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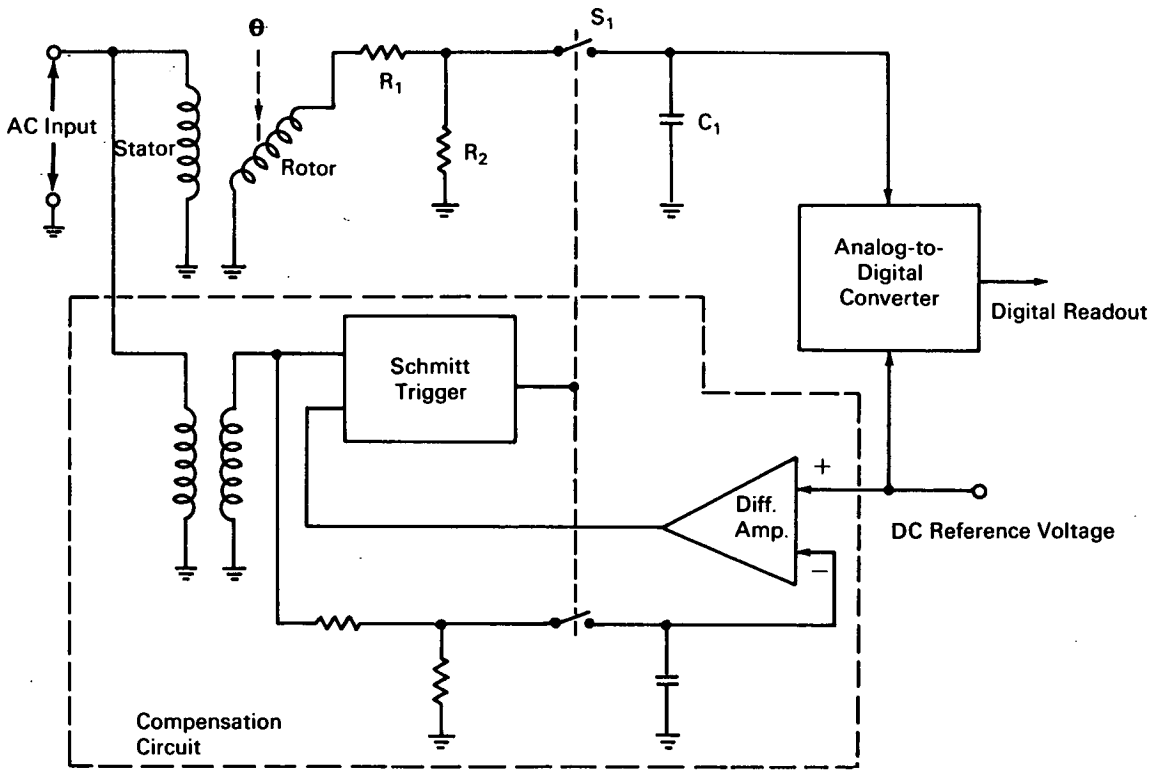
Brief 66-10436

# NASA TECH BRIEF



## Shaft Encoder Presents Digital Output




### The problem:

To design a circuit that gives a digital indication of the position, at any given time, of a mechanical shaft.

### The solution:

A circuit that includes compensation circuitry to time a capacitance relative to a reference voltage so that a digital presentation occurs that is representative of the positional condition of the mechanical shaft being monitored.

### How it's done:

The monitored shaft (represented by θ in the figure) drives a variable ratio transformer rotor. The transformer stator is excited by a sine wave ac input. Voltage across the rotor winding is applied to a voltage divider $R_1$, $R_2$ and then a sampling and averaging circuit consisting of $S_1$ and $C_1$. Capacitance of $C_1$ is sufficiently large so that the time constant of $C_1 - R_1 - R_2$ is substantially longer than a half cycle of the ac excitation input. In typical operation, $S_1$ may be

(continued overleaf)

closed during the half cycles of one polarity of the excitation waveform and open during the half cycles of opposite polarity so as to rectify the input voltage. This dc voltage, stored across $C_1$, is applied to the digital-to-analog converter that compares it with a dc reference voltage and provides a digital representation of their ratio in the form of binary coded pulses. Compensation circuitry adjusts the timing of $S_1$ so that the averaging function varies in a manner to compensate for any change in the ac excitation input with respect to the dc reference voltage so that the digital output is independent of both.

**Notes:**

1. This circuitry may be employed in multiples to furnish binary encoding of a number of rotating devices simultaneously.
2. Inquiries concerning this invention may be made to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B66-10436

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D. C. 20546.

Source: Donuil Alan Hillis
of Hughes Aircraft Company
under contract to
Jet Propulsion Laboratory
(JPL-SC-191)