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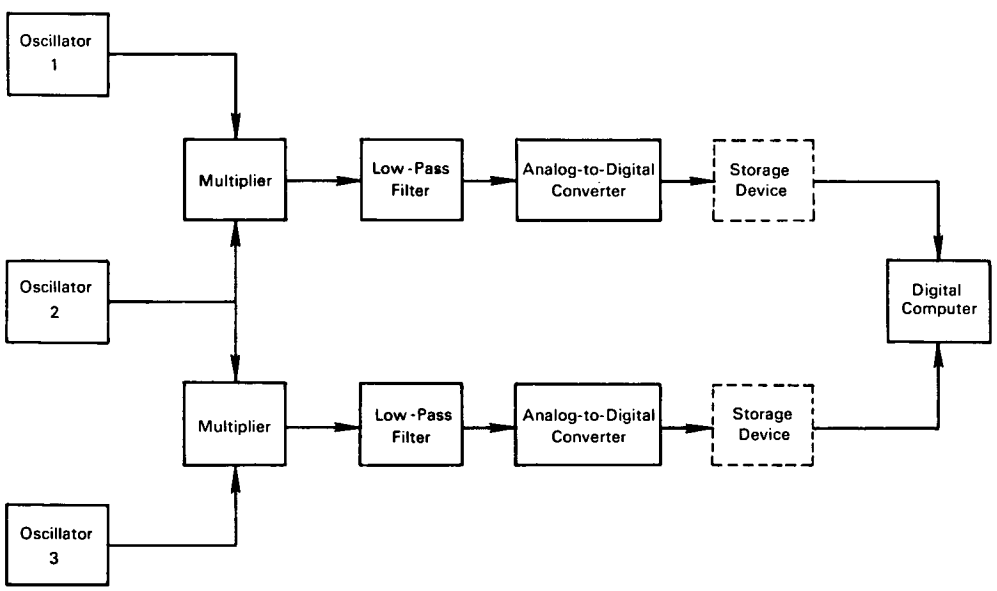
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

Computer Determines High-Frequency Phase Stability



The problem: Determining phase stability of a high-frequency (30 Mc) signal using a computer. In narrowband, phase-locked receivers, optimum band-pass design requires a knowledge of the signal source phase stability in order to provide the best signal-to-noise ratio possible. Present computers are not useful at high frequencies and a reliable reference source of known phase stability, in the same frequency region, is normally unavailable.

The solution: A discriminator-type circuit that uses two auxiliary oscillators, multipliers, and low-pass filters, in cross correlation with the oscillator producing the signal of interest. The products are converted to digital data and may be stored or fed directly to the computer.

How it's done: Two oscillators (1) and (3) are used, having characteristics (center frequency, input/output impedance, etc.) similar to those of the oscillator (2) producing the signal of interest. The output signal from (2) is independently multiplied by the output signal from each of the auxiliary oscillators (1) and (3) in separate multipliers. The ouput signals from the multipliers, containing the sum and difference frequencies of (1) and (2) and of (2) and (3), lose their higher frequency components to the low-pass filters. The remaining signal is digitized in the analog-to-digital converters and fed either to a storage device, such as a tape recorder or card punch, or directly to the computer. The computer is programed to compute the cross-correlation function of the two

(continued overleaf)

derived signals and determine its frequency distribution by taking its Laplace transform. This frequency distribution of the cross-correlation function is equivalent to the spectral power distribution of the signal of interest and from it the equivalent phase instability of the oscillator under investigation is derived.

Notes:

1. This technique may be used as a very accurate substitute for a high-grade reference oscillator.
2. For further information about this innovation inquiries may be directed to:
   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B63-10555

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

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(GSFC-113)