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# NASA TECH BRIEF

## Manned Spacecraft Center



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### Polarographic Carbon Dioxide Transducer Amplifier

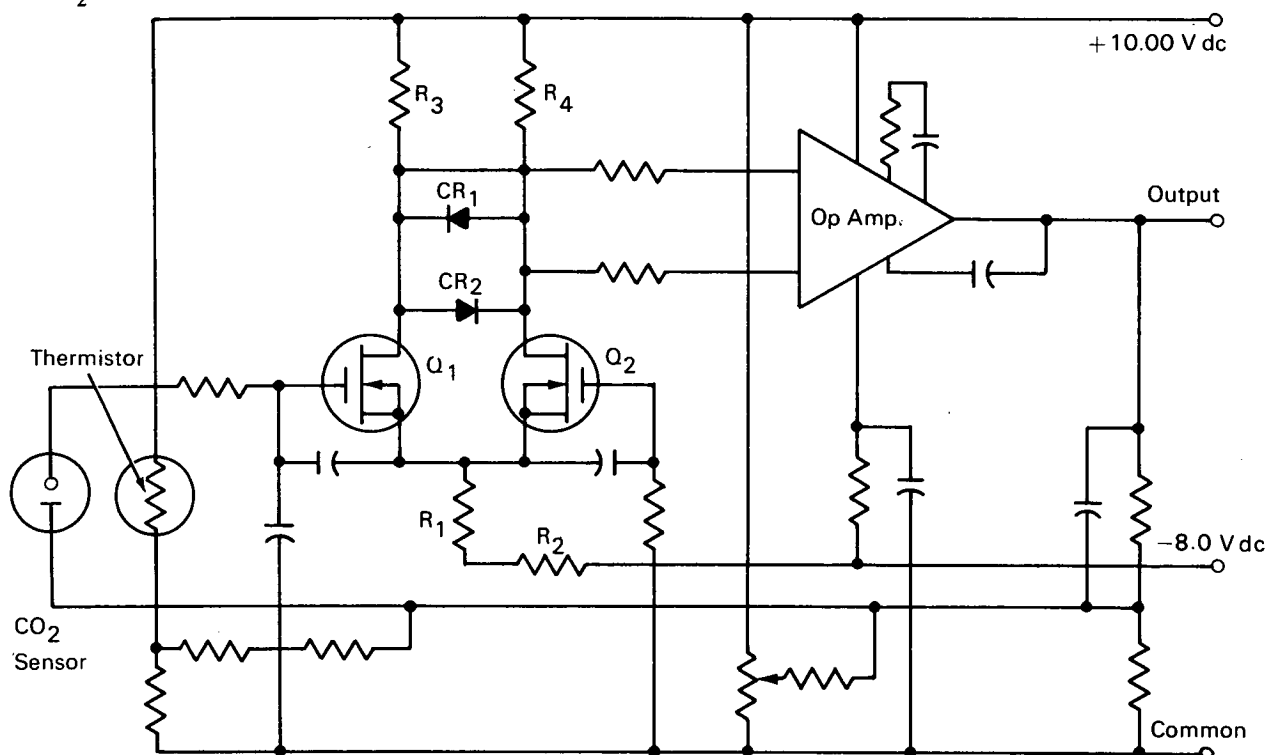
#### The problem:

To devise a means of amplifying the output from a carbon dioxide sensor. The electronic amplifier must have long-term stability, high input impedance (greater than  $10^{12}$  ohms) and a temperature coefficient which will compensate for large drifts in the CO<sub>2</sub> sensor.

ance and long-term stability. Temperature compensation is provided by a thermistor in a feedback loop.

#### How it's done:

Transistors Q<sub>1</sub> and Q<sub>2</sub>, a matched pair of N-channel, depletion mode, insulated-gate field-effect



#### The solution:

An electronic amplifier containing a matched pair of metal-oxide semiconductor field effect transistor (MOSFET) devices which have high input imped-

ances, form a differential input with a dc gain of 15V. Resistors R<sub>1</sub> and R<sub>2</sub> control the total emitter current; and resistors R<sub>3</sub> and R<sub>4</sub>, which divide the total current between Q<sub>1</sub> and Q<sub>2</sub>, de-

(continued overleaf)

termine the total dc gain; and diodes  $CR_1$  and  $CR_2$  protect the operational amplifier from excessive differential voltages caused by turn-on transients, input transients, and output overloads. The voltage supply requirements for the circuit are 10.0 Vdc at 3.0 mA, and 8.0 Vdc at 2.0 mA.

The overall temperature coefficient, referred to the input, is  $12 \mu\text{V}/^\circ\text{K}$  from  $288^\circ\text{K}$  to  $308^\circ\text{K}$ , and  $20 \mu\text{V}/^\circ\text{K}$  from  $273^\circ\text{K}$  to  $323^\circ\text{K}$ . An important design feature of this circuit is the operation of the matched input transistors at or near the zero-temperature coefficient point, resulting in superior temperature tracking.

**Note:**

Requests for further information may be directed to:

Technology Utilization Officer  
Manned Spacecraft Center, Code JM7  
Houston, Texas 77058  
Reference: TSP71-10090

**Patent status:**

No patent action is contemplated by NASA.

Source: Gerald Stillman of  
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