

TECHNICAL REPORTS

Quad 33 Control Unit and Quad 303 Power Amplifier. Price: £98 complete. Manufacturer: The Acoustical Manufacturing Co. Ltd., St. Peters Road, Huntingdon, England.

Makers' Specification:

QUAD 33 CONTROL UNIT

Distortion: All controls level, 0.5V rms output with any input 0.02% } 30-10,000 Hz
Any control settings and any level within overload ratings 0.1% }
Residual noise: 0-30 phon weighting 15.7 kHz, bandwidth controls level or cancel -90 dB
Frequency response: Any input, any output, RIAA or flat as appropriate ± 0.5 dB 30-20,000 Hz.
Tone controls: ± 1 dB of published curves;
Bass control +16 dB, -16 dB at 40 Hz.
Treble control +14 dB, -13 dB at 10,000 Hz.
Filters: Within $\pm 5\%$ of published curves at 5, 7 and 10 kHz.
Inter-channel balance: Within 1 dB with volume control varied from maximum to -45 dB.
Balance control range: 9 dB either way.
Crosstalk: Dependent on input source impedances.
Replay/record typically better than 70 dB, 30-10,000 Hz.
Interchannel better than 40 dB, 30-10,000 Hz.
Inputs (all voltages rms):

		Recommended Source Impedance	Load Impedance	Input Level for 0.5V	Max. Input	Signal/noise
Radio		20K or less	100K	100mV	2V	85 dB
Tape Replay	H	Any	40K	1V	10V	85 dB
	M	Any	40K	400mV	4V	85 dB
	L	Any	40K	100mV	1V	85 dB
Disc	M1	Low output magnetic 0.5-2mV/cm/sec.	68K	2mV at 1 kHz	40mV at 1 kHz	70 dB
	M2	High output magnetic 1.5-6mV/cm/sec.	68K	5.6mV at 1 kHz	120mV at 1 kHz	80 dB
	C1	Ceramic 450-800 pF 25-80mV/cm/sec.	Special	100mV at 1 kHz	1.2V at 1 kHz	—
	S	For special requirements				0-30 phon weighting

		Level	Source Impedance	Recommended Load Impedance	Max. Cable Lengths (using 20 pF/ft. screened lead)
To power amplifier ..		0.5V	1K	10K or over	100 ft.
To tape recorder ..	H	100mV*	800 Ohms	25K or over	150 ft.
	M	20mV*	200 Ohms	Any	Any
	L	3.7mV*	180 Ohms	Any	Any

* For 30% programme modulation.

Weight: 6½ lb. (3 Kg).

Dimensions: 10½ in. × 3½ in. × 6½ in. free standing (260 mm × 92 mm × 165 mm).

Power input: 100-130/200-260V 50-60 Hz 1.5 Watts.

QUAD 303 POWER AMPLIFIER

The figures refer to measurements on either channel, with or without the other channel operating.

Power output and distortion (unrestricted bandwidth):
70 Hz 0.03% } Any level up to 28 Watts, 16 Ohm load.
700 Hz 0.03% } Any level up to 45 Watts, 8 Ohm load.
10 kHz 0.1%

Frequency response: -1 dB (ref. 1 kHz) at 30 Hz and 35 kHz into 8 Ohms.
-1 dB (ref. 1 kHz) at 20 Hz and 35 kHz into 16 Ohms.

Output source impedance: 0.3 Ohms in series with 2,000 μ F and 6 μ H.

Input level: 0.5V rms for 30 Watts into 16 Ohms.

Input impedance: 22 Kilohms in parallel with 60 pF.

Hum and noise: -100 dB below full output.

Interchannel crosstalk: 30-10,000 Hz, better than 60 dB, input 1K.

Stability: Unconditionally stable with any load.

Power input: 100-125/200-250V, 50-60 Hz.

40-200 Watts depending on signal level.

Weight: 18 lb. (8.2 Kg).

Dimensions: 4½ in. × 6½ in. × 12½ in. (120 mm × 159 mm × 324 mm).

Other applications: The amplifier may be used for any purposes into load impedances greater than 8 Ohms. Below 8 Ohms, applications should be restricted to music and speech reproduction or intermittent sine-wave duty.

In September 1953 Peter Walker, the Managing Director of the Acoustical Manufacturing Co. Ltd., introduced a revolutionary control unit and 15 Watts power amplifier that created a new standard in high quality reproduction. Not only did the Quad amplifier have technical features not previously explored but it also created a new style in presentation. Matching the control unit was an AM tuner. Later followed a FM tuner and a stereo control unit, but so right were the design parameters of the power unit that it has continued unchanged until now.

The Acoustical design team resisted the temptation to introduce a transistor amplifier

until they were convinced that its performance was a considerable improvement over their current design. The new control unit occupies the same space in the cabinet as its predecessors. One important difference is that the Quad 33 is self-powered, whereas the previous control unit derived its power from the power amplifier. Whilst the styling bears a strong resemblance to the earlier control unit it now has a strong rectangular motif finished in shades of brown with white and orange press-buttons.

The front panel carries the following controls: combined on/off switch with volume control, bass control, treble control and filter slope control. The volume control has a 1½ in. knob,

engraved on both its face and edge so that the setting can be viewed from any angle. The other variable controls are mounted flush with the panel and are thumb controlled. Below the volume control is a straight line control to adjust the balance between channels. The left-hand group of seven press buttons select the appropriate input signal source and mono or stereo functions. The buttons reading left to



Quad 33 Control Unit

right are mono left, mono right, stereo, disc, radio 1, radio 2 and tape. Below the tone controls are four further push-buttons to control filters starting at 5, 7 and 10 kHz. The fourth push-button cancels any setting of the bass, treble, slope and filter buttons and gives a straight-line response.

At the rear of the chassis are six DIN sockets, three-pin mains supply socket, 2 Amp. fuse, two mains output sockets and earth terminal. These are all mounted behind a cream plastic panel which carries a description of all the pin connections, etc., a commendable idea which simplifies interconnecting. Two DIN sockets are provided for Radio 1 and Radio 2, so that a FM tuner with or without stereo decoder can be permanently plugged into Radio 1 and an AM receiver, for example, can be plugged into Radio 2. Other sockets are for disc, tape record, tape replay and the output to the power amplifier.

In earlier Quad control units, external plug-in units were used to match pickup cartridge to amplifier. In the Quad 33 control unit a novel and ingenious plug-in printed

Quad 303
Power Amplifier



circuit board is used. The board carrying the compensation circuits is square and has printed edge connections on each side of the square. Depending on which side is plugged into the self-locating socket, the control unit is automatically corrected for low output magnetic cartridges, medium to high output magnetic cartridges, ceramic cartridges, and a fourth spare position which is unwired. This position can be used in the future for any new type of cartridge that may be introduced. The board is pushed home through a slot on the right-hand side of the rear panel and a neat, movable cover prevents the ingress of dust.

A second (tape) adaptor board provides compensation for three signal levels for recording and three levels for tape replay. This panel can only be inserted one way and carries two BC109 silicon planar epitaxial low noise transistor circuits. The emitter circuit of each channel has three tapings and, by locating a screw in the appropriate position, the board will cover the input and output requirements of any tape recorder.

Removing two 1 inch screws enables one to remove the screening cover and reveals one of

the finest examples of electronic construction in the field of audio. Three further plug-in printed circuit boards are seen—a twin channel pre-amplifier and separate left- and right-hand amplifiers. All the press-button switches are mounted directly on two printed circuit panels which carry all the input compensation components. In the centre of the chassis is the mains power supply transformer, rectifier and smoothing components. All the inter-panel wiring is excellently engineered and, if it was ever necessary to replace any component such as a ganged potentiometer, the neatly laced wiring automatically falls into position for re-wiring. With such a well-conceived and engineered piece of equipment, it is a pity that the screening cover cannot be made of Perspex! The variable controls are silky in operation and the press buttons require little effort.

The Quad 303 power amplifier is built on a substantial cadmium plated, steel chassis which carries at one end a die-cast, massive heat sink for the four output transistors. At the opposite end is another die-cast recessed panel carrying the mains voltage selector, fuse, input DIN socket, two pairs of loudspeaker sockets and input mains socket. Two decorative perforated covers prevent accidental damage and allow adequate ventilation. Removal of the top cover reveals a massive power transformer, four silicon rectifiers mounted on small heat sinks, four 2,000 microfarad electrolytic capacitors, two being used for smoothing and the others as output capacitors for the power amplifier channels. Below the chassis are three printed circuit boards, two for the driver amplifiers and the third for the stabilizing circuit. Again, to simplify possible servicing, the panels are hinged and held in position with snap clips. The harnessed wiring is extremely neat and in every way it is a first-class example of electronic engineering.

Silicon transistors are used throughout both units, twelve in the control unit, nine in each power amplifier channel and three in the power stabilisation circuit plus a total of fourteen silicon diodes and the mains supply bridge rectifier.

Performance tests

The accompanying graphs were measured with Bruel & Kjaer equipment and they are virtually identical with those published by the manufacturer. Taking the control unit first, harmonic distortion measured better than the specification at 0.014%, a remarkably low figure. Residual noise is inaudible and, with the controls set in the flat condition, signal-to-noise measured -86 dB. Measurements made on input sensitivity for an output of 0.5 V were as follows:

Radio, 92 mV; Tape replay, H = 1.2 V, M = 580 mV, L = 115 mV; Disc, M1 = 2.2 mV, M2 = 6.4 mV, C1 = 35 mV.

There is a very large factor of safety against overload. The power amplifier is fully loaded with 0.5 V input, yet each of the input channels can give an output of about 1.5 Volts before one reaches distortion.

Measurements on the Power Amplifier created a number of problems because the makers' claims, particularly for harmonic distortion at full power, are so low that normal equipment could not be used. First one requires quite hefty 8 and 16 Ohm load resistors so

Fig. 1. Quad 33 control unit frequency response and 5 kHz filter

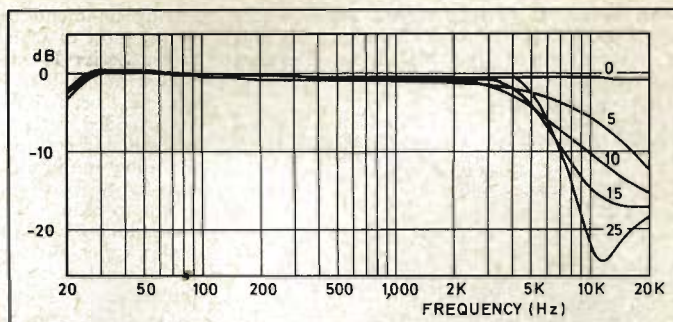
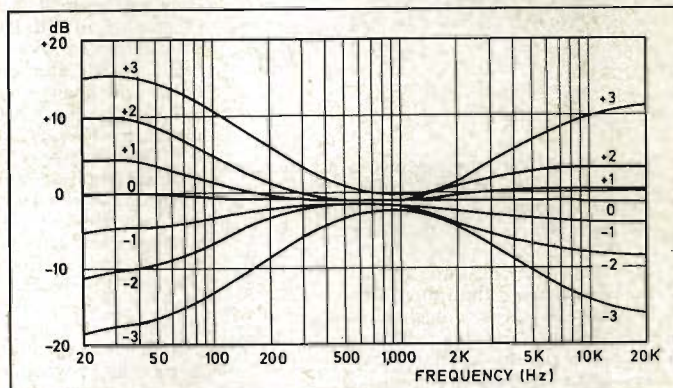


Fig. 2. Bass and treble tone control ranges



that, when driven at the full power of 45 Watts, they do not over-heat and exceed their nominal values. Second, many first-class audio oscillators have a harmonic content far in excess of the Quad equipment and it took a long time—and nearly £400—to find an oscillator with a guaranteed harmonic distortion of less than 0.005%. Such an instrument is the Dynamco Precision Oscillator which, when measured with the Radford Distortion Measuring Set DMS2, gave a figure of 0.003% total harmonic distortion. The following results were obtained:

70 Hz	0.03%	at 45 Watts into 8 Ohms.
700 Hz	0.035%	do. do.
10 kHz	0.09%	do. do.

The frequency response with an 8 Ohm load was flat within 0.6 dB from 30 Hz to 35 kHz and interchannel crosstalk measured -62 dB. Hum and noise measured -96 dB, which is well below audibility, and using a Tannoy Guy R. Fountain Autograph loudspeaker it is impossible to tell if the power amplifier is on or off. With the volume control fully on and the bass and treble controls level, no hum is audible, the only sound being a gentle background hiss. With the volume control set to normal, again the hiss completely disappears and one must rely on the illuminated "Quad" panel to confirm that the amplifier is on. Certainly this is the quietest equipment I have ever reviewed and I fail to see how anyone could improve on this aspect of the performance.

Having confirmed every part of the makers' specification, the obvious thing is to use it and assess its performance under listening conditions. One minor problem will confront persons changing over from other amplifiers. It has become conventional in the UK to use phono sockets for all input and output connections on control units and many tuners and pickup arms are terminated in this form of screened connection. The more expensive DIN plugs and sockets are standard continental practice and, with world markets in view, Quad have wisely adopted them for all input and inter-unit connections. The excellent instructional manual gives full details of their construction. It does mean that the purchaser will require to change the usual phono plugs for DIN plugs—which can easily be undertaken by a dealer.

With previous Quad control units, the pickup sensitivity was such that users of low output magnetic cartridges experienced some difficulty in fully loading the power amplifier. One such cartridge is the Shure V15 Mark II, with a rated output of 3.5 mV per channel at 5 cm/sec. Mounted in a SME arm with a Thorens TD124/II transcription turntable and a pair of Guy R. Fountain Autograph enclosures, this cartridge gave more than adequate domestic volume with the volume control only about one-third open, leaving an enormous reserve of power quite adequate for a large auditorium.

I liked the in-line slide control for balancing the stereo image. On the earlier control units this was a small lever concentric with the main volume control and it was possible to move it by accident, when adjusting the volume.

With any programme source—disc, radio, microphone or tape—the Quad control unit and power amplifier produced superb quality with a complete absence of distortion or background noise. It is very seldom that a reviewer finds himself in the position of not being able to find anything to criticise. I can only offer unstinted praise for the skilful design, both technically and in appearance. The valve-operated Quad range of equipment spanned some 14 years and, although in latter years one hoped at each Audio Fair to see a new model, one now knows the reason for the delay. Peter Walker and his design team saw no advantage in producing a transistorized system unless it offered positive advantages in every direction. They realized that, although it was possible to obtain high power outputs from transistors at small distortion, the distortion level increased as one reduced the volume to a quiet domestic level. With the Quad 33 and 303 they have succeeded in keeping harmonic distortion to 0.03% under all conditions and, in so doing, have bettered the performance of any valve-operated amplifier.

I see no valid reason why this Quad equipment should not still be in production ten years hence and so, for a few years, Peter Walker can rest content that he has produced one of the world's most superb amplifier systems—his only worry will be to produce enough to meet the demand.

JOHN GILBERT.

NEXT MONTH

The March issue will contain Part Two of the Specifications Survey, covering pickup arms. Technical Reports will include the new Revox A77 and the Grundig Hi-Fi equipment.