A Brief Description of Discriminators

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Discriminators are often used when putting together a data acquisition electronics setup. The purpose of a discriminator is to decide when the input is something you are interested in. It does this by putting out a logic pulse when the input signal meets an adjustable threshold value. All discriminators fall into one of two categories, leading edge or constant fraction.

A leading edge discriminator looks just at the leading edge of signal and when the signal reaches the threshold level the logic pulse is emitted. This however can lead to "walk", that is timing variance that depends on the size of the signal. That walk can make it difficult to adjust the timing in the rest of the setup, and makes it impossible to obtain accurate timing information later. For that reason the constant fraction discriminator was created.

A constant fraction discriminator (CFD)works by looking at the whole signal and emits the logic pulse when the input signal reaches a certain fraction of the peak value. In this way a signal that has a wide time variance using a leading edge discriminator can be narrowed significantly. However there are some times that a leading edge discriminator is more appropriate, They are often used when timing information is not critical because they tend to be much cheaper.

I typical discriminator will have three adjustments, threshold, blocking width and, if it's a constant fraction discriminator "walk" control.

The threshold is the level that a signal must reach before the logic pulse is emitted. It should be adjusted so that it triggers only on the input signal. If the setup introduces a lot of noise it may be necessary to set the threshold much higher than you otherwise would.

The blocking width is the minimum time between when the discriminator trips and when it can be triggered again. This is useful if you have a noisy

signal that is likely to pass the threshold level and then dip down tripping the discriminator a second time on the way back up.

The final adjustment is the "walk" control. The "walk" control allows you to optimize the walk characteristics for your particular setup. For example if all of you signals will fall within in a certain range of maximum values then you can trim the "walk" control for better time in that region.

There is one other major variation on discriminators and that is a windowing discriminator. A windowing discriminator will allow you to set both an upper and lower threshold. This allows you to set a window around a particular range of signals. For example it could be used to isolate a particular energy from photo multiplier tube signal.

This is intended only as a general introduction to discriminators and should not be relied upon to heavily for any particular setup since obviously the specifics will depend on the model and manufacturer.

If you feel that something important has been left out here please contact **daqdocs@nscl.msu.edu** .