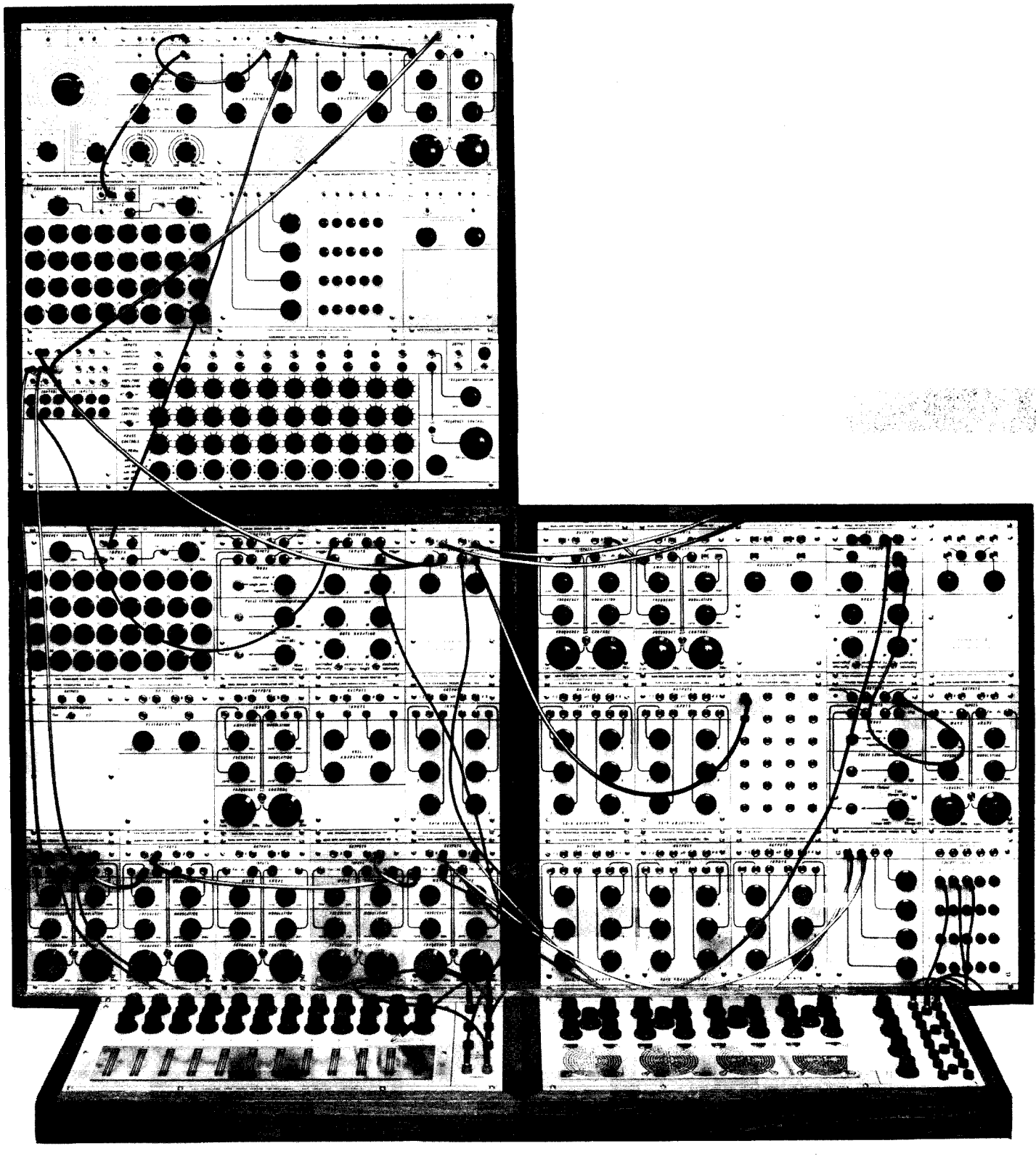
THE MODULAR ELECTRONIC MUSIC SYSTEM



THE MODULAR ELECTRONIC MUSIC SYSTEM

Now offered for sale by the

SAN FRANCISCO TAPE MUSIC CENTER

An exciting new instrument for generating and processing electronic material.

An imaginatively flexible studio instrument capable of producing an enormous range of sounds and formats.

Direct immediate control of musical parameters enabling live real-time performance of electronic music without tape buffering.

Comment

"The instrument is the answer for composers who wish to work with electronic materials but care nothing for electronics, and teachers will find it student-proof."

Robert Erickson,
Composer
Teacher, San Francisco Conservatory of Music

"Aside from creating an imaginatively flexible studio instrument, Mr. Buchla has made it practical for a composer to have a complete electronic music studio in his own home."

Mort Subotnick,
Composer

". . . a keyboard connected to an enormous range of the sounds of our time. Every composer should come to see, hear, and possibly play the thing, just to know what resources Buchla has made available."

Lou Gotlieb,
San Francisco Chronicle

"It could be the precursor of fascinating developments in the field of electronic music."

Carl Cunningham,
San Francisco Chronicle

"A most remarkable instrument for manipulating sound. As useful in the concert hall as it is in the studio."

David Tudor,
Musician

SOME HISTORY

In the past decade electronic music has developed into a form that assumes all the roles of music in our culture, from concert pieces to film music and rock-and-roll. Studios specializing in electronically generated music have been built in Europe and America and, while still few in number, have exerted considerable impact on the cultural activity of our time. An increasing number of composers are active in the field, and within a few years electronic music may well be part of the curriculum at every college and university music department.

The offspring of a technology which is itself but half a century old, electronic music is in its infancy. Instruments specifically designed for its production have been crude and generally unavailable. The San Francisco Tape Music Center approached the instrumentation problem in the traditional manner: ingenious application of surplus equipment that saw service in World War II bombers; occasional acquisition of new (and expensive) instruments designed for the physics laboratory; construction of innumerable pieces of electronic gadgetry from circuits provided by trade publications, hobby manuals, and friendly engineers.

As the number of member-composers grew, the limitations of the Tape Music Center's facilities became increasingly apparent. Maintenance and overhead costs were high, studio time was wasted in setup and tape splicing, and instruction in the intricacies of impedance matching and ground loops was necessary.

Last year the Tape Music Center received Rockefeller Foundation support which enabled the Center to initiate the development of a line of improved studio equipment. Basic objectives were:

1) The achievement of direct, immediate control of musical parameters. Instruments should be played in real time, eliminating such note-forming routines as: set frequency—start recorder—stop recorder—measure—cut—splice—repeat, etc.

2) Compatability of all equipment. Rules for interconnecting equipment to be straight-forward and consistent. Interfacing with external equipment (recorders, tuners, microphones, etc.) should be readily accomplished.

3) Fully transistorized circuitry, employing conservative design and high quality components. Reliable operation with minimal maintenance must be realized.

4) A special requirement of the Tape Center was that the equipment be lightweight and portable, thus making feasible its use in the composer's home, the concert hall, and on tour.

5) Without compromising other design objectives, cost should be low. Power supplies and cabinetry should be common to several units, and modular construction should be employed to permit economical system expansion.

Equipment that meets the above criteria has been designed and installed in the Center's studio. Results have exceeded all expectations. The new instrumentation can accommodate twice as many member-composers, and the time required to put a composition on tape has been reduced substantially. The range of sounds and formats far exceeds that previously available. The instrument has been played on stage in several concerts in the Bay Area. (Live, on-line, real-time performance of electronic music without tape buffering is, to our knowledge, unprecedented.)

THE SYSTEM

The Modular Electronic Music system that was developed at the Tape Music Center is composed of functional *modules*, each designed to generate a particular class of signals or perform a specific type of signal processing. Each module is 7 inches high and 4¼ inches (or an integral multiple thereof) wide. Up to 15 modules sharing a single power supply may be assembled in a single cabinet, and form a *super-module*.

The system employs three varieties of signals, each with a distinctly different function:

Audio signals, the raw material of electronic music, are formed by various sorts of generators (sine, square, sawtooth, harmonic) or are produced externally (tape loop, radio, microphone). In constructing a piece, they may be filtered, gated, mixed, modulated, or otherwise processed. The patch cords carrying audio signals within the system are grey, shielded cables terminated with miniature phone plugs. A standard level of Odb (ref. 600Ω) is employed for audio signals within the system.

Control voltages, used to determine frequencies, envelope characteristics, amplitudes and other parameters, are generated by keyboards, programmable voltage sources, and format generators. Black banana plug patch cords are used to interconnect control voltages. The standard control voltage range is from .5 to 15 volts.

Timing pulses are originated by keyboards, programmable sequencers, and pulse generators. They are used to trigger notes, open gates, or initiate chains of musical events. Timing pulses are about 10 volts in amplitude and are interconnected with red banana plug patch cords.

The rules for interconnection are straight-forward. Any number of inputs may be connected to a single output. Timing pulse outputs may be paralleled and connected to one input. The system output may be derived from any module; output is of sufficient magnitude to drive line inputs on tape recorders or sensitive inputs on power amplifiers.

AVAILABILITY

The Modular Electronic Music system described herein is now offered for sale through the Tape Music Center. Data and prices are available on request. Demonstrations and instruction can be arranged in many localities.

Delivery is approximately 60 days from receipt of order. Units are shipped air parcel post FOB San Francisco unless otherwise specified. Average shipping weight is 35 pounds per super-module.

Terms are 50% cash with order; 50% on delivery. Thirty days credit may be extended to rated institutions.

The system is guaranteed by the manufacturer, Buchla Associates, against defects in parts and workmanship. Guarantee extends for six months, unless equipment is modified or tampered with.

Address inquiries and orders to:

~~THE SAN FRANCISCO TAPE MUSIC CENTER~~
~~321 Divisadero Street, San Francisco, California 94117~~

BUCHLA ASSOCIATES
P.O. BOX 5051
BERKELEY, CALIF. 94705

Model 100 Cabinet

Specially designed walnut cabinet accommodates power supply and 15 panel units. (Most modules are $4\frac{1}{4}$" x 7" and occupy one panel unit, but some are $8\frac{1}{2}$" or 17" wide and occupy two or four panel units.) Overall dimensions are 23" x 23" x 8".

Model 106 Mixer

Two 3-channel mixers with both separate and common outputs and level controls for each input.

Model 107 Voltage Controlled Mixer

Two 5-channel mixers with both separate and common outputs. Input levels are controlled by externally applied control voltages usually derived from a Model 114 touch controlled voltage source.

Model 110 Dual Voltage Controlled Gate

Two voltage controlled amplifiers generally used in conjunction with a Model 180 attack generator to control the envelope of applied signals.

Model 111 Dual Ring Modulator

Two independent ring modulators. Each output consists of the sums and differences between frequency components of two input signals. Original signals are suppressed about 55 db.

Model 112 Touch Controlled Voltage Source

Touch activated keys produce one of twelve preselected voltages at each of two outputs. A third output voltage is proportional to finger pressure, and a fourth output is a pulse generated whenever a key is activated. Generally used to initiate notes and control their pitches.

Model 114 Touch Controlled Voltage Source

Ten independent, touch activated keys, each with a corresponding control voltage output and pulse output. The voltage outputs are particularly useful for controlling gates (110) or mixers (107), and the pulse outputs for initiating attack waveforms (180) or other events.

Model 115 Power Supply

Regulated supply for powering a cabinetful of modules plus one or two keyboards. Installed in Model 100 cabinet, unit occupies no panel space.

Model 117 Dual Proximity Detector

Two capacitance-actuated control voltage sources for enabling spatial control of sound parameters. Theremin-style antennas may be remotely located.

Model 123 Sequential Voltage Source

Produces a sequence of two to eight programmed voltages at each of three outputs. Switching is accomplished by applying a pulse, usually from a Model 140 pulse generator. Indicator lamps show which of the 24 potentiometers are in control. Eight pulse outputs are energized as corresponding segments are switched. Unit may be used to simultaneously program pitch, amplitude, and duration of single or repetitive sequences of notes.

Model 124 Patchboard

Consists of 24 miniature audio jacks mounted on a panel. Used in studio installations to facilitate connection to tape recorders, monitors, and other auxiliary equipment.

Model 130 Dual Envelope Detector

Produces a control voltage proportional to the instantaneous amplitude of an applied signal. Detector time constant is variable from .01 to 1 second.

Model 144 Dual Square Wave Oscillator

Two independent oscillators in one unit. Frequencies are continuously variable from 5 cps to 20 kc and may be controlled internally or with externally applied voltages. There is provision for wide band amplitude and frequency modulation.

Model 146 Sequential Voltage Source

Produces a sequence of two to sixteen programmed voltages at each of three outputs. Otherwise identical to Model 123.

Model 148 Harmonic Generator

Generates a fundamental and its first nine harmonics (harmonic numbers 1 - 10). Fundamental frequency is continuously variable from 5 cps to 5 kc and may be controlled internally or with an externally applied voltage. There is provision for wideband frequency modulation. The 148 is frequently used in conjunction with mixers (106, 107), gates (110), and attack generators (180) to enable precise programmed envelope control of individual overtones.

Model 150 Frequency Counter

Four digit counter measures frequencies to 100 kc with a precision of 10 cps. Frequencies below 10 kc are measured with a precision of 1 cps.

Model 155 Dual Integrator

Produces continuous control voltage functions when used in conjunction with sources of discrete control voltages (e.g. keyboards, sequencers). Positive and negative slopes may be individually and continuously varied from 15 volts in .0025 seconds to 15 volts in 10 seconds; either or both slopes may be voltage controlled. Particularly useful for generating complex voltage controlled envelopes, frequency glides, and repetitive control functions.

Model 156 Dual Control Voltage Processor

Serves to mix, compress and invert control voltages. Each channel has two control voltage inputs and an internal voltage source. Particularly useful for obtaining fine pitch control, transposition capability, and range compression of control voltage sources.

Model 157 Control Voltage Inverter

Four channel unit complements control voltages to accomplish a variety of inverted functions.

Model 158 Dual Sine-Sawtooth Oscillator

Two independent oscillators in one unit. Frequencies are continuously variable from 5 cps to 20 kc and may be controlled internally or with externally applied control voltages. Waveshape is continuously adjustable from sine to sawtooth; oscillators may be wideband frequency modulated.

Model 160 White Noise Generator

Produces white noise with a flat frequency distribution from 5 cps to 20 kc and weighted noise with a constant power per octave distribution.

Model 165 Dual Random Voltage Source

Produces two uncorrelated, random output voltages, each of which is changed by applying a trigger pulse. Used to randomize frequency, amplitude, and time.

Model 170 Dual Microphone Preamplifier

Two high-gain mike preamplifiers. Input connectors are 3 pin XLR. Input impedences are selected by a panel mounted switch.

Model 171 Dual Instrument Preamplifier

Two preamplifiers for electric guitars, contact microphones, and other low-level signal sources. Input impedences are 200 kΩ; input connectors are standard phone.

Model 172 Dual Signal Leveler

Two high-gain, constant-output amplifiers. Output signal levels are maintained at 0 db (± 1 db) for input variations of from -40 db to +10 db. Time constants are variable from .05 to 5 seconds.

Model 175 Dual Equalizer - Line Driver

Used in studio installations to drive 600Ω headsets or unbalanced lines at a nominal +4 db (max. +20 db). Unit incorporates bass and treble controls of the variable turnover variety.

Model 176 Dual Hiss Cutter

Reduces tape hiss by restricting bandwidth of signals that would otherwise be masked by high frequency noise. Signals above a certain threshold (including fast transients) are unaffected.

Model 180 Dual Attack Generator

Two independent units produce envelope control voltages initiated by pulses. Attack time is variable from .002 to 1 second; decay time from .002 to 5 seconds; duration from .002 to 5 seconds. Duration may be optionally controlled by trigger pulse length.

Model 185 Frequency Shifter

Shifts frequencies contained in input signal by an amount equal to the applied carrier frequency. Raised and lowered signals are simultaneously available.

Model 190 Dual Reverberation Unit

Two independent spring type reverberators. Degree of reverberation is continuously variable.

Model 191 Sharp Cutoff Filter

Voltage controlled highpass and lowpass filters with 24 db/octave slopes. Cutoff frequencies are variable from 5 cps to 20 kc with no range switching. Also functions as a bandpass filter with voltage controlled center frequency and bandwidth.

Model 192 Dual Lopass Filter

Two lowpass filters with cutoff frequencies variable from 200 cps to 20 kc. Slopes have sharp knees and are 12 db/octave.

Model 194 Bandpass Filter

Divides an input signal into four frequency bands. Cross-over frequencies are 200 cps, 900 cps, and 4 kc. Slopes have sharp knees and are 12 db/octave.

Model 195 Octave Format Filter

Divides an input signal into ten frequency bands centered at octave intervals from 31 cps to 16 kc.

Model 196 Phase Shifter

Shifts phase of input signal such that a 90° (±5°) phase relationship between the two outputs is maintained from 5 cps to 20 kc. Used in conjunction with ring modulators for frequency shifting or for exotic visual displays.

The following systems are presented as examples of complete, well-balanced Modular Electronic Music Systems:

Modular Electronic Music System No. 1

A single super-module consisting of the following components:

- 1 Model 100 Cabinet
- 2 Model 106 Mixers
- 1 Model 110 Dual Voltage Controlled Gate
- 1 Model 111 Dual Ring Modulator
- 1 Model 112 Touch Controlled Voltage Source
- 1 Model 115 Power Supply
- 1 Model 123 Sequential Voltage Source
- 1 Model 140 Timing Pulse Generator
- 1 Model 144 Square Wave Oscillator
- 1 Model 156 Dual Control Voltage Processor
- 3 Model 158 Dual Sine-Sawtooth Oscillators
- 1 Model 160 White Noise Generator
- 1 Model 180 Dual Attack Generator
- 1 Model 190 Dual Reverberation Unit
- 1 Patch Cord Set

Modular Electronic Music System No. 2

Two super-modules consisting of the following components:

- 2 Model 100 Cabinets
- 3 Model 106 Mixers
- 1 Model 107 Voltage Controlled Mixer
- 2 Model 110 Dual Voltage Controlled Gates
- 1 Model 111 Dual Ring Modulator
- 2 Model 112 Touch Controlled Voltage Sources
- 1 Model 114 Touch Controlled Voltage Source
- 2 Model 115 Power Supplies
- 1 Model 123 Sequential Voltage Source
- 1 Model 124 Patchboard
- 2 Model 140 Timing Pulse Generators
- 1 Model 144 Square Wave Oscillator
- 1 Model 146 Sequential Voltage Source
- 2 Model 156 Dual Control Voltage Processors
- 4 Model 158 Dual Sine-Sawtooth Oscillators
- 1 Model 160 White Noise Generator
- 1 Model 165 Dual Random Voltage Source
- 1 Model 170 Dual Microphone Preamplifier
- 2 Model 180 Dual Attack Generators
- 1 Model 190 Dual Reverberation Unit
- 2 Patch Cord Sets

Modular Electronic Music System No. 3

Three super-modules consisting of the following components:

3 Model 100 Cabinets
4 Model 106 Mixers
1 Model 107 Voltage Controlled Mixer
2 Model 110 Dual Voltage Controlled Gates
1 Model 111 Dual Ring Modulator
2 Model 112 Touch Controlled Voltage Sources
1 Model 114 Touch Controlled Voltage Source
3 Model 115 Power Supplies
2 Model 124 Patchboards
1 Model 130 Dual Envelope Detector
2 Model 140 Timing Pulse Generators
1 Model 144 Square Wave Oscillator
2 Model 146 Sequential Voltage Sources
1 Model 148 Harmonic Generator
1 Model 155 Dual Integrator
2 Model 156 Dual Control Voltage Processors
1 Model 157 Control Voltage Inverter
4 Model 158 Dual Sine-Sawtooth Oscillators
1 Model 160 White Noise Generator
1 Model 165 Dual Random Voltage Source
1 Model 170 Dual Microphone Preamplifier
1 Model 175 Dual Equalizer - Line Driver
2 Model 180 Dual Attack Generators
1 Model 185 Frequency Shifter
1 Model 190 Dual Reverberation Unit
1 Model 191 Sharp Cutoff Filter
1 Model 192 Dual Lopass Filter
1 Model 194 Bandpass Filter
3 Patch Cord Sets

Other Systems

The instrument complement of Modular Electronic Music Systems can be optimized to suit the requirements of individual composers or institutions. Systems have been designed to facilitate:

*advanced four-track tape composition
*processing and recording of live sounds
*live electronic music performances
*programming of complex multi-media environments
*instruction in basic electronic composition technique.

In addition to the instrumentation described herein, Buchla Associates can supply equipment for recording, sound reproduction, and programmed projection. Let us know your requirements -- proposals and cost estimates will be promptly submitted.

The following are representative of several modular instruments devised for controlling visual aspects of "total theater" compositions. All are mechanically and electrically compatible with the Modular Electronic Music System.

Model 311 SCR Driver

Ten channel unit transforms control voltages to 120 cps pulses for phase control of silicon controlled rectifiers. Each channel can control up to ten 1 kilowatt SCR units. Diagrams of suggested SCR circuits are provided; complete control units of various sorts are available.

Model 320 Dual Projector Controller

Enables control voltages to regulate the intensity of 35 mm. slide projectors. Slide changing (forward and backward) is accomplished with switches or externally applied timing pulses. Appropriately modified slide projectors (Kodak AV-900) are available.

Model 321 Cross Fader

Provides control voltages and pulses to a Model 320 Dual Projector Controller for "dissolving" one slide into another. Change may be initiated manually, through applied timing pulses, or automatically at a preset rate. Fade rate is variable from .5 to 20 seconds and may be voltage controlled. Display time (in the automatic mode) is variable from .5 to 20 seconds.

Model 350 Flash Source

A compact, powerful strobe unit with a variety of applications. Flash rate may be controlled internally, remotely, or through the application of a control voltage or timing pulses. Energy input to the xenon-filled tube is 30 watt seconds at low rates, diminishing to 10 watt seconds at the maximum rate of 15 flashes per second. Horizontal light distribution is 90°; vertical is 40°. Dimensions are 8" high x 14½" wide x 10½" deep; weight is 35 pounds. Remote control box and 50' connecting cable are provided.

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MODULAR ELECTRONIC MUSIC

PRICE INFORMATION JANUARY 1968

Model No.	Panel Units	Description	Price
100	0	Cabinet	$ 70.
106	1	Mixer	75.
107	2	Voltage Controlled Mixer	350.
110	1	Dual Voltage Controlled Gate	100.
111	1	Dual Ring Modulator	165.
112	0	Touch Controlled Voltage Source	310.
114	0	Touch Controlled Voltage Source	310.
115	0	Power Supply	100.
117	1	Dual Proximity Detector	250.
123	2	Sequential Voltage Source	280.
124	1	Patchboard	35.
130	1	Dual Envelope Detector	135.
140	1	Timing Pulse Generator	150.
144	1	Dual Square Wave Oscillator	190.
146	4	Sequential Voltage Source	460.
148	2	Harmonic Generator	950.
150	1	Frequency Counter	550.
155	1	Dual Integrator	225.
156	1	Dual Control Voltage Processor	95.
157	1	Control Voltage Inverter	95.
158	1	Dual Sine-Sawtooth Oscillator	200.
160	1	White Noise Generator	75.
165	1	Dual Random Voltage Source	175.
170	1	Dual Microphone Preamplifier	125.
171	1	Dual Instrument Preamplifier	125.
172	1	Dual Signal Leveler	190.
175	1	Dual Equalizer - Line Driver	165.
176	1	Dual Hiss Cutter	175.
180	1	Dual Attack Generator	140.
185	1	Frequency Shifter	420.
190	1	Dual Reverberation Unit	200.
191	2	Sharp Cutoff Filter	450.
192	1	Dual Lopass Filter	140.
194	1	Bandpass Filter	135.
195	2	Octave Format Filter	225.
196	1	Phase Shifter	140.
311	2	SCR Driver	250.
320	1	Dual Projector Controller	160.
321	1	Cross Fader	200.
350	0	Flash Source	600.
		Patch Cord Set	65.
		Complete System No. 1	2690.
		Complete System No. 2	5450.
		Complete System No. 3	8690.

The numbers in the "Panel Units" column indicate the relative space occupied in the cabinet by the corresponding modules. Total the number of panel units desired in a system and order one power supply (115), one cabinet (100), and one patch cord set for each 15 (or portion thereof) panel units.

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