Circuit & Design Ideas

Ignition advance for alternative fuels

To obtain reasonable engine performance with alternative fuels such as LPG or CNG, it is necessary to advance the spark ignition, compared to that required for petrol.

This circuit has been proved on the bench and can be connected between the points and a transistor-assisted ignition, or used with the TAI shown (from the December 1979 issue of EA).

All commercial electronic ignition designs for alternative fuels actually delay the spark, so it is necessary to set the points up with the required advance for LPG (or CNG, compressed natural gas) and switch in the delay when using petrol.

A feature of this design is that the points can be set as for the manufacturer's specifications for petrol and then the advance introduced for LPG or CNG.

Therefore it is not necessary to keep moving the points to tune the motor on gas. The advance can be preset or switch-selectable and, in the event of failure, the unit can be bypassed for the engine to be used on petrol.

The concept is to use two counters clocked by a common oscillator. The first counter, IC6, counts up between two successive openings of the points. The contents of IC6 are then transferred to the "down" counter, consisting of ICs 8, 9 and 10. IC6 is then reset and the cycle begins again.

When the down counter reaches zero the output is used to switch the TAI and hence deliver the spark.

Provided that the counters are both clocked at the same rate, there is no spark advance.

To advance the spark, it is necessary to clock the "up" counter at a slightly lower rate. This means that it will have a lower count at the time its contents are transferred to the "down" counter. The down counter then reaches zero in a shorter time and hence advances the spark.

To provide adjustable advance, 4527 BCD rate multipliers, IC4 and IC5, are used. These divide the clock oscillator by a proportion set on their programmable inputs, either by preset links or thumbwheel switches.

IC4 is the most significant multiplier and would normally be set to multiply by 0.9 whereas IC5 is the least significant, giving an adjustment from 0.9 to 0.99. The amount of advance in degrees depends on the number of cylinders of the engine.

For a four-cylinder engine, the points open twice per revolution and so the counter contents represent 180 degrees. The BCD rate multipliers provide a resolution of 1% (1-0.99, etc) which is therefore 1.8 degrees of advance. For example, to give 14.4 degrees of advance (over and above the normal petrol ignition advance) the rate multipliers would be set to a value of 0.92. To get this rate, IC4 would have pins 14 and 3 (A & D inputs) and IC5 would have pin 15 (B input) high.

The master oscillator (IC7) is set at a nominal frequency to ensure that the up counter does not overflow at very low engine speeds. Note that any drift in the frequency has no effect because the up and down counters are locked together.

The points are filtered and trigger a monostable (IC1a). This removes the reset from IC2 which then generates the load pulse to store the up counter contents in the down counter and then the reset for the up counter. Finally, it also resets monostable IC1a.

IC3 forms the selector to switch in the advance. When the CNG line is high, the output of the down counter is selected, to trigger the TAI or monostable as shown. During starting, or when not on CNG, the points are switched to the output via the monostable.

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Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.