

The Acoustical Manufacturing Co. Ltd.
HUNTINGDON,
Cams.,
PE18 7DB.

Telephone No.: Huntingdon (0480) 52561
Telex: 32348 QUAD G

Quad is a registered trade mark

405 Current Dumping Amplifier Instruction Book

QUAD 405

Current Dumping Amplifier

INSTRUCTION BOOK

The Quad 405 is capable of very high output levels. Read this book thoroughly before connecting your loudspeakers.

CONTENTS

	<i>Page Number</i>
Preamble	
Packing	2
Service	2
Guarantee	2
Description	3
Specification	4
Installation	<i>Page Number</i>
Mains supply	7
Earthing (Grounding)	7
Fuses	8
Input connection	8
Loudspeaker connection	8
Loudspeaker protection	9
Output Limiter	10
Quad electrostatic loudspeaker	10
Loudspeaker phasing	11
Headphones	11
Heatsink temperature	12
Additional loudspeakers	12

The Acoustical Manufacturing Co. Ltd.,
HUNTINGDON,
Cambs.,
PE18 7DB.

Telephone No.: Huntingdon (0480) 52561
Telex: 32348 QUAD G

Quad is a registered trade mark

Packing

The amplifier is supplied with an input lead, mains connector, two voltage limiting resistors, and a spare mains fuse. The packing material comprises a two part expanded polystyrene shell and a cardboard carton and should be retained for re-use in case the unit has to be returned at any time.

Service

If servicing is required the amplifier should be returned to the supplier, to the agent for the country of purchase or to the Acoustical Manufacturing Co. Ltd. A brief note should be enclosed giving your name and address plus the reason for returning it.

Guarantee

This amplifier is guaranteed against any defect in material and workmanship for a period of twelve months from the date of purchase.

Within this period we undertake to supply replacement parts free of charge provided that failure was not occasioned by misuse, accident or negligence. Labour and carriage costs are not covered unless by local agreement.

Within the U.K. the guarantee offered with this equipment does not limit the consumer's existing statutory rights.



Description

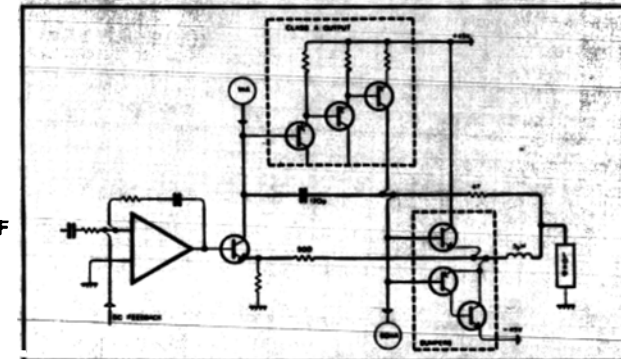
The Quad 405 is a two channel power amplifier primarily intended for use in high quality sound reproducing systems. The amplifier is usually used with a Quad control unit though other signal sources can readily be accommodated.

The amplifier uses a current dumping output circuit, a Quad invention which eliminates many of the problems associated with transistor amplifiers, and covered by patents in several countries.

In a current dumping amplifier there is in effect both a low powered very high quality amplifier and a high powered heavy duty amplifier. The low power amplifier controls the loudspeakers at all times, calling upon the high power section to provide most of the muscle. The small amplifier is so arranged – it carries an error signal – that provided the larger power transistors (the dumpers) get within the target area of the required output current it will fill in the remainder accurately and completely. The reproduced quality is *solely* dependent on the small amplifier which because of its low power can be made very good indeed.

Problems of crossover, crossover distortion, quiescent current adjustment, thermal tracking, transistor matching, all disappear. There are no internal adjustments or alignments and the choice of power transistor types is less restrictive.

SIMPLIFIED SCHEMATIC OF 405 AMPLIFIER SHOWING CLASS A, DUMPERS & BRIDGE COMPONENTS



QUAD 405 SPECIFICATION

Measurements apply to either channel, with or without the other channel operating

Power Output

The amplifier is intended for use with loudspeakers of 4–16 Ω nominal impedance.

Power and distortion for various frequencies.
Continuous sine wave into 8 Ω resistive load.

100 Hz any level up to 100 watts <0.01% D tot
1000 Hz any level up to 100 watts <0.01% D tot
10,000 Hz any level up to 100 watts <0.05% D tot

For other impedances and frequencies see graphs.

Notes:

- In addition to the performance into a resistive load R, the amplifier will maintain full voltage within the same distortion rating into a load $R \pm jX$ where X is any value from zero to infinity.
- With the additional power limiter inserted the maximum output voltage is limited to 20V rms \pm 10% (50 watts 8 Ω); all other performance figures unchanged.

Output Internal Impedance and Offset

3.3 μ H in series with 0.03 Ω
Offset <7mV.

Frequency Response

Ref. 1 kHz

Low frequency –1dB at 20 Hz. Filter attenuation as curve.

High frequency –0.5dB 20 kHz –3dB 50 kHz.

Signal Input Level

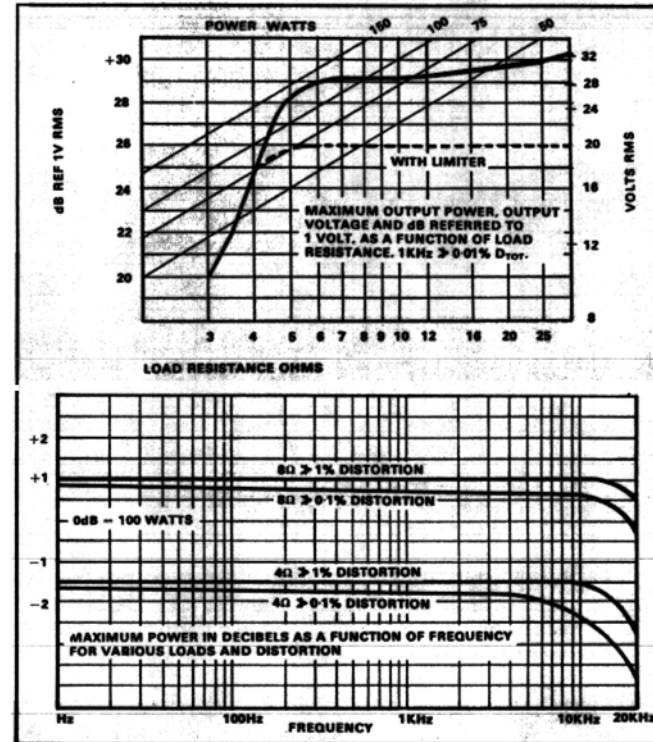
0.5V rms \pm 0.5dB for 100 watts into 8 Ω . Amplifier loads the input by 20k Ω in parallel with 220pF.

Signal Input Slew Rate Limit

0.1V/ μ S.

Provided the rate of change of input voltages does not exceed this figure and the amplifier is not driven into clipping, then the

total of all distortions appearing in the audio range (20–20,000 Hz) due to transient or repetitive waveforms with frequency components inside or outside the audio range will be at least 80dB below full rated power. If the major portion of the input energy is wanted signal then –80dB (0.01%) represents the maximum possible distortion on programme.



Signal Input Overload

Instantaneous recovery up to +20dB overload.

Crosstalk

(Input loaded by 1k Ω)
80dB @ 100 Hz
70dB @ 1 kHz
60dB @ 10 kHz.

Hum and Noise

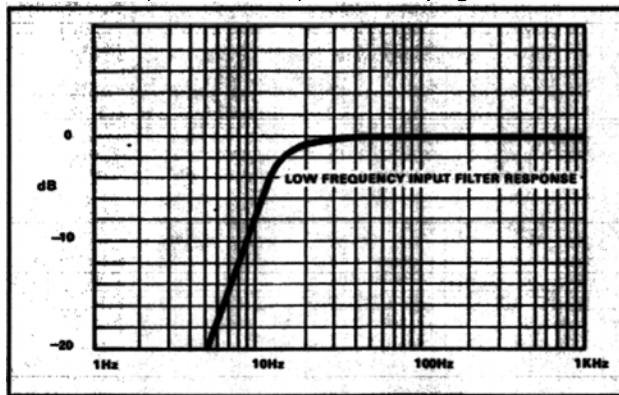
'A' weighted -95dB ref full power
Unweighted -90dB ref full power (15.7 kHz measurement bandwidth).

Protection

The amplifier is suitable for use under the most arduous music conditions and is electrically protected by current limiters; 7 amps in-phase current at peak voltage and 3½ amps at zero voltage. Shorting both outputs simultaneously on signal for an extended period (minutes) is not protected.

Stability

Unconditionally stable with any load and any signal.



Power Input

110-120-130V, 220-230-240V
50-60 Hz, 30-350 watts depending on signal level.

Dimensions

Height 115 mm (4.5")
Width 340.5 mm (13.4")
Depth 195 mm (7.7") allow an extra 38 mm (1.5") for plug and socket.

Weight

9 Kg. (20 lbs.)

INSTALLATION

The Quad 405 carries no controls and may be mounted out of sight in a cabinet or any other convenient location.

The Quad 405 is provided with a substantial heat sink, and must always be adequately ventilated, particularly if positioned in a cabinet or cupboard.

If used in close proximity to the control unit, tuner or magnetic cartridge, care should be taken to ensure that hum is not induced by radiation from the mains transformer of the 405.

Mains Supply

A mains voltage selector is fitted on the rear panel of the amplifier (except for CSA units), which has six positions and must be adjusted before the amplifier is connected to the mains supply. The operating voltage is indicated by the arrow-head above the voltage selector, the voltage selector being rotated to the required voltage.

Earthing (Grounding)

The supplied mains connector is terminated at one end by a two-pin plug. When the Quad 405 is used with a Quad 33 control unit, which should itself be earthed, the 405 will be earthed via the audio lead and should not be connected to the earth lead in the mains cable. In other cases, where the 405 must be earthed directly, a three-core mains lead should be used.



Fuses

In addition to the mains supply fuse on the rear panel of the amplifier, each channel is protected by two internal fuses, located on the printed circuit boards.

The main fuse is a 2.5 amp surge-resisting (2.5AT) type for 200–250 volt supplies while a 5 amp surge-resisting (5AT) fuse is required when operating with 100–125 volt supplies. In either case all four internal fuses are 4 amp quick blowing (4AF). To reach the internal fuses it is necessary to remove the top cover of the amplifier, by undoing the two retaining screws and sliding the cover about 10 mm, (0.5"), backwards before lifting it clear. Withdraw the mains plug before removing the cover.

The indicator lamp on the amplifier is powered from the +50 volt supply. If the indicator lamp is on, the main fuse must be intact, but illumination of the indicator lamp does not imply that the internal fuses are intact.

When the mains supply is drawn from the Quad 33 or similar fused source, the current rating of the source fuse should be the same as that of the main fuse of the 405. See above. The spare fuse packed with the amplifier may be used.

Note: Existing Quad 33's are fitted with 2AT fuses in 240V models and 4AT fuses in 110V models.

Input Connections

The input lead supplied with the Quad 405 should be used with signal sources other than the Quad 33. The phono plugs are marked L and R and should be connected to the appropriate output sockets of the pre-amplifier or mixer.

When used with the Quad 33 control unit, the standard four-pin Din/four-pin Din lead supplied with the 33 should be used.

For remote installation up to 30 metres of screened lead of 60pF/metre maximum capacity may be used.

Loudspeaker Connections

The Quad 405 is provided with spring loaded speaker terminals. 24/0.2 mm flex with a rating of 6 amps, or similar, should be used to connect the loudspeaker to the amplifier. For very short runs, up to five metres, 16/0.2 mm flex is permissible.

Each loudspeaker should be connected to its appropriate amplifier output so that the two pairs of wires are connected in the same way, to ensure that the speakers operate in phase. The output terminals are colour-coded to facilitate this.

Should there be any doubt the phasing can be checked later experimentally. (See Page 11.) Where one loudspeaker only is used for mono, either channel may be used and the terminals of the other channel left vacant. A dummy load resistor is not required.

In cases where loudspeakers, such as the electrostatic loudspeaker, also require an energising supply, the instructions provided with the loudspeaker should be followed.

Each loudspeaker should be capable of handling the full output of the amplifier, or the protection facility described below should be used.

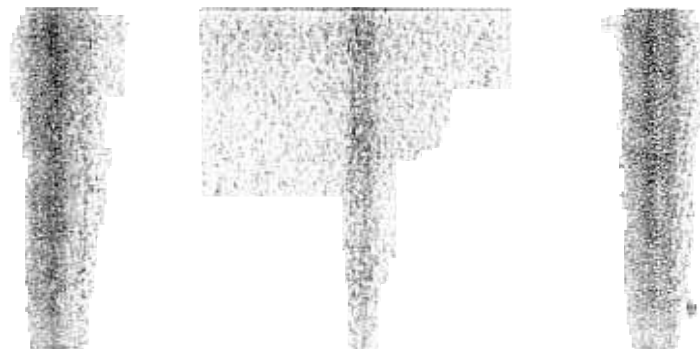
The red output terminals must not be connected in parallel.

Loudspeaker Protection

The loudspeaker manufacturer usually states a maximum recommended amplifier power for his loudspeaker. If this figure is below 100W (into 8Ω) then the limiter facilities provided with the amplifier should be fitted. Failure to do so may cause damage to the loudspeaker and infringe its guarantee.

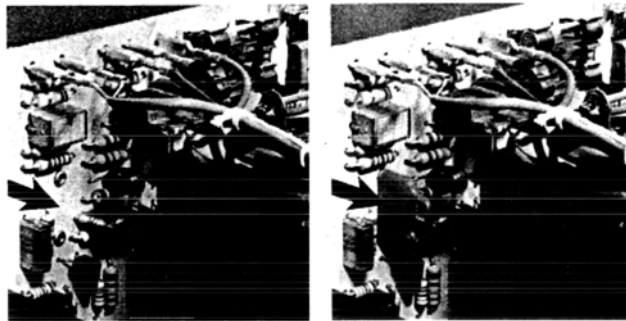
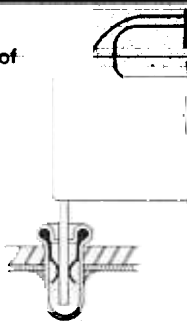
Maximum safe power for most loudspeakers is time and frequency dependent and so is difficult to define precisely for a music signal. Some manufacturers will permit their loudspeakers to be used with amplifiers exceeding the quoted handling capacity provided certain precautions are observed. This can sometimes be advantageous in enabling short duration high level peaks to be handled without overload. The advice of the loudspeaker manufacturer or his agent should always be obtained before embarking on such a procedure.

All amplifiers from serial no. 9000 are fitted with additional protection across the outputs, which short circuits under conditions likely to damage the speakers.



Output Limiter

To limit the output to 20 volts rms insert one of the shorting links supplied, in the sockets provided in each of the amplifier boards, as illustrated below. These sockets are spring loaded (see diagram) and the links should be pushed firmly home but not soldered. First withdraw the mains plug and then remove the top cover by undoing its two retaining screws, sliding the cover about 10 mm (0.5") backwards and lifting it clear. The adhesive label provided should be stuck on to the amplifier to indicate that the limiters have been fitted.



Quad Electrostatic Loudspeaker (except for ESL-63)

The Quad 405 amplifier should always have the voltage limiters in place when driving a single Quad electrostatic loudspeaker on each channel. When two such speakers are used on each channel (stacked pairs) they should be connected in parallel with the limiters in circuit.

Note:

Quad electrostatic loudspeakers prior to serial number 16800 (March 1966) need slight modification before being used with the Quad 405 unless they have already been modified for use with the Quad 303.

Loudspeaker Phasing

If there is any doubt about the way in which the loudspeakers are connected (see Page 9), their phasing may now be checked by playing a mono disc over both channels, when the sound should appear to emanate from a point midway between them. If this is indefinite the connections to either of the loudspeakers, but not both, should be reversed. Correctly connected the loudspeakers will give a definite centre sound source accompanied by a more full-bodied sound in the tenor and bass registers.

Headphones

Headphones should be connected to the Quad 405 outputs in place of the loudspeakers and a typical wiring arrangement is shown in Fig. (i). Any of the headphone switch units on the market will provide the necessary switching and many of them also provide for incorporating the resistors which adjust the signal level to suit most magnetic headphones. The Quad 405 does not require dummy load resistors.

Electrostatic or other types requiring a high level input should be connected in accordance with manufacturers' instructions.

The loudspeaker return leads (which may be commoned if necessary) must be taken to the black sockets and never to chassis or earth.

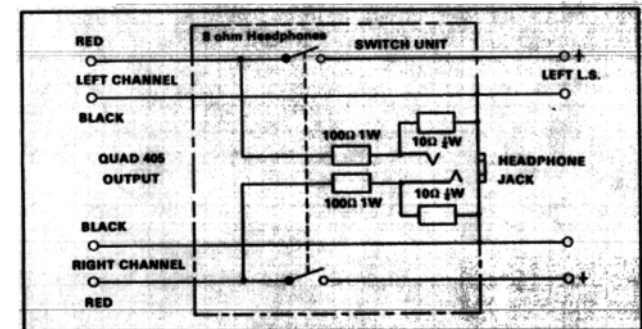


Fig. i

Heatsink Temperature

The current dumping circuit technique used in the Quad 405 enables extra robust transistors to be used without impairing programme quality and the amplifier can operate higher than normal temperatures without compromising reliability.

When operated at high power levels it is quite normal for the heatsinks to be hot to the touch.

Additional Loudspeakers

Fig. (ii) shows the switching arrangements if more than one pair of loudspeakers is to be used. The switch may be either of the rotary type or one of the proprietary switch boxes which are readily available.

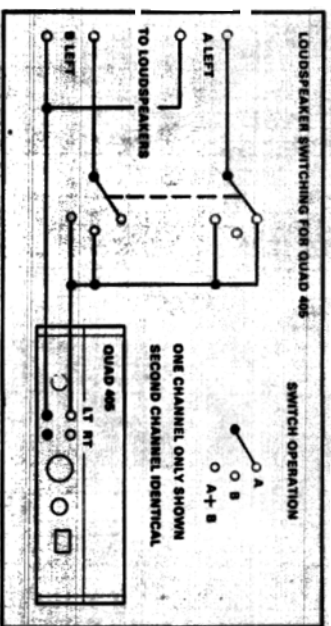


Fig. ii