places the counters in the count-up mode to increment the output voltage. In contrast, when the tension developed by the muscle is greater than that desired, the counters are decremented. In this manner, the control voltage is adjusted to recruit the proper number of motor units to maintain the desired tension in the muscle. The counting speed is set by a 566 phase-locked loop voltage-controlled oscillator (IC2) which was wired with the same resistor and capacitor values as those chosen for IC1 in Fig. 2. To prevent the control voltage from oscillating quickly over and under that necessary for the muscle to maintain a given tension, the frequency of the clock is controlled by a control voltage from amplifier IC1. This amplifier slows the clock down to as low as 5 Hz as the muscle tension approaches that required while it speeds up the clock to as fast as 50 Hz when the muscle tension is far away from the desired tension.

A similar circuit is used to control the stimulation frequency. Since the frequency is to remain constant until all motor units are recruited, the only difference between the two circuits is that the counters in the frequency-controlling network are kept cleared until the output of the amplitude-controlling network reaches its maximum voltage as sensed by the carry output of IC9 on the amplitude-control module.

5 Conclusions

A simple digital–analogue hybrid stimulator design has been presented which can provide up to nine channels of sequential square-wave stimulation. The present design has a maximum voltage output of about 12V with a current capacity of about 25 mA. Although the current capacity of the output is low the operational amplifier used in the present design cannot be burned out by an overload since it is internally short-circuit protected. If larger currents or voltages are needed, an emitter follower can be added to the output stage, followed, if necessary, by a radio-frequency isolation transformer and output-voltage booster. The present design, however, works quite well for the stimulation of peripheral motor nerves or spinal roots where the output for supramaximal stimulation is usually less than 1 V and where the current is typically much less than 1mA (PETROFSKY, 1978, 1979).

The controller described will adjust the voltage and frequency in steps of 1/4096 of the maximum change in frequency and amplitude. However, for static exercise, this form of stimulation has been shown previously to offer excellent control of muscle throughout brief and fatiguing isometric contractions (PETROFSKY, 1978, 1979).

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Erratum

Adequacy of measurements in compartmental modelling of metabolic systems

R. F. Brown, E. R. Carson, L. Finkelstein, K. R. Godfrey and R. P. Jones (*Med. & Biol. Eng. & Comput.*, 1979, **17,** 216–222).

The following typographical errors occurred in the above paper:

on p. 221, the beginning of the line under eqn. 15 should read 'For subject APL (BROWN *et al.*, 1979), $K = 3\,688$ μmoles/l/h.'

in Table 2, the rate constant for a_{32}, h^{-1}, Fig. 4*b*, should be 1·71.