NASA TECH BRIEF

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Low-Distortion Receiver for Bilevel, Baseband PCM Waveforms

The problem:

Common receiver designs in pulse-code modulated (PCM) digital communication systems consist of high-gain, saturating differential amplifiers with level-shifting circuits, to convert transmission-line signals to standard logic levels. These receivers also include auxiliary circuits for detection and discrimination between information signals and spurious signals. Often these receivers are equally responsive to both information and spurious signals, which increases the difficulties in extracting encoded information and the likelihood of data errors.

The solution:

A new digital receiver was developed which improves discrimination between information signals and noise and provides an order of magnitude reduction in systematic distortion.

How it's done:

This receiver combines the advantages of a band-limiting prefilter and high-amplitude thresholds to provide asynchronous discrimination between information signals and spurious signals. It minimizes systematic
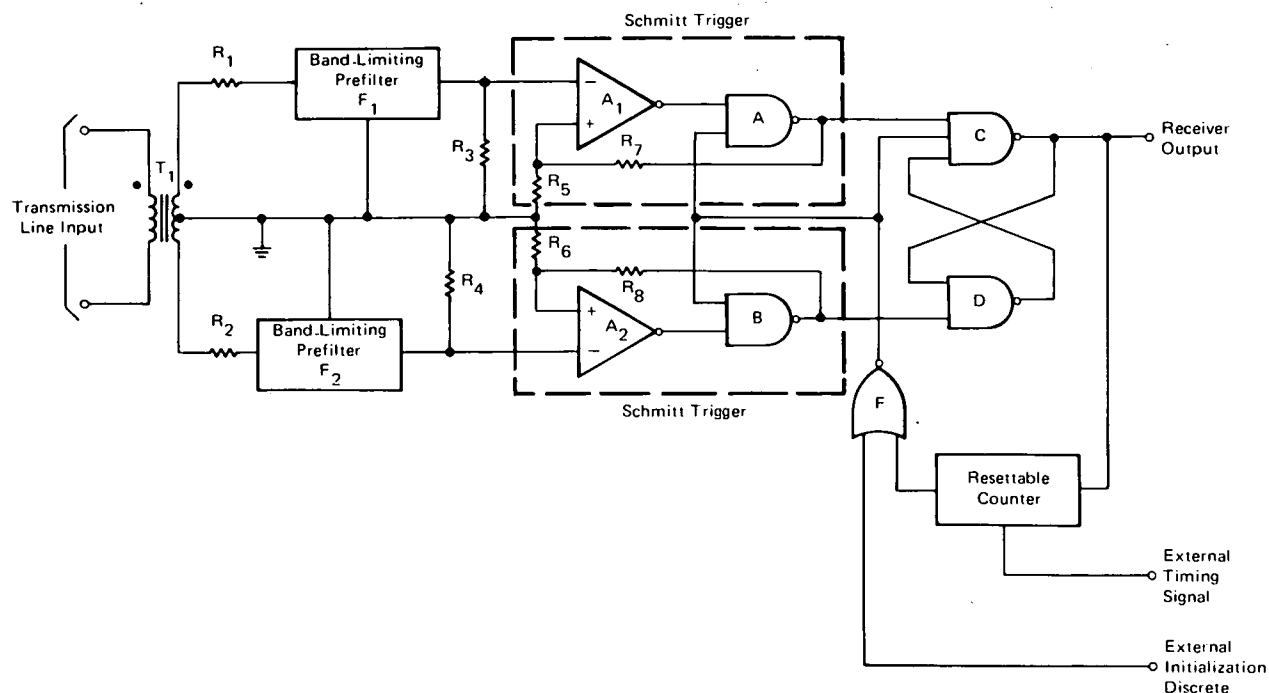
Low-Distortion Receiver

distortion by a unique configuration that cancels those factors which cause it. The threshold circuit converts filtered signals to standard logic levels and has a hysteresis characteristic for stable performance at threshold-level signal amplitudes. The design also attenuates baseline wander of the received signal and features an automatic reset capability.

In the diagram shown, the transmission-line signal is coupled into the receiver by transformer T_1, to provide dc isolation between the line and the receiver and rejection of common-mode voltages. The inputs to the prefilters, F_1 and F_2, are of equal amplitudes and opposite polarities.

Resistors R_1, R_3, and R_2, R_4 are source and termination matching impedances for the two filters. In the absence of power-supply voltages, these resistors also provide a proper load reflected across the transmission line, to prevent excessive mismatches in multiterminal systems. The prefilters are designed to limit the high-frequency response of the communication channel, in order to provide a standard waveform characteristic at the detector input. The necessary filter characteristic can be realized with an RC, LC, or RLC type of low-pass filter network, with a cutoff frequency of 0.6 to 0.8 times the inverse of the minimum information waveform pulse width.

Each of the two filtered signals is applied to a Schmitt-type trigger circuit for the conversion of filtered signals to standard logic levels. Each Schmitt trigger circuit is comprised of a differential amplifier, a NAND gate, and a two-resistor feedback network. The resulting hysteresis characteristic provides threshold detection level stability. The bilevel outputs of the two trigger circuits are combined in an RS-latch to provide a single serial output stream.

Note:

Requests for further infomation may be directed to:
Technology Utilization Officer
Johnson Space Center
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Reference: TSP74-10025

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:
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