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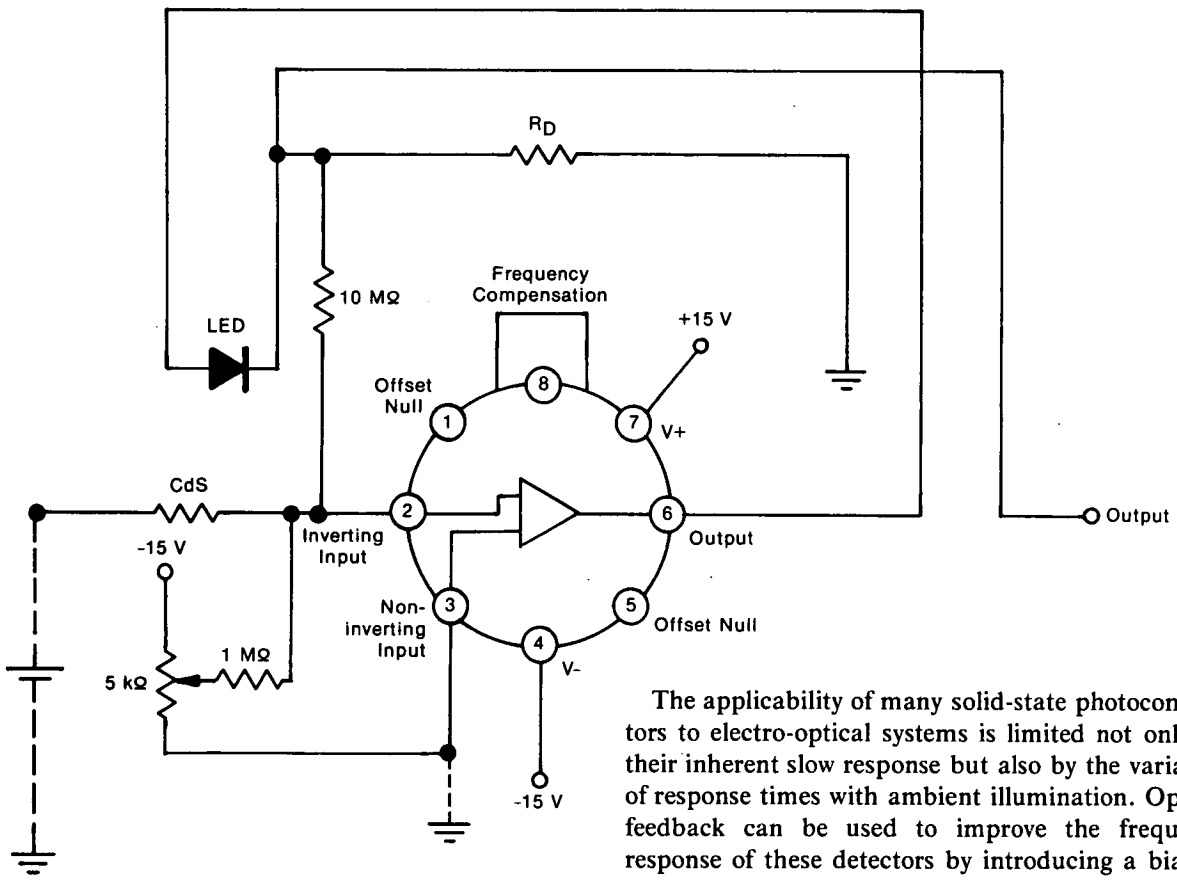
NASA TECH BRIEF

Langley Research Center

Optical Feedback Technique Extends Frequency Response of Photoconductors



Schematic Diagram of Optical Feedback Circuit

A new optical feedback technique extends the frequency response of cadmium sulfide and renders it useful at frequencies orders of magnitude above the internal 3-dB frequency of the photoconductor. This can improve many solid-state photoconductors used in electro-optical systems, as a primary limitation has been their slow response in converting varying light intensities into electrical signals.

The applicability of many solid-state photoconductors to electro-optical systems is limited not only by their inherent slow response but also by the variation of response times with ambient illumination. Optical feedback can be used to improve the frequency response of these detectors by introducing a biased, negative-feedback light signal so that the photodetector is stimulated by both the signal radiation and the feedback signal. The use of negative feedback allows a tradeoff between signal gain and signal bandwidth, and as long as the dominant noise in the system is that from the photoconductor, basic signal-to-noise ratios are unaffected.

The optical feedback circuit (see schematic diagram) basically consists of a high-gain light-to-voltage converter with the frequency-limited nonlinear photoconductor (CdS in this case) inside the feedback

(continued overleaf)

loop. The feedback element is a visible light-emitting diode (LED) with a light-out versus current-in characteristic that is linear over several decades.

The optical feedback maintains, or attempts to maintain, a constant summed input and feedback light on the CdS. This maintenance of operating point is useful, since simple frequency compensation of CdS is impractical because its internal 3-dB frequency is ambient illumination dependent. The optical feedback stabilizes the operating point and hence the effective response time of the CdS, which permits simple frequency compensation.

Notes:

1. The following documentation may be obtained from:
   North Carolina Science & Technology
   Research Center
   P. O. Box 12235
   Research Triangle Park, North Carolina 27709
   Single document price $3.25
   Reference: NASA TN D-7727, Some Aspects of Optical Feedback with Cadmium Sulfide and Related Photoconductors
2. Technical questions may be directed to:
   Technology Utilization Officer
   Langley Research Center
   Mail Stop 139-A
   Hampton, Virginia 23665
   Reference: B75-10223

Patent status:

NASA has decided not to apply for a patent.

Source: Stephen J. Katzberg
(LAR-11768)

Categories: 03 (Physical Sciences)
01 (Electronics - Components and Circuitry)