ROCKTONE

THE ROCKTONE is intended as a versatile aid for technicians working within the music industry, such as soundcrew, DJs and engineers, and provides a compact and robust unit which allows accurate adjustment of tone controls, graphic equalisers and crossover units of a PA system or disco amplifier. It allows correct tonal balance to be obtained by pinpointing irregularities in frequency response thus achieving a true-to-life sound system.

A sinewave is injected into the input of the amplifier/mixer of the sound system to be tested or adjusted. This signal automatically sweeps through the audio band (20Hz–20kHz), and by adjusting parameters such as the graphics, speaker combinations, position and direction, tape or phono de-emphasis etc, a superior sound may be obtained. This method, unlike expensive real-time bandwidth analysers, which need a display and precision microphone and pre-amp set-up, requires only a trained ear to set up a complete PA system in minutes, free of any spurious resonances and dropouts that may occur.

GENERAL

The Rocktone is based on two i.c.s—the XR2206 and the LM324 quad op-amp. The XR2206 is a high-quality waveform generator which can produce sinewave frequencies ranging from a fraction of a Hz to several hundred kHz, and which may be swept over a large range using an external current source or variable resistance.

The swept frequency output is buffered/amplified and inverted by two of the op-amps to produce a balanced line output of 0dB. The other two op-amps form a comparator and monostable which produce a reset mechanism enabling the circuitry to automatically sweep and resweep through the audio band at an adjustable rate.

OPERATION

The output frequency of the generator is proportional to the current drawn from pin 7 of IC1, given a fixed value of C3. This variable current is generated by TR1, the base current of this device being supplied by the charge stored on C4 via a limiting resistor, R2. The discharge time of C4 is determined by the setting of VR1. D2, D3 and R5, D4 in this path produce a rate of discharge that allows even time spacing between octaves, as the frequency sweeps across the audio band. The voltage on C4 is monitored by IC2a which compares this to a preset value, determined by D6 and the variable potential divider, R7 and VR4. When the voltage on C4 falls to about 0·7 volts, i.e. the base-emitter threshold of TR1, the output of IC2a goes high which triggers IC2b, the monostable. The current through TR1 is now at a minimum and thus the output frequency also falls to a minimum value.

The monostable time period (approx 10ms) is determined by R15, C6 and the hysteresis produced by R13 and R14. D8 clamps the inverting input of IC2b pin 6, to a diode drop below 0 volts. When the monostable is triggered IC2b is switched on, charging up C4 via R3, and D1 to D5 producing a constant charging voltage. D1 is introduced to prevent C4 from discharging via the charging path. TR1 consequently conducts and the output frequency rapidly increases to its upper limit, determined by R1. The frequency then sweeps down as described earlier.

The automatic sweep may be disabled, and the frequency set manually by VR2. S2a disables the comparator, while S2b discharges C4 and switches in VR2. Note that VR2 is connected in the 'anti-log' configuration.

IC2c acts as a buffer/amplifier, the gain set at −1/3 by R16, 17. IC2d acts as an inverter and together with the complementary output of IC2c produces a balanced output at 'line' level, about 2·2V pk–pk.

CONSTRUCTION

Assemble the p.c.b. in the usual order, i.e. resistors first, then capacitors and diodes followed by semiconductors and i.c.s using the component layout in Fig. 3 as a guide. Check the polarity and orientation of the i.c.s, diodes and capacitors before soldering. On the prototype unit C5 was mounted on the track side of the p.c.b., care must be taken to ensure that the compo-

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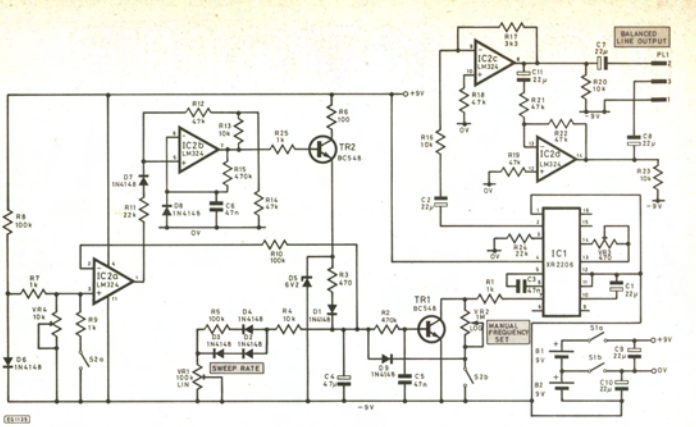


Fig. 1. Circuit diagram

nent body remains clear of the tracks. Once the p.c.b. has been assembled, solder in the connecting wires, battery clips and potentiometers, taking care to wire up VR2 in the 'anti-log' configuration, i.e. maximum resistance between the potentiometer connections in the 'off' position.

TESTING AND ALIGNMENT

Connect up the batteries and switch the unit on with the manual override control (VR2) set to 3/4 maximum. Monitor the output of IC1 (pin 2) with the aid of an oscilloscope and check that a 3V pk–pk 1kHz signal is present. If no signal is present, check IC1 and associated components.

Adjust VR3 for best sinewave purity, i.e. with least 'triangle ramping' distortion. Monitor the outputs of IC2c–d (pins 8 & 14), and check that there is just over 1V pk–pk of signal with respect to 0V and approximately 2·2V between outputs. If there is any variation check R16 and R17, and IC2d associated components. Adjusting VR2 should give a range of frequencies between 20Hz and 20kHz. Switch over to automatic sweep and monitor the falling frequency waveform with VR1 set maximum

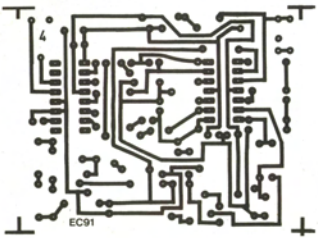


Fig. 2. P.c.b. design

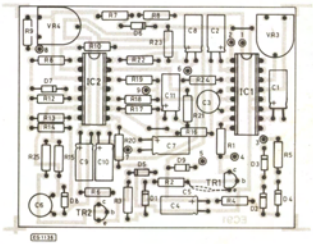


Fig. 3. Component layout

anticlockwise, i.e. slowest sweep rate. Adjust VR4 anticlockwise to decrease the lowest frequency output, which should be set at 20Hz. The sweep rate should be adjustable between about 5 and 20 seconds via VR1 and produce an even time span between octaves. If this is incorrect then check C4, TR1, VR1 and associated components.

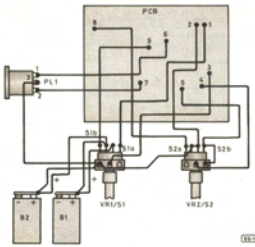
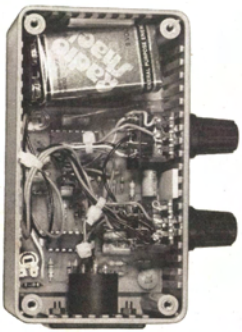


Fig. 4. Wiring details

USAGE

The PA should first be set up approximately using a vocal microphone or tape, the input equalisation being bypassed or set flat. Consideration should be given to the type of sound that is to be reproduced, thus providing a reasonable starting point for frequency analysis. The Rocktone can then replace the input to provide an accurate signal reference.

Using the Rocktone in its sweep mode and set to a long sweep time, the output of the speakers as affected by the acoustics of their environment can be heard. Careful attention to the volume



Final assembly showing p.c.b. in position

COMPONENTS . . .

Resistors

R1, R7, R9, R25	1k (4 off)
R2, R15	470k (2 off)
R3	470
R4, R13, R16, R20, R23	10k (5 off)
R5, R8, R10	100k (3 off)
R6	100
R11, R24	22k (2 off)
R12, R14, R18, R19, R21, R22	47k (6 off)
R17	3k3
All resistors ¼W 10%	

Capacitors

C1, C2, C6 to C10	22µ 16V electrolytic (7 off)
C3, C5	47n ceramic (2 off)
C4	47µ 16V electrolytic

Semiconductors

D1 to D4, D6 to D9	1N4148 (8 off)
D5	6V2 Zener, 400mW
TR1, TR2	BC548 (2 off)
IC1	XR2206
IC2	LM324

Potentiometers

VR1	100k Lin (miniature) plus dpst switch
VR2	1M Log (miniature) plus dpst switch
VR3	470 preset
VR4	10k preset

Miscellaneous

P.c.b. (see Constructor's note)
Case, about 40 x 65 x 180mm
PL11, XLR Series Connector, 3-pin plug
9V PP3 battery (2 off)
Battery clips (2 off)
Knobs (2 off)

Constructor's note

A complete kit of parts for this project is available from **Watford Electronics, 33 Cardiff Road, Watford, Herts (0923 40588).** The kit is priced at £19.95 including VAT and p&p.

present in the room as each frequency sweeps through will reveal resonances of loud peaks and weaknesses where response is poor or absorption is high. Output equalisation should now be readjusted to provide a smoother response. As the response becomes increasingly flat with adjustment, smaller variations will become audibly apparent. It is common with most sound systems to have frequency bands of particularly high irregularity, often at 100–300Hz, 1–2·5kHz, and at 5–6kHz as cross-over points, cabinets, drivers, filters and amplifiers peak. These points will produce a warbling sound during incorrect adjustment when swept.

Use should also be made of the manual frequency control facility to pinpoint the frequencies concerned, rolling the frequency back and forth over the band required. With some practice and attention to detail a smooth response will be obtained. As a final check, the whole band should be covered at a fast sweep rate. Professional use of this unit at major European and UK concerts has revealed several additional uses for the Rocktone. It has proved invaluable for testing speakers, filters, signal cables, channel and effects patching and in the workshop as a general purpose frequency generator. ★