D I G I T A L F R E Q U E N C Y D I S C R I M I N A T O R

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This article presents a non-linear digital frequency discriminator, that is, its output is not proportional to its input, like the sound discriminators in FM detectors, for example, but a '0' or '1', if the frequency is greater or smaller than certain standard frequency.
This is much useful in the case of FSK signal detectors, where it exist both 'mark' and 'space' frequencies, for instance, RTTY signals.
In Figure 1, the input signal is supposed rectangular and activates the retriggerable monostable with characteristic time **τ**. As it is retriggerable, its output **Q** will be 'high' while the input signal period is smaller than **τ** and 'low' in the opposite case. This first output enters the D input of a type "D" flip-flip with the same rectangular pulses sequence as its clock input. The result is the output Q of the flip-flop, which is 'high' if the input period T is smaller than the characteristic time **τ** and 'low' in the opposite case.
In this sense, the circuit is, indeed, a period discriminator, not a frequency one.
Figure 2 shows a possible implementation of this method using circuits of the CMOS series.
Figure 3 shows an interface to be used when the available signal is sinusoidal (normal FSK case).
For the correct operation of the CMOS, it is necessary that such a signal be converted to the rectangular shape.
The interface amplifies the signal and defines a threshold above what the conversion to the rectangular shape occurs. This decreases the noise influence and avoids that the latter triggers the CMOS when no sinusoidal signal is present

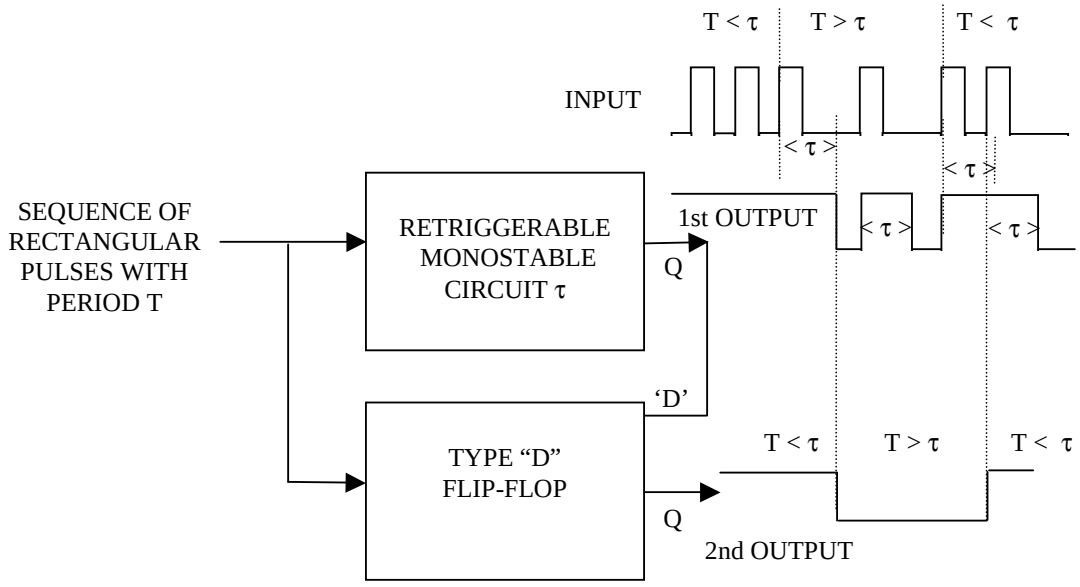

Figure 1

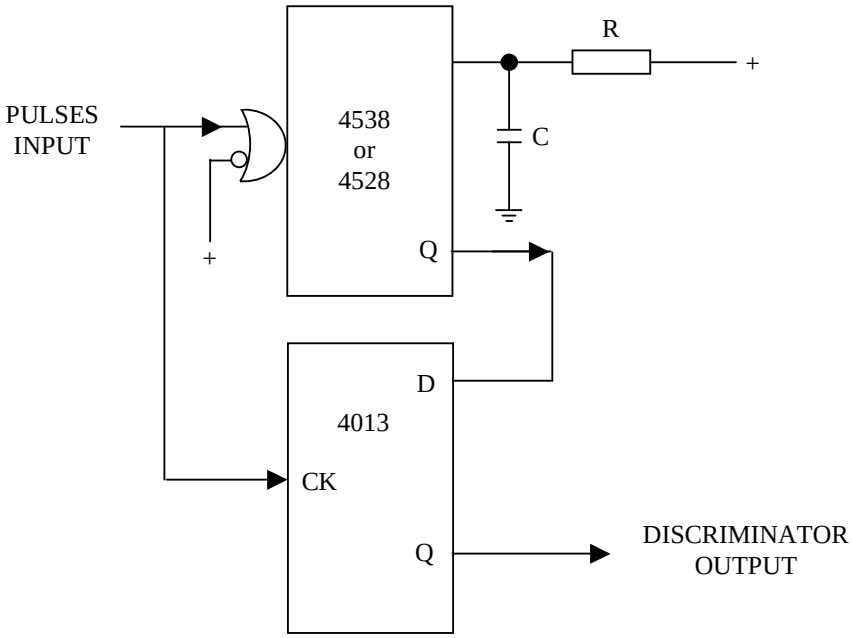

Figure 2

R e **C** in Figure 2 define the value of **τ** that must be chosen accordingly the desired use. The final output is shown as the signal **Q**, but depending on the case, the signal $\overline{\mathbf{Q}}$ may be used. The shown iput of the monostable is positive transitions sensitive, but grounding this input, the signal may be connected to the negated input and the circuit will be, then, negative transitions sensitive.
The monostable circuit may be the CD4538B (MC14538B) or the CD4528B (14528B), depending on the desired value of **τ**. Each one has its own lowest and highest limits for **τ** and, therefore, their datasheets must be consulted. The 4538 has a better quality and precision and must be used whenever possible.

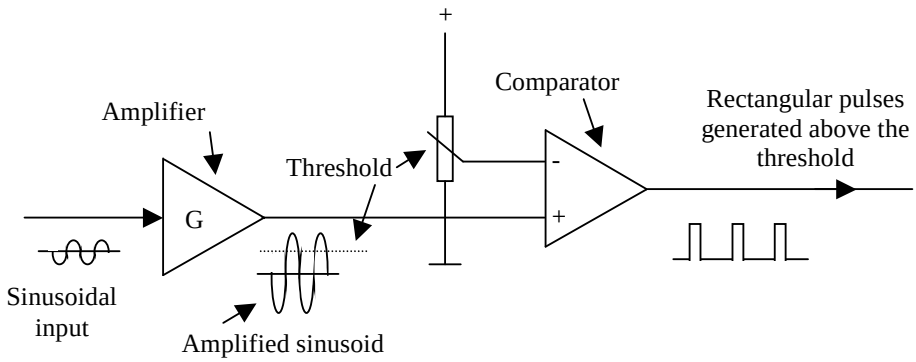

Figure 3

The amplifier is normally implemented with Op Amps, as much as the comparator that may use one Op Amp of the same IC case (with many ones).
As the comparator is polarized at the level called ‘threshold’, it only change its state when the amplified sinusoid exceeds that value, that is, low amplitude noise don’t produce any output. Se, the comparator output is perfectly adapted to the the digital discriminator.
The interface is show with certain plarities, but it is up to the designer to define them accordingly his needs.

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