# Constant Fraction Discriminator Model 2616

Description

The constant fraction discriminator model 2616 is an electronic signal processing instrument for determining the maximum points of a fast input signal in the desired range by using the simulation of mathematical operations. This instrument receives the PMT output negative signals and produces the positive and negative outputs using specific coefficients and detection levels. The general block diagram and different sections of the CFD are shown in following figuration.
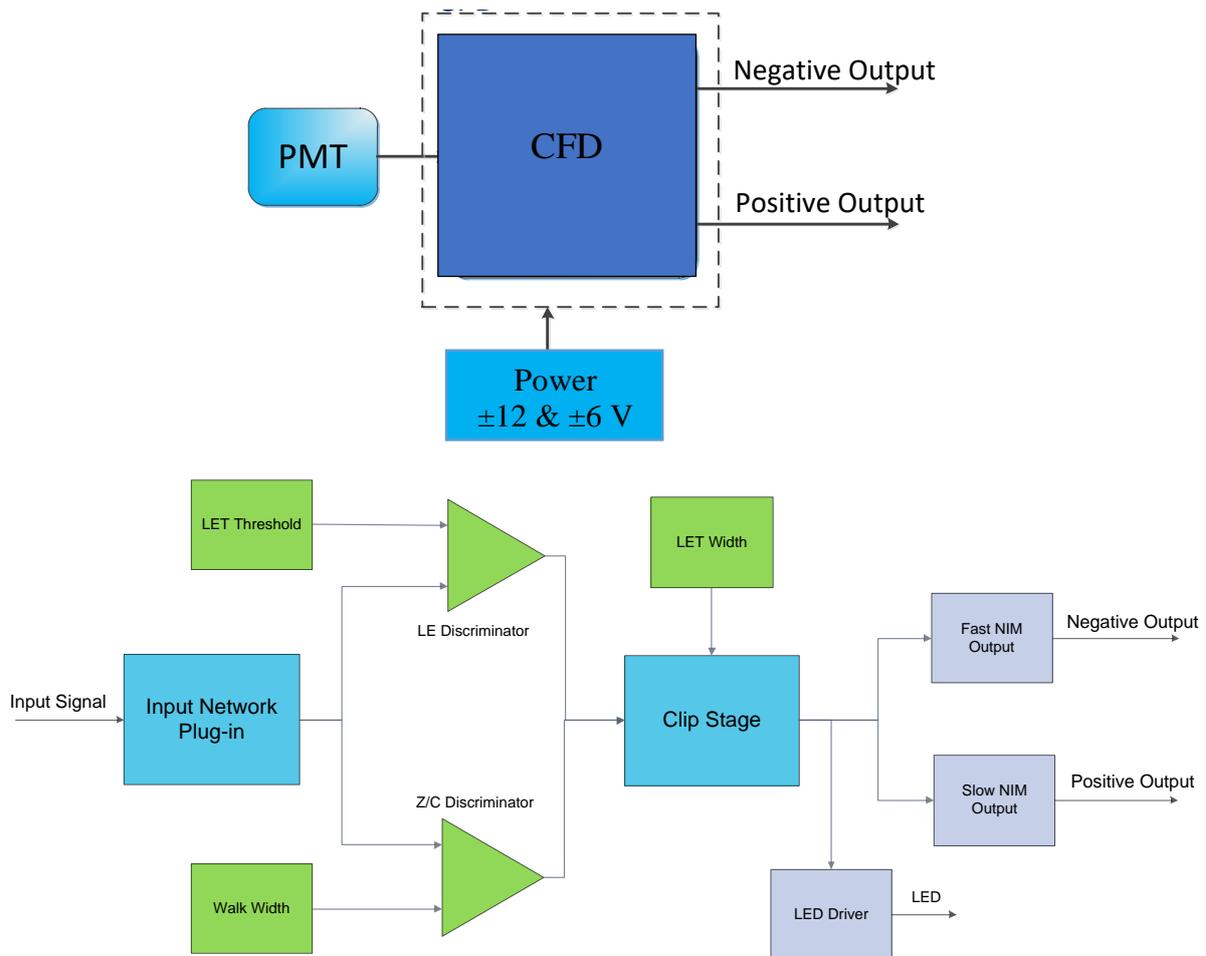
The general block diagram and different sections of the CFD

1. Specification

- Power: ±6 and ±12 V

- R Pack: Z/C, CF, LE

- LE discriminator: It is consisted of a fast comparator which works based on ECL logic, compares the input signal to a constant DC threshold voltage level.

- Z/C discriminator: It compares delayed input signal to walk width.

- LED driver: The Light-Emitting Diodes (LEDs) in the front panel changes the color with the counting rate.

- LET threshold: For determining threshold level

- Walk width: It creates a Z/C discriminator input, so that the sensitivity is determined by the walk inspect output on the front panel. Therefore, it can change the pulse width.

- Clip stage: It includes MC10H131 with two flip-flops for producing positive and negative outputs.

- LET width: For changing the pulse width of LET inspector

- Slow NIM output: This block is used to generate positive outputs and converts standard ECL signals to the standard TTL level in a period of 4.5 ns. Therefore, it is not suitable for fast outputs.

- Fast NIM output: It generates a negative output for system.

2. Performance

- Dynamic range: 1:1000

- CFT displacement: The pulse with a rise time of 1 ns over a dynamic range of 1:100 (reference: -5 V), usually 50 ± 30 ps.

- Leading edge: $t_{rise} < \pm 400$ ps for the dynamic range of 1:10; $t_{rise} = 500$ ps for the dynamic range 1:500

- Counting range: It is limited by dead time up to 100 MHz (usually 120 MHz) (adjusted by width).

- Pulse-pair resolution: < 10 ns

- Threshold instability: $\pm 0.02\% / \,^{\circ}\text{C}$ (± 200 ppm/$^{\circ}\text{C}$)

- Temperature range: 0 to +50 $^{\circ}\text{C}$

- Threshold linearity: $\pm 0.25\%$

- Cable lengths:

  ➤ Plastic: 1.5 to 3.3 ft (0.5 to 1 m)

➢ Surface Germanium: 3.3 to 7 ft (1 to 2 m)

➢ Ge(Li) for coaxial: 7 to 14 ft (2 to 4 m)

- Power requirement:

    ➢ Standard version: + 6 V, 150 mA, -6 V, 450 mA

    ➢ Special edition: + 12 V, 150 mA, -12 V, 450 mA

3. Inputs

- Accept liner pulses from -5 mV to -5 V

- Rise time in constant fraction > 700 ps

- DC-coupled, Z_{in} = 50 Ω

- BNC front panel connector

- Minimum input pulse width > 1 ns

- Accept lower input pulses for LET mode

- Delay: Two front-panel BNC connectors embedded by a delay cable for the required constant-fraction shaping. Proposed length is 1.5 ns/ft (almost 5 ns/m) for providing a rise delay of 0.2 t_{rise} for germanium detectors and 0.8 t_{rise} for more types of detectors.

4. Outputs

- Leading edge: The timing output displays the leading edge and also width is controlled by the leading edge adjustment potentiometer.

- Negative output: Two independent negative outputs with a 32 mA output current (50 ohms); rise time ∼ 2 ns; nominal width pulse: 5 ns.

- DC coupling: The effective width of the negative output pulses is adjusted by the cable between the two BNC connectors on the rear panel and according to the adjacent INT/EXT switch

- Positive output: Two independent positive voltage outputs with 2 V (50 ohms); rise time ∼ 4 ns; nominal width pulse: 5 ns.

- The output pulse width is determined by the front panel potentiometer.

- Rear panel external cable: Two BNC connectors that connect to a delay cable and adjust the effective width of the negative output pulses by the adjacent INT/EXT switch.

5. **Controls**

- Threshold: Front-panel 10-turn potentiometer adjustable from -5 mV to -1 V.

- Leading edge pulse width: 10 turn potentiometer sets the pulse width of the leading edge, is used to match the negative edge of the walk inspect output.

- 3-position switch (CFRR-CFT-LET): 3-position switch selects the constant fraction with slow rise time rejection (CFRR), constant fraction timing (CFT) and the leading edge timing (LET).

- Width: 10-turn screwdriver adjustment sets the width of the positive slow output pulse in front-panel and is equivalent to the internal dead time.

- Intern/Extern: front-panel switch for selecting the negative output (EXT) and the constant width (INT).

- Indicator: LED indicates the active or inactive mode. The color of the LED changes at a counting rate of almost 2 kHz to approximately 50 kHz. Green represents frequencies less than 5 kHz, orange 5 to 10 kHz and red over 10 kHz.