

VCS3

by EMS

the new
instrument
for the new
music



The VCS 3 Electronic Music Studio is the result of two years collaboration between musicians and electronic engineers and embodies circuitry which cannot be equalled even by instruments costing four or five times its price. In designing this studio the musician's point of view has been kept constantly in mind; functions are labelled clearly, the sounds available are those most wanted by musicians and nearly all the variable controls follow a logarithmic law, which is the natural law of musical material, both in pitch and loudness.

VCS means Voltage Controlled Studio, and it is difficult to describe in a few words the remarkable qualities of this type of circuit. Briefly, the main function of each device can be controlled not only by means of a knob but also by applying a voltage to a special control input. This voltage may be derived from a steady direct current, or may be a low or high frequency AC; the device responds instantly. In terms of flexibility this enhances the possibilities of the studio enormously, because all outputs can be either signal and/or control outputs, although in practice some very low frequencies can be generated which are used only for control because they are well below the audible range. Thus a device may be made to influence one or several other devices, and may itself be influenced, and the complexities of such interactions are limited only by the imagination of the user. In addition, the control inputs can be operated by external sources (inputs are provided for this as well as for external signals), and the remoteness of these control sources is almost unlimited—a frequency, a level, a filtering, an amount of reverberation, can be controlled along half a mile of cable without the slightest trouble from hum or signal loss, because the line is carrying control and not the signal itself.

A glance at the specification below will show that to assemble the separate devices included in the VCS 3 would not only cost a great deal more, but would lack the overall complementing of design and the simplicity of operation built into this studio. Apart from this, the actual circuitry performs to a standard previously only obtainable from the most expensive and bulky laboratory apparatus, and is designed to give the maximum short and long term stability. The compact electronics are entirely solid state, giving high reliability with negligible maintenance and running costs, no warm up time and no excess heat. The whole instrument runs on low voltages (except for the mains input) and can be operated without the slightest electrical hazard.

The owner of a VCS 3 will devise for himself innumerable variations on its uses, but its design makes it particularly suited to the following applications:

(1) **As a complete unit in itself**, using its own internal speakers and needing no ancillary equipment. The range and quality obtainable from the necessarily small speakers is surprising, and if a mains outlet is available the machine can be enjoyed anywhere. The only loose items are the patch pins, and these have a neat and retentive stowage when not in use.

(2) **As an electronic music studio**, combined now with tape recorders and any extra monitoring or generating devices which the user may have. For example, if the composer wishes to designate particularly accurate pitches, the studio can easily be connected to a frequency meter. Four part chords are already possible, but more parts can be added from external oscillators. In conjunction with normal tape editing and montaging techniques, complex electronic music can be realised in permanent form using the VCS 3.

(3) **As a live performance instrument**. Its small size and modest weight make the VCS 3 easily transportable to any location, and its outputs will drive any standard amplifier system. The inputs will accept various kinds of air or contact microphone (the Company will be pleased to recommend suitable types), so that a live instrumental performance can be processed in dozens of ways, apart from the studio's contribution as an instrument in itself. A wide range of precise or random sounds can be obtained by using the manual controls provided. As well as the pin matrix and the knob controls these include an attack button, a joystick and pan controls, as well as the possibility of remote operation.

(4) **As a sound effects generator**. We are confident that the VCS 3 will appeal to recording, film, television and radio studios as an invaluable addition to their equipment. Its generators can create almost any sound effect at will, from wind and sea to percussive and machine sounds. It is eminently suitable for strange, unusual effects, and its excellent modulator and filter can be patched into any studio channel to process the sound being recorded or broadcast.

(5) **As a teaching aid**. The VCS 3 can demonstrate effectively and easily all the main acoustic phenomena, and will help teachers in schools and universities to impart much greater interest to such demonstrations. The sounds, simple or complex, are quickly set up, can be manipulated by the students, and are far more flexible and of better quality than prepared examples on tape and disc. An oscilloscope can be connected to the studio to demonstrate waveshape in the clearest possible way.

It is not too much to say that no serious worker in the field of sound, whether scientist, teacher, composer, performer or engineer, can afford to be without the VCS 3. Its modest size and cost conceal a truly remarkable range of useful and exciting applications, and a richness of aural experience which was previously possible only to owners of costly and elaborate suites of equipment.

SPECIFICATION

GENERAL

Power Supply : 220-240, or 105-115VAC, 50 or 60 cps. (battery operation is also possible—details on request).

Input Sensitivities : High Gain Inputs : 2 X 5mV AC into 600 ohms. Low Gain Inputs : (1) $\pm 50\mu\text{A}$ into $500\Omega \pm 2.5\text{VDC}$ or 1.8VAC (r.m.s.) into 50K.

(Although the studio is self-generating and no input is required to produce a very large range of sounds, high gain AC inputs are provided so that microphones and other audio signals can be fed into the studio, and high impedance DC inputs so that external control voltages may be applied).

Output : High Level Outputs : 2 X 10V into 50 ohms (without panning facility—normally a headphones output.)

Line Level Outputs : 2 X 2V into 600 ohms (with panning facility—normally for driving amplifiers, tape recorders, etc.)

DC Output : A control voltage can be brought out and applied to another device.

Monitor Speakers : Internal monitor speakers are fitted, driven by 1-watt amplifiers; their volume and frequency range is necessarily limited by their small size. They can be muted if not required.

Dimensions : 17 $\frac{1}{2}$ " (438 mm) high X 17 $\frac{1}{2}$ " (444 mm) wide X 16 $\frac{1}{2}$ " (419 mm) deep. The unit stands on small feet, and all external connections come in from behind. The width is specially chosen so that it can be permanently mounted in a 19" rack if desired, only simple brackets being necessary.

Weight : 22 $\frac{1}{2}$ lbs. (10.2 Kg.).

Finish : The cabinet is of solid afrormosia, and the bottom and back panels slide in grooves, so that the whole interior can be reached without complicated dismantling. The panel work is in heavy gauge aluminium with screen printed legending and a special plastic finish which enables temporary wax pencil marks to be made and easily erased. A strong vinyl slip cover protects the studio from dust and accidental damage when not in use.

SOURCES

Every sound source has level controls for each output. There are three voltage controlled oscillators with various waveforms. Two of them are primarily designed for audio signals, while the third has a frequency range extending far below the audio spectrum, and is intended principally for control. But all three can be used for either purpose, and oscillatory waveforms are available elsewhere as well. A combination of highly stable design and a stabilised power supply ensures a virtually drift-free performance from all three oscillators.

1. **Oscillator 1.** This has sine and ramp waveforms, and covers more than 1Hz to 10 KHz in one range, without switching. The two separate outputs can be mixed if so desired to provide a large range of timbres. Frequency control (as well as that of Oscillators 2 and 3) is by slow motion dial.

2. **Oscillator 2.** This generator has the same frequency range as Oscillator 1, and also has two outputs, but in this case the alternatives are square and ramp, and a shape control enables the waveform to be varied from an asymmetrical (short pulse and saw-tooth) through a symmetrical (square and triangle) to a mirror image asymmetrical with polarities opposite to those of the first position.

3. **Oscillator 3.** This has exactly the same waveform control arrangements as Oscillator 2, but has a specially low frequency range, extending from approximately 1 cycle every 40 seconds (.025 Hz) to 500 Hz. Thus very slow transitions of voltage control can be made.

4. **Noise Generator.** This has amplitude and colouration controls, so that various bandwidths of noise can be obtained at any level.

5. **Filter Used as Oscillator.** When the filter (see below) is adjusted so that it is self-oscillatory, it produces a very pure sine wave output. Both filter and oscillator functions cannot, however, be used at the same time.

6. **Trapezoid Output from Envelope Generator.** This output is available whether or not the attack/decay facility is being used. Normally a low frequency, it provides another shape of control waveform.

7. **External Sources.** Up to two simultaneous external sources (for example, a microphone and an external oscillator, or a second VCS 3 and a prepared tape) can be fed into the studio, where they can be processed with internally generated sources.

TREATMENTS

1. **Envelope Generator (Attack/Decay).** This device has four time controls—attack-time, on-time, decay-time (which can also be voltage controlled), and off-time. The off-time control can be set so that repetition is automatic at a wide range of speeds, or so that a button or external switch must be pressed to activate each cycle. As mentioned above (Source No. 6) the repetition frequency of this generator is also available as a trapezoid control waveform.

2. **Reverberation.** A spring reverberation unit has a reverberation/direct signal ratio which can be either manually or voltage controlled, as well as an output level control.

3. **Filtering.** A bandpass filter with manually controlled "Q" and manually or voltage controlled centre frequency. When the "Q" is sharpened beyond a certain point the circuit becomes an oscillator (Source No. 5).

4. **Ring Modulator.** This very advanced I.C. transformerless modulator has a high carrier rejection and low distortion. The only control needed is output level.

INPUT AND OUTPUT AMPLIFIERS

The input amplifiers (see general specification above) each have a level control on the panel. The two output amplifiers not only have tone controls as well as level controls, but can also be voltage controlled, so that amplitude modulation and automatic fades and crossfades can be applied. Pan controls, which cross one channel to the other, are available on the line outputs.

MONITORING AND PATCHING

A meter is provided which can be plugged to read any required parameter. It can be used to log AC levels accurately, or as a centre-zero DC meter to monitor subsonic waveforms which cannot be checked by ear. (If other indicating devices, such as an oscilloscope or a frequency meter, are available, it is a simple matter to connect them to the VCS 3.) The patching is by a 16 x 16 way pin-panel matrix, completely eliminating unreliable and untidy cord patching. As well as being clearly labelled in words, the matrix carries a letter and number code which is repeated on the panel near the appropriate control. Each of the 256 locations in the matrix board can therefore be designated by simple map reference (B12, G4 for example). In addition, perforated templates can be marked with selected locations and placed in position over the matrix board, making pin plugging literally child's play.

MANUAL CONTROL

As well as the attack/decay button mentioned above (Treatment No. 1), the studio is provided with a joystick which enables any two control parameters to be varied simultaneously with one hand, and the joystick is so placed that it and the button can both be operated by the right hand, leaving the other free for altering knobs or matrix plugging. In addition EMS will shortly announce a range of peripheral equipment, including a sequencer keyboard which it will be possible to add to an existing VCS 3 by simply plugging it in, a special socket having been provided for this purpose.

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