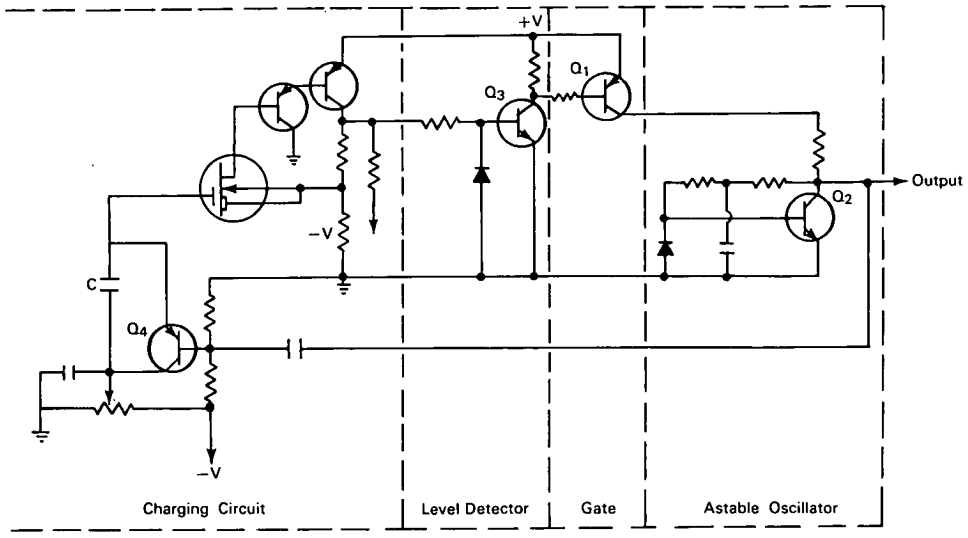
NASA TECH BRIEF

Sensitive Electrometer Features Digital Output



The problem: To design an electrometer that will measure very low currents (10^{-6} to 10^{-12} amperes) and produce a digital output linearly related to the magnitude of the input.

The solution: A four-stage, transistorized electrometer consisting of a charging circuit, a level detector, a gate, and an astable oscillator, plus a feedback loop to reset the charging circuit.

How it's done: The gate transistor Q_1 is normally not conducting and prevents the positive supply from being applied to the astable oscillator Q_2. The astable oscillator, therefore, generates no output. When an input current is applied to the circuit, capacitor C starts to charge. When the charge on C reaches some predetermined level, the level detector Q_3 is triggered. The level detector turns the gate Q_1 on and a positive voltage is applied to Q_2, which generates an output pulse. The trailing edge of this pulse is fed back to Q_4, which turns on and discharges C, returning it to zero charge level. The level detector Q_3 is no longer energized and the gate Q_1 turns off. This process is repeated, producing a series of pulses from the oscillator Q_2. Because the time required for C to charge depends on the magnitude of the input current, the frequency of the output pulses from Q_2 is a direct indication of input current magnitude.

Notes:

1. This circuit eliminates the need for a logarithmic compression network, a temperamental feature of prior circuits.
2. This electrometer will permit advantage to be taken of the capabilities of state-of-the-art sensors in very low current ranges (10^{-6} to 10^{-12} amperes).

(continued overleaf)

Previously, data at levels 10^{-10} amperes or lower have been lost.

3. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland, 20771
Reference: B65-10206

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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