ACTIVE POTENTIOMETER

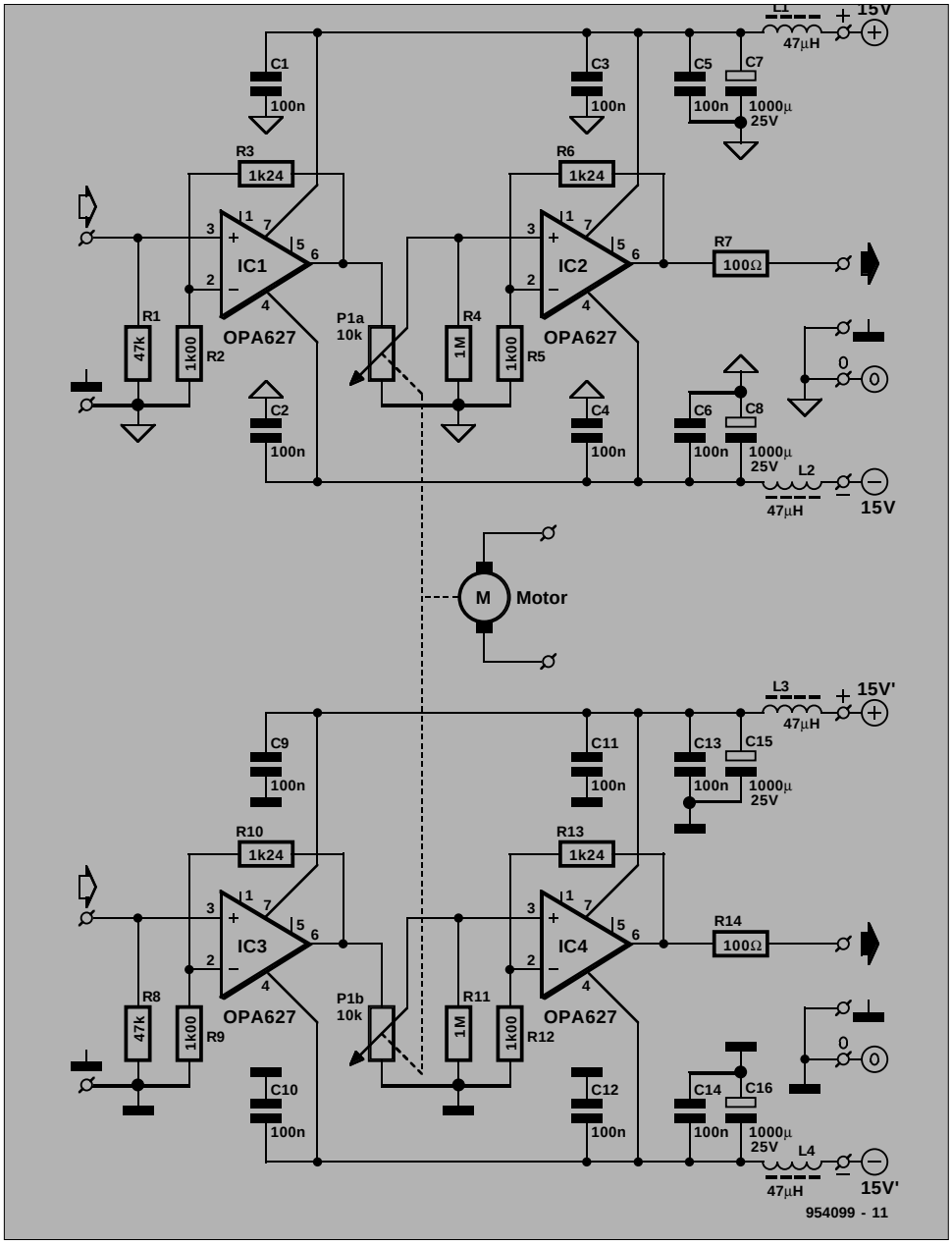
The potentiometer introduced by Panasonic a little while ago is of a quality exceeded only by the likes of the Penny & Giles potentiometer (which cost in excess of £ 100). The Panasonic devices have multilayer tracks made from conductive plastics and carbon, which are linked to the terminals by silver electrodes. The five-fold wiper is also made of silver and guarantees high accuracy (tracking within 0.8 dB) and smooth operation. In other words, this is an attractive, reasonably priced, high-quality volume control.

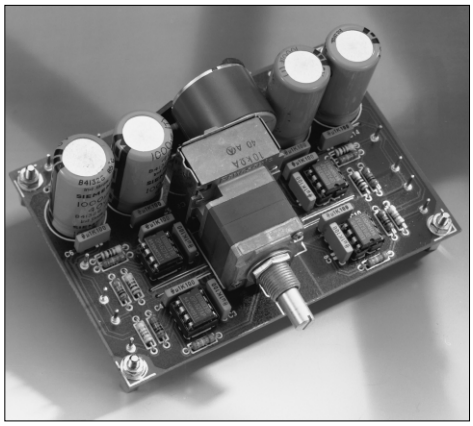
The potentiometer is a standard device which is preceded by an input amplifier and followed by an output buffer. It can be inserted into a line connection, so that appliances that have no volume control can be expanded to complete control amplifiers.

With the component values specified in the diagram, each op amp amplifies ×2.24 to give a total amplification per channel of ×5.This is sufficient to raise the line level of 200 mV to the standard output amplifier input level of 1 V. It is possible to alter the amplification to some extent, but it is advisable to carry any changes only to the buffer stages (IC_2 and IC_4). For example, the amplification of IC_2 is $1+R_6/R_5$. In most applications, this will do fine. With an input signal of 2 V (for instance, from a CD player), there is still a headroom of 6 dB.

If there is a need to add a selector switch at the input, R_1 and R_8 may be omitted. Bear in mind, however, that it must be possible for a bias current to flow.

The PCB allows the use of the Panasonic potentiometers and models from Alps, motor-driven as well as manually operated types. The board provides complete electrical isolation of the two channels. Moreover, signal earth and the negative supply line





have been kept as far apart as feasible: they are linked only at the buffer capacitors. These arrangements prevent any effect of decoupling currents on the signal quality.

Moreover, r.f. decoupling capacitors and chokes (L_1–L_4) in the supply lines prevent any spurious products entering the signal processing circuits.

The circuit is highly suitable for being combined with the IR volume control published earlier*.

Parts list

Resistors:
R_1, R_8 = 47 kΩ
R_2, R_5, R_9, R_{12} = 1.00 kΩ, 1%
R_3, R_6, R_{10}, R_{13} = 1.24 kΩ, 1%
R_4, R_{11} = 1 MΩ
R_7, R_{14} = 100 Ω
P_1 = 10 kΩ logarithmic stereo (motor-driven) potentiometer

Capacitors:
C_1–C_6, C_9–C_{14} = 100 nF
C_7, C_8, C_{15}, C_{16} = 1000 µF, 25 V, radial

Inductors:
L_1–L_4 = 47 µH

Integrated circuits:
IC_1–IC_4 = OPA627AP

Miscellaneous:
PCB order no. 954009 (see p. 70)

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Design by T. Giesberts
[954099]

Parameters
(measured with U_{in} = 200 mV and U_B = 15 V)

Nominal output voltage	1 V r.m.s.
Maximum input voltage	4 V r.m.s.
Maximum output voltage	9 V r.m.s.
THD+N	
(bandwidth 80 kHz, 1 kHz, 1 V out)	0.0011%
(bandwidth 80 kHz, 20 kHz, 1 V out)	) 0.0012%
THD	
(2^{nd} + 3^{rd} harmonic, 1 kHz, 1 V out)	0.00012%
(2^{nd} + 3^{rd} harmonic, 20 kHz, 1 V out)	0.00054%
Signal-to-noise ratio	
P_1 at max (22 Hz – 22 kHz)>	>106 dB (108 dBA)
0.5 V out (22 Hz – 22 kHz)	>94 dB (95 dBA)
Crosstalk	
(20 Hz, 1 V out)	–140 dB
(20 kHz, 1 V out)	–115 dB
(20 Hz – 20 kHz, 0.5 V out)	–75 dB
Tracking error P_1	
(up to –60 dB)	<0.8 dB
(–60 dB to –80 dB)	<1–3 dB
Bandwidth	
(0.5 V out	2.7 MHz
(1 V out)	9 MHz
Slew rate	19 V µs^{-1}
Current drawn per channel	
(4 V in)	15.5 mA