

Circuit & Design Ideas

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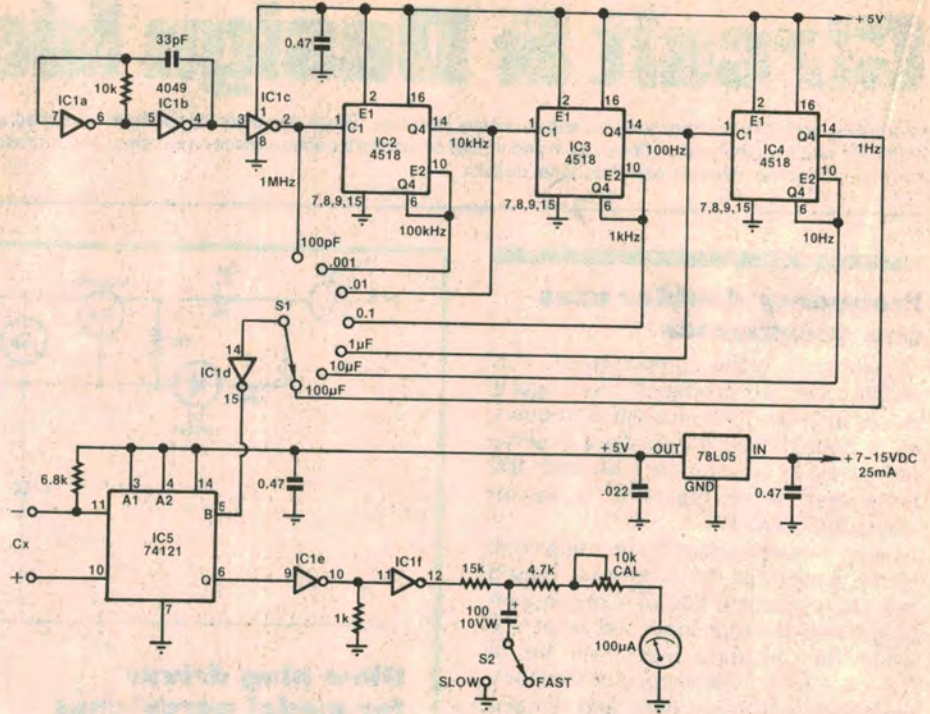
Wide range capacitance meter

Need a low-cost capacitance meter that covers the range 4pF to 100µF with high accuracy? This unit functions by averaging the value of a monostable pulse train with pulse width proportional to the unknown capacitance C_X and rate set by the frequency of a trigger clock. Other features include six-decade range switching and a linearly calibrated meter scale.

Unlike previous circuits published in EA, range changing in this circuit is accomplished by selecting different clock frequencies which are exact decade multiples. Calibration thus needs to be carried out only on one range using a known capacitance, the calibration for all other ranges then being automatically correct.

Gates, IC1a and IC1b form a 1MHz oscillator whose output is buffered by IC1c. From there, the signal is fed to three CD4518 CMOS dual decade dividers (IC2,3&4) while range switch S1 selects one of the seven available clock frequencies from 1MHz to 1Hz. The selected clock signal is then buffered by IC1d and fed to the trigger input of IC5.

IC5 is a TTL SN74121 monostable whose pulse width is set by the unknown capacitor C_X connected to pins 10 and 11. The monostable output pulse



train is taken from pin 6 and buffered by IC1e and IC1f to produce defined output logic levels of 0V and 5V. Finally, the signal is fed to an averaging network and then applied to a 100µA FSD meter via a 10kΩ calibration trimpot.

The meter inertia provides sufficient smoothing on most ranges to provide stable readings, but additional filtering on the 10µF and 100µF ranges is

necessary. This function is performed by the 100µF capacitor. Switch S2 switches out the capacitor on the lower ranges to avoid a slow response time or problems due to leakage current.

Construction is straightforward but take care to minimise stray capacitance to IC1e and IC1f.

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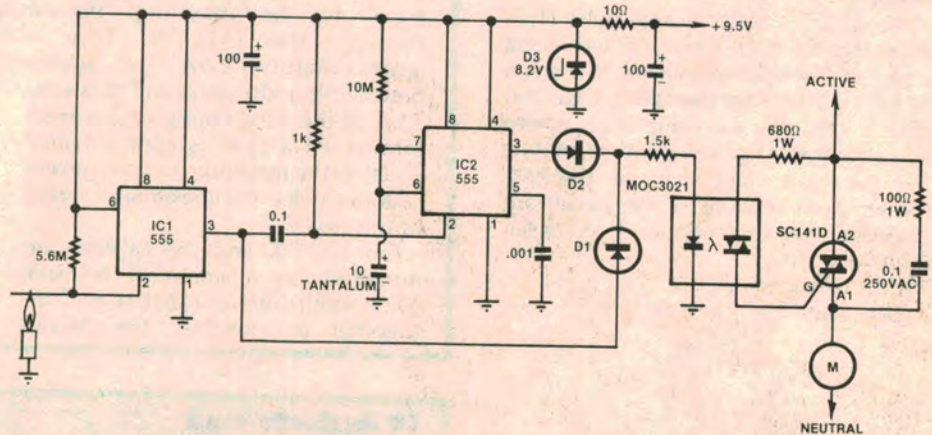
Flame detector circuit controls booster fans

Most gas space heaters are equipped with booster fans that operate continuously. The problem is that the booster fan in some designs can be quite noisy or can become noisy with age. This flame detection circuit alleviates the problem by turning the fan on only when it is required – ie, when the main heater flame is on.

Here's how it works. IC1 is a 555 timer IC used here as a comparator. When the main flame is on, pin 2 of IC1 is pulled low and thus its pin 3 output is high. This, in turn, triggers the SC141D Triac via a MOC3021 optocoupler and so the fan motor runs for as long as the flame is present.

IC2 is a 555 monostable delay circuit that keeps the fan running for 132 seconds after the main flame has gone out. When the heater thermostat cuts off the flame, pin 3 of IC1 goes low and triggers IC2 via a 0.1µF capacitor. Pin 3 of IC2 is high during the monostable period and thus the fan will continue to run during this time.

After about 132 seconds, the 10µF tim-



ing capacitor of IC2 reaches $2/3V_{CC}$ and the pin 3 output goes low. The fan motor now turns off and remains off until the heater thermostat turns on the heater flame once again. Diodes D1 and D2 form a simple OR gate to isolate the outputs of the two 555 timers from each other.

Construction of the circuit is straightforward, but take care with the mains wiring to the Triac and the fan motor. A piece of tungsten wire should be used for the flame detector, while

power for the circuit can be derived from a plugpack supply.

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Editorial Note: As a source of tungsten wire, we suggest a standard electric light bulb which has been broken but with the stem preserved to support the filament. Solder connections can then be made easily to the socket. The life of the filament may not be long under these conditions because it is exposed to air.