

BUCHLA 400

electronic musical instrument



description and specifications

COMPUTERS & MUSIC

1989 Junipero Serra Blvd.

Daly City, CA 94014

(415) 994-2909

BUCHLA 400 - electronic musical instrument

CONTROL VOLTAGE INPUTS

- pitch
- timbre
- modulation input
- filter cutoff frequency
- gate level
- 4 software defined inputs
- range: 0 to 10 volts

CONTROL VOLTAGE OUTPUTS (10 total)

all functions software defined

PULSE INPUTS/OUTPUTS

- forward/reverse frame pulse input/output
- 3 software defined inputs each
- input threshold: 1.5 volts
- output level: 10 volts or TTL
- output duration: .001 seconds

AUDIO OUTPUTS (8 total)

2 channel stereophonic bus; 1/4" phone connectors; 200 ohms impedance; 6 individuals voice outputs; miniphone connectors; 600 ohm impedance; audio output levels are 1.2 volts rms.

INTERCONNECTIONS

Standard Banana connectors

video out: BNC connector, 75 ohms, composite signal, for use with standard video monitor.

Tape in/out: miniphone connectors, 1.2v rms, for use with quality audio cassette recorder.

terminal/printer: RS232 with selectable baud rate, for user access to internal computer.

CIRCUITRY AND ARCHITECTURE

supervisory control and data handling: internal IEEE-696 based general purpose digital computer; functional generation and input correlation: 64 channel multiple arbitrary function generator; signal generation: pipelined, multiplexed, 6 voice digital oscillator with PROM based microcode; signal processing (gating, filtering, phasing and location): voltage-controlled analog circuitry; primary editing inputs: 24 touch activated keys, pressure sensitive joysticks, sealed pushbutton switches; primary performance inputs: 100 programmable touch activated keys, pressure sensitive joystick; accessories software: MIDAS, a PROM resident, instrument definition, performance and scoring language.

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NEW PRODUCT ANNOUNCEMENT

From Buchla & Associates comes the latest member of the 400 series electronic musical instruments. Incorporating a five octave, weighted action clavier, the model 406 provides the keyboard player access to the extensive sonic resources and powerful music languages that characterize the Buchla 400 series instruments.

Of particular interest to the composer is a musically sophisticated score editor that functions in real time. Six orchestrally differentiated voices can simultaneously be displayed, auditioned, and edited. A high resolution graphic display employs linear-time notation to visually present considerable more musical data than is possible with video display of conventional symbolic notation. Instrument definitions, dynamics, tempi, registration, and tunings are all completely programmable. Efficient cursor control combines with menu-driven displays to provide unusually efficient interactive editing capabilities. The instrument can decode, display, and track a SMPTE time code signal, facilitating film, video and multitrack composition.

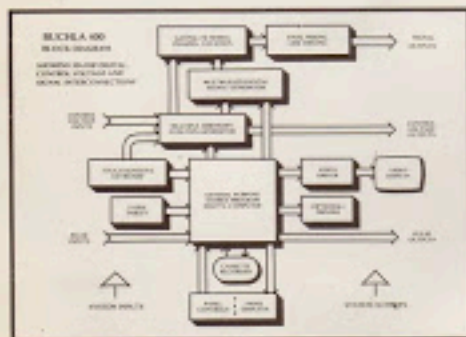
The model 406 is a performance instrument with no equal. Dynamic waveshaping techniques, multiple complex envelope generation and advanced concepts of instrument definition provide an extensive electronic vocabulary. Tunable to any imaginable scale, the specialized keyboard employs a novel capacitance sensing technique to achieve accurate response to both force and pressure. Under computer control, these performance gestures can be used to control any combination of the 406's musical variables. Pressure-sensitive joysticks, control voltage inter-connections and analog modifiers further extend the performance possibilities.

The model 406 combines architecturally advanced hardware with specialized high-level software to achieve performance characteristics unprecedented in the world of musical instrumentation. Three computers are employed, each optimized to its task. A host computer takes charge of user communication, data handling and executive control. A second processor is responsible for processing time-varying parametric data and a third processor applies digital pipelined techniques to the generation of sound.

The Buchla 406 is available now; introductory price is \$10,500. Further information may be obtained from Computers & Music, 1989 Junipero Serra Blvd., Daly City, CA 94014

The 400's unique architecture features three computers, each of a different nature, and each optimized to its particular function.

SERVING AS THE NERVE CENTER OF THE INSTRUMENT is a general purpose digital computer. Programmed to perform user communication, data handling, and supervisory control, this "host" computer may be reprogrammed to realize future musical needs or alternative instrumental concepts.



Receiving instructions and data from the host, a second computer (called the multiple arbitrary function generator), directs the progress of 64 acoustic parameters, each with a time resolution of 1/1000 of a second. This facility enables precise specification of complex sonic detail and offers expanded possibilities for expressive articulation.

A third computer, this one a pipelined digital signal generator, produces the instrument's six voices. Built into this computer are unusually powerful algorithms for timbre generation, including frequency modulation, waveshape interpolation and timbre modulation (unique to the Buchla, this technique significantly augments the electronic vocabulary).

Gating and filtering are performed by voltage-controlled analog circuitry, providing a dynamic range exceeding 90 db. Specialized phasing and location circuitry provides unusual depth and imaging in the resultant acoustic field and enables independent location of each voice in stereo space.

Multilevel extensibility is a fundamental aspect of the 400's design.

AN ARRAY OF CONTROL VOLTAGE INPUTS AND OUTPUTS permits the instrument's powerful control structure to interact with a variety of auxiliary equipment. 200 series modules may be used to augment the 400 for specialized applications, ranging from biofeedback control to signal processing of accompanying instruments. Pulse interconnections allow synchronization with external events, additional instruments, or other media; and individual voice outputs facilitate post-processing of signals.

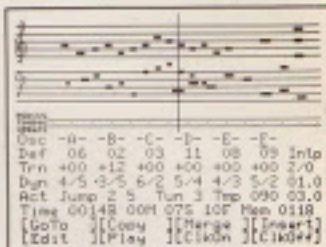


To further assure ease of expansion of resources and capabilities, the internal processor incorporates the industry standard IEEE-696 bus. By adding readily available plug-in cards, the instrument can be expanded into a flexible computer system appropriate to applications such as word processing, network communications or program development.

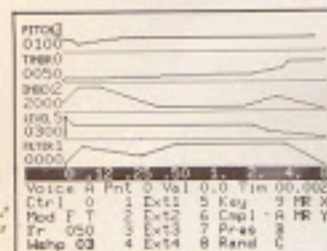
The instrument's operational language (MIDAS) is programmed in musicFORTH, a high level language distinguished by its transportability, extensibility and ease of user access. MIDAS presently combines a real-time score editor with a comprehensive instrument definer. New versions of MIDAS will add new capabilities, keeping the Buchla 400 a growing and vital instrument with ever-expanding resources.

Multifunctional in nature, the Buchla 400 is designed to serve the needs of composers, performers, educators, and listeners.

OF PARTICULAR INTEREST TO THE COMPOSER is a musically sophisticated score editor that functions in real time. Six orchestrally differentiated voices can simultaneously be displayed, auditioned, and edited. Musical data is efficiently presented with linear-time notation and a high-resolution graphic display. Instrument definitions, dynamics, tempi, registration, and tunings are programmable, and a menu-driven editor provides for sectional labeling, recall, inserts, merges, copies and jumps. The instrument can decode, display, and track a SMPTE time code signal, facilitating film, video, and multitrack composition.



THE PERFORMER CONCOCTS HIS SONIC FEASTS from an array of timbral ingredients unprecedented in musical cuisine. Dynamic waveshaping techniques, multiple complex envelope generation, and advanced concepts of instrument definition provide an extensive electronic vocabulary. A specialized touch sensitive keyboard can be organized in traditional or nontraditional fashions, can be tuned to any imaginable scale, and responds to the subtlest of musical gestures. Pressure-sensitive joysticks, control voltage interconnections, and analog modifiers further extend the possibilities.



AS AN EDUCATIONAL TOOL, the Buchla 400 is unusually comprehensive. With an architecture capable of implementing a variety of synthesis techniques, the intricacies of frequency modulation, timbre modulation and non-linear waveshaping can be effectively presented. Fast real-time graphic displays of waveshape tables and parametric envelopes enable experimentation with the elements of musical structure. Tuning systems, principles of orchestration, and other aspects of theory can be explored, and sophisticated high level software facilitates the development of new musical languages and compositional algorithms.

FOR THE LISTENER, who is the final link in the musical chain, the Buchla 400 offers some unusual possibilities. With the capability of storing complete scores on cassette tape or plug-in cards, the instrument serves as an idealized playback medium, recreating the composer's intent with uncompromised fidelity. If he chooses, the listener can display a score and interact with it at any level, from modifying balances, tempi, or instrumentation, to completely reconfiguring a composition. Thus the listener may abandon his role of passive consumer, and become a creative producer of the acoustic experience.

This is an expressive instrument created by musicians for musicians.

DIRECTED BY DON BUCHLA, the 400 development team includes composers and performers as well as experts in man-machine interface, electronic design, computer science, and psycho-acoustics. Mr. Buchla's professional background includes space biophysics research, multimedia composition, the performance of avant garde and traditional music and the design of both acoustic and electronic instruments. As a Guggenheim fellow, he recently completed research in interactive performance-oriented computer music languages, and as an NEA fellow, he is currently designing instrumentation and music for a hundred piece electronic orchestra.

"Don is easily among the most advanced and imaginative of the instrument builders of the 20th Century."

Morton Subotnik
California Institute of the Arts

"I have to admire what Don Buchla has done. He hasn't allowed himself to limit the complexity of his instruments to meet the demands of the so called 'market place'... As a result, I think of all the systems that are available, his can be organized in arbitrarily complex ways most easily."

Robert Moog
Electronotes v7, n50

Technical Specifications

CONTROL VOLTAGE INPUTS (9 total)

pitch
timbre
modulation input
filter cutoff frequency
gate level
4 software defined inputs
connectors: standard banana
range: 0 to 10 volts

CONTROL VOLTAGE OUTPUTS (10 total)

all functions software defined
connectors: standard banana
range: 0 to 10 volts

AUDIO OUTPUTS (8 total)

2 channel stereophonic bus; 1/4" phone connectors; 200 ohms impedance
6 individual voice outputs; miniphone connectors; 600 ohms impedance
all audio output levels are 1.2 volts rms.

ADDITIONAL INTERCONNECTIONS

video out: BNC connector, 75 ohms, composite signal, for use with standard video monitor.
tape in/out: miniphone connectors, 1.2v rms, for use with quality audio cassette recorder.
terminal/printer: RS232 with selectable baud rate, for user access to internal computer.

ELECTRICAL REQUIREMENTS

voltage: 110 or 220 VAC
power: 75 watts maximum

PULSE INPUTS (5 total)

forward frame pulse
reverse frame pulse
3 software defined inputs
connectors: standard banana
threshold: 1.5 volts

PULSE OUTPUTS (5 total)

forward frame pulse
reverse frame pulse
3 software defined outputs
connectors: standard banana
level: 10 volts or TTL
duration: .001 seconds

PHYSICAL CHARACTERISTICS

weight: 15 kg (33 pounds)
dimensions: 68 cm x 40.5 cm x 12.5 cm

CIRCUITRY AND ARCHITECTURE

supervisory control and data handling: internal IEEE-696 based general purpose digital computer
function generation and input correlation: 64 channel multiple arbitrary function generator
signal generation: pipelined, multiplexed, 6 voice digital oscillator with PROM based microcode
signal processing (gating, filtering, phasing and location): voltage-controlled analog circuitry
primary editing inputs: 24 touch activated keys, pressure sensitive joysticks, sealed pushbutton switches
primary performance inputs: 100 programmable touch activated keys, pressure sensitive joystick, accessories
software: MIDAS, a PROM resident, instrument definition, performance and scoring language

The Buchla 400 is manufactured by
BUCHLA & ASSOCIATES
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