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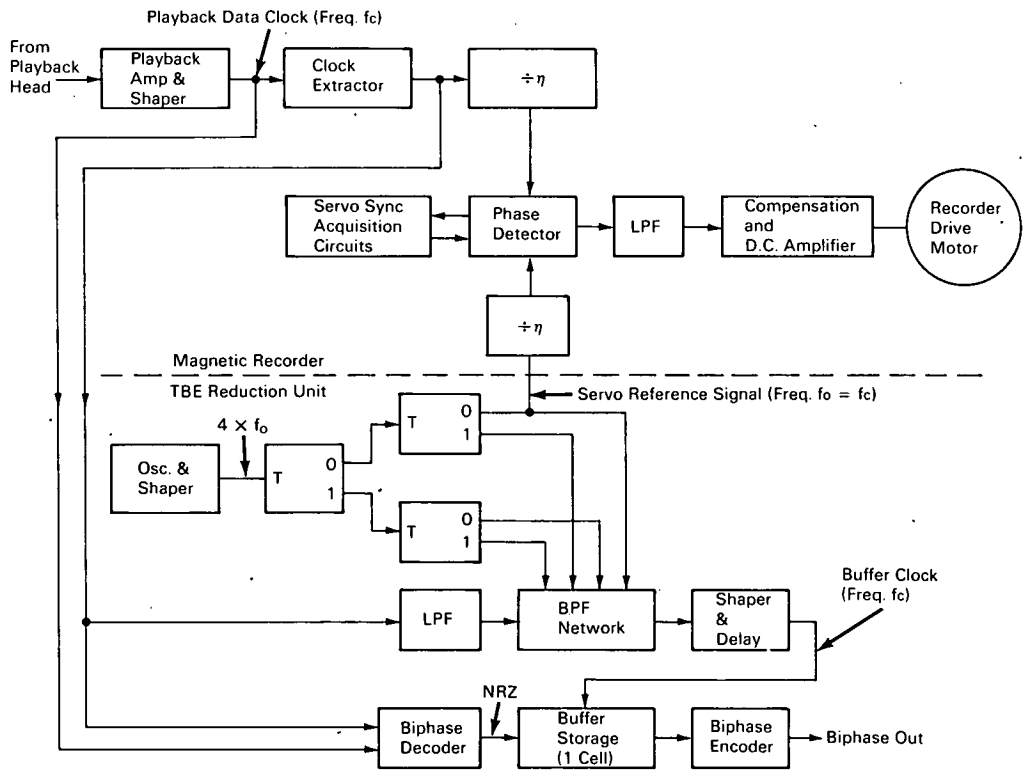
NASA TECH BRIEF

Method of Reducing Time Base Error in Digital Magnetic Recorders



An apparatus for the reduction of time base error (TBE) in the playback of digital data from a certain class of magnetic recording equipment is described herein. The TBE of a signal is defined as the dynamic phase deviation of the signal from an extrapolated long term average phase. The apparatus was developed for a magnet which employs a servo position control of the tape by which the playback data clock is phase locked with a fixed frequency reference signal. The peak-to-peak TBE of the playback data of the recorder must be less than the period of a data bit for the apparatus to function properly.

The accompanying figure shows a block diagram of the system. The playback data is in biphase form and the clock is extracted from it. The TBE in the data (and clock) is a result of angle modulation caused by tape speed variations. The clock signal is passed through a very narrow bandpass filter which has a center frequency equal to the nominal (average) playback data rate. The filter band limits the clock signal and in so doing effectively removes harmonic components and the angle modulation sideband components

(continued overleaf)

except those with frequencies very nearly equal to the nominal data rate. The resulting signal has a lower degree of angle modulation and therefore a reduced amount of TBE. For effective TBE reduction, the bandwidth of the bandpass filter must be very small. Also it is essential that the frequency corresponding to the nominal playback data rate lie in the passband region of the filter where the attenuation and phase shift are negligible. The use of a fixed frequency filter is not practical due to the stringent requirements which would be imposed on the center frequency tolerance and the drift characteristic.

The filter employed is one in which the center frequency tracks the frequency of the servo reference signal. Since the extracted clock is phase locked to the servo reference signal, the nominal data rate lies in the center of the filter's bandpass region. The filter is of a type sometimes referred to as a digital filter. It employs a synchronous modulator–demodulator type of circuit which translates the amplitude and phase characteristics of a low pass filter which are symmetrical about zero frequency by an amount equal to the modulation frequency, which in this case is the frequency of the servo reference signal. The output of the filter is squared and delayed to obtain the proper phase for reclocking the data. The playback data is converted to NRZ and fed to a signal cell buffer storage unit where it is held until transferred out by the processed clock. The TBE of the buffer output is equal to that of the processed clock. The data is then reconverted to biphase form.

The advantage of the system described over one in which the buffer output clock is obtained from the servo reference signal by delaying it is that the phase difference between the data and buffer output clock is independent of the phase difference between the playback data and servo reference signal. Any changes in the mechanical load on the servo motor resulting in a change in the phase difference between the servo reference signal and playback signal will not cause changes in the clocking points of the signal from the buffer in the system described.

The advantage of this system as compared to others for achieving TBE reduction is that the system requires less circuitry. In cases where the worst case peak-to-peak TBE is greater than the period of a data bit, a buffer of increased capacity is required.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland 20771
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No patent action is contemplated by NASA.

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of Electro-Mechanical Research, Inc.
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