Microstim DBS Mk 3 Technical Description.

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Overview.

The Microstim DBS Mk 3 is a battery powered, hand held, nerve stimulator for use by anaesthetists. It can produce four stimulus pulse waveforms: T.O.F., D.B.S, P.T.C. and continuous 1 Hertz, each at an adjustable amplitude of up to 110 volts. A flashing LED indicates that pulses are being output and an audible clicking confirms that the pulses are being correctly delivered to the patient. There is a low battery-warning indicator. The unit is classed as Internally Powered, Type BF.

Design detail.

A 9-volt alkaline battery provides power, with D1 protecting against reverse battery connection. C2 and C5 minimise battery voltage droop due to the current surge as a pulse is being produced. Two separate capacitors are used both for space considerations and better circuit performance. To prevent accidental pulse output and unnecessary battery drain, the unit is only powered when one of the mode switches is pressed to select an output pulse.

VR1 is a standard 5-volt regulator with C8 and C4 providing stability and noise filtering. C3 holds up the 5-volt supply when the current surges could take the regulator out of regulation.

The PIC16F84 micro-controller is the heart of the design. It provides operating mode decoding via inputs RB4 – RB7, pulse timing, LED indication of pulses, pulse output drive to the power amplifier stage and audio confirmation of correct pulse delivery.

The PIC16F84 uses a standard design 4 MHz crystal oscillator to control all timings. The /MCLR reset pin is tied to 5-volts to use the PIC's internal reset generator. Pin 17 is used to drive the LED that shows pulses are being generated. Pin 9 is the pulse output drive pin to the power amplifier. Feedback from the output stage arrives at pin 1. When sufficient current passes through the patient's skin, pin 1 pulses high. This is detected by the PIC which operates the piezo sounder connected to pin 8, to confirm correct pulse delivery to the patient.

The output pulse amplitude from the Microstim is controlled by potentiometer RV1, which varies the drive to Darlington connected transistors TR1 and TR2. TR2 drives the two parallel connected transformers T1 and T2, which act as a step-up transformer. The maximum output into a 1k-ohm load is about 110 volts. Diode D2 clamps the spikes produced when TR2 switches off. The output pulses pass through the circuit comprising R6, ZD3 and C1 to provide feedback to the PIC. R6 limits the instantaneous pulse current whilst ZD1 limits the feedback pulse to 3.9 volts and C1 provides noise filtering.

The circuit comprising ZD1, LD1 (green), R2 and R1, LD1 (red) and ZD2 provide pulse indication and warning that the 9-volt battery is going flat as the indication turns from green, through yellow to red.