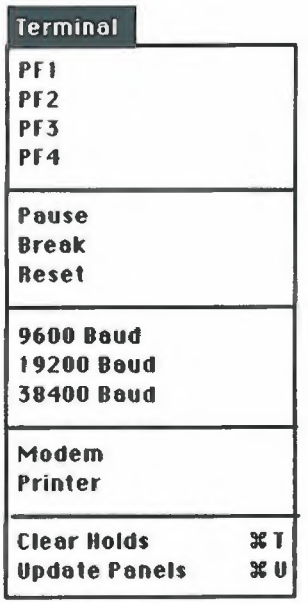


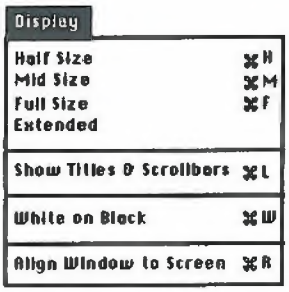
Edit menu

Menu item	Key equivalent	Function
Undo	⌘Z	The Undo command is disabled.
Cut	⌘X	The Cut command is disabled.
Copy	⌘C	Copies the currently displayed menu, directory listing or display to the Macintosh Clipboard. Some displays and parts of displays are not copied.
Paste	⌘V	Pastes any text on the Macintosh Clipboard into most Macintosh applications.
Clear		The Clear command is disabled.

Terminal menu

Menu item	Key equivalent	Function
PF1	F1	Moves from the RTP system to the Reverse Compiler.
PF2	F2	Moves from the Music Printing module to the RTP system.
PF3	F3	Moves from the RTP system to the Music Printing module.
PF4	F4	Moves from the RTP system to the Signal File Manager.
Pause (Resume)		Stops (or resumes) drawing of graphics or scrolling of text on screen.
Break		Moves to the Monitor module. The current RTP screen is replaced with a Ready> prompt.
Reset		Returns to either the Main or Welcome menu.
9600, 19200 or 38400 Baud		Shows the current baud rate. It should correspond to the baud rate of your Synclavier or Direct-to-Disk.
Modem or Printer		Shows whether the Macintosh modem port or printer port communicates with the Synclavier or Direct-to-Disk.
Clear Holds	⌘T	Clears held buttons anywhere on the VK Panel.
Update Panels	⌘U	Updates all panels so that what is displayed is current.





Display menu

Menu item	Key equivalent	Function
Half Size **Mid Size** **Full Size**	⌘H ⌘M ⌘F	Determines the size of the NED StartUp window.
Extended		Currently implemented only in Music Printing F.5. Allows editing of graphics larger than the screen. The terminal screen becomes a window that you can move around with scroll bars to view and edit different portions of the graphic.
Show (Hide) Title & Scrollbars	⌘L	Adds (or deletes) "Synclavier Terminal" to top of NED StartUp window and scroll bars at bottom and right.
White on Black (Black on White)	⌘W	Exchanges background and foreground colors.
Align Window to Screen	⌘R	Aligns the window to the top left of the screen.

Window menu

Menu item	Key equivalent	Function
Terminal/VK Panel	⌘D	Toggles between the current RTP display and the VK Panel display.
Activate Window		When checked, any click of the trackball in a non-active window brings that window to the front. When not checked, the trackball can be used in the non-active window without bringing it to the front. At any time, however, a click in the inactive window's title bar brings it to the front.
Arrange VK Panel	⌘A	Allows you to rearrange the VK Panel sections and store preset arrangements.
Panel Presets		Use to call up arrangements of the VK Panel which have been set up and stored using the Arrange VK Panel command.
Preset 1	⌘1	
Preset 2	⌘2	
Preset 3	⌘3	
Preset 4	⌘4	
Preset 5	⌘5	
Preset 6	⌘6	
Colors		Choose any color for listed VK Panel areas and buttons. Make sure your monitor color is on. If it is not, activate the Control Panel under the NED menu and turn it on.
Transfer to Applications		Allows you to move directly to the EditView or MIDInet module without first returning to the Finder.