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SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 23EET206 CONTROL SYSTEMS AND INSTRUMENTATION

II YEAR ECE /III SEMESTER

Unit 5-Oscilloscope, Signal Generator, Analyzer and Data Acquisition System

Topic 5 : Frequency Counter

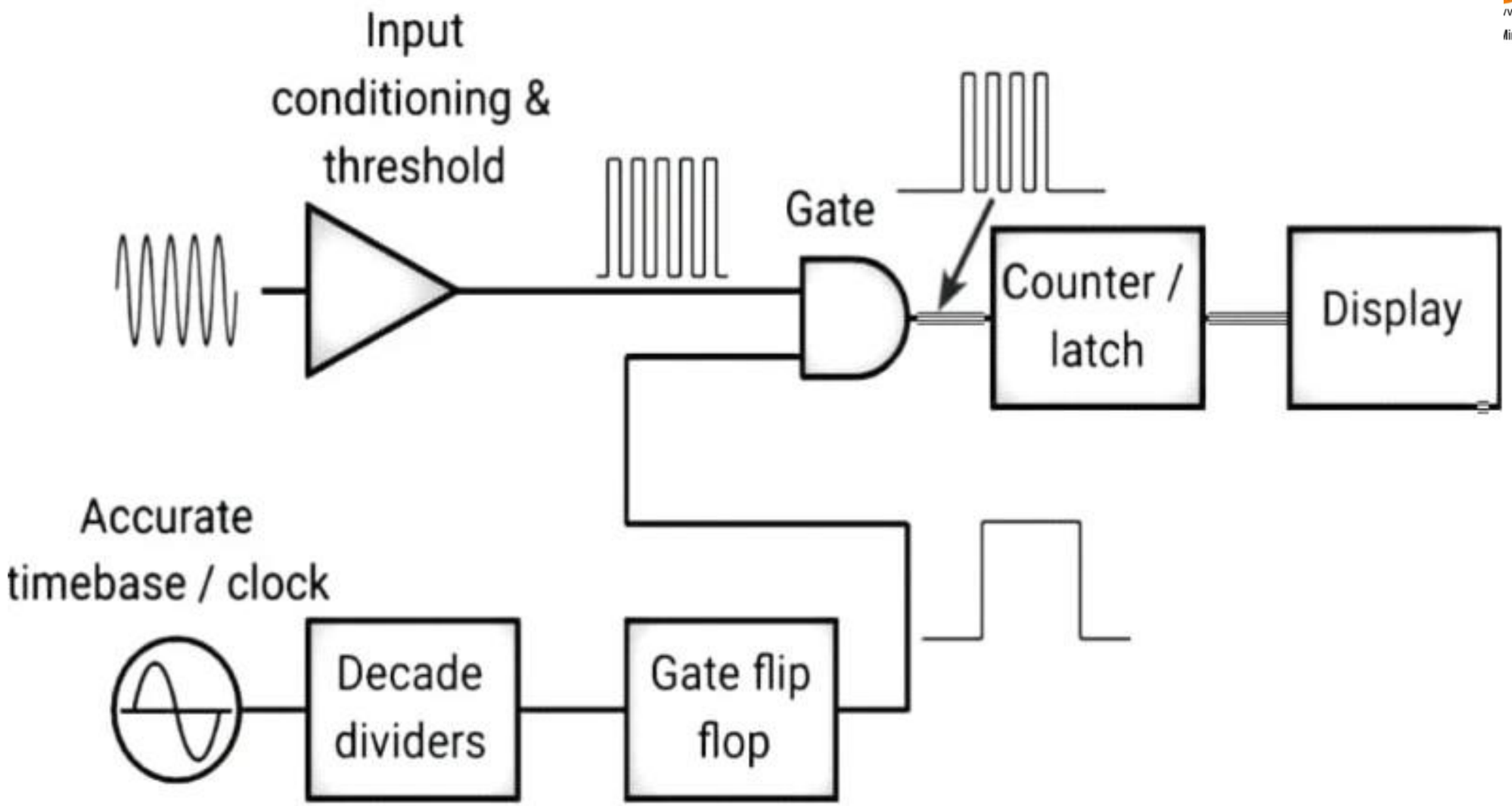
FREQUENCY COUNTER

- A frequency counter, also popularly known as a **frequency meter**, is an instrument that helps measure the time of reputed digital signals and the frequency correctly and associates with a wide range of radio frequencies.
- These counters operate by counting signal cycles using a stable time base oscillator for accuracy.
- It displays the frequency of analog and digital signals in Hz.
- Frequency Counters are vital tools in Electronics, Telecommunications and Research, measuring the frequency, bandwidth, peak-to-peak voltage or current or rise time of input signals.
- They come in various types including Direct Count, Reciprocal and Microwave Counters.

FREQUENCY COUNTER

- A **frequency counter** uses Prescaler that eventually reduces the frequency, which is further helpful in operating the Digital circuit.
- Frequency counters count the pulses and transfers them into the frequency counter when the number of pulses or events occurs in a period and displays it on the frequency range of vibrations.
- The counter then sets to zero. Frequency counters are often found in-built into other devices, such as radio receivers, radar sets, and test equipment. It is a device that is easy to use, measures the frequency accurately, and displays it digitally.

WORKING OF FREQUENCY COUNTER



WORKING OF FREQUENCY COUNTER

- A frequency counter measures a signal in the first split into the pulse setting.
- It operates by counting the number of times the signal passes through the voltage point to a trigger point in a duration.
- The trigger of frequency counters starts at zero crossing point automatically.
- It is a device that sets in a clock speed with pulse per unit cycle and the pulses present send to the device for a limited time.
- After this, vibrations/Pulses apply in a definite interval of time, counts the Pulses.
- An electric counter does the whole process, and the pulses are sent to the cycle to represent the unidentified Signal and give it a value.

WORKING OF FREQUENCY COUNTER

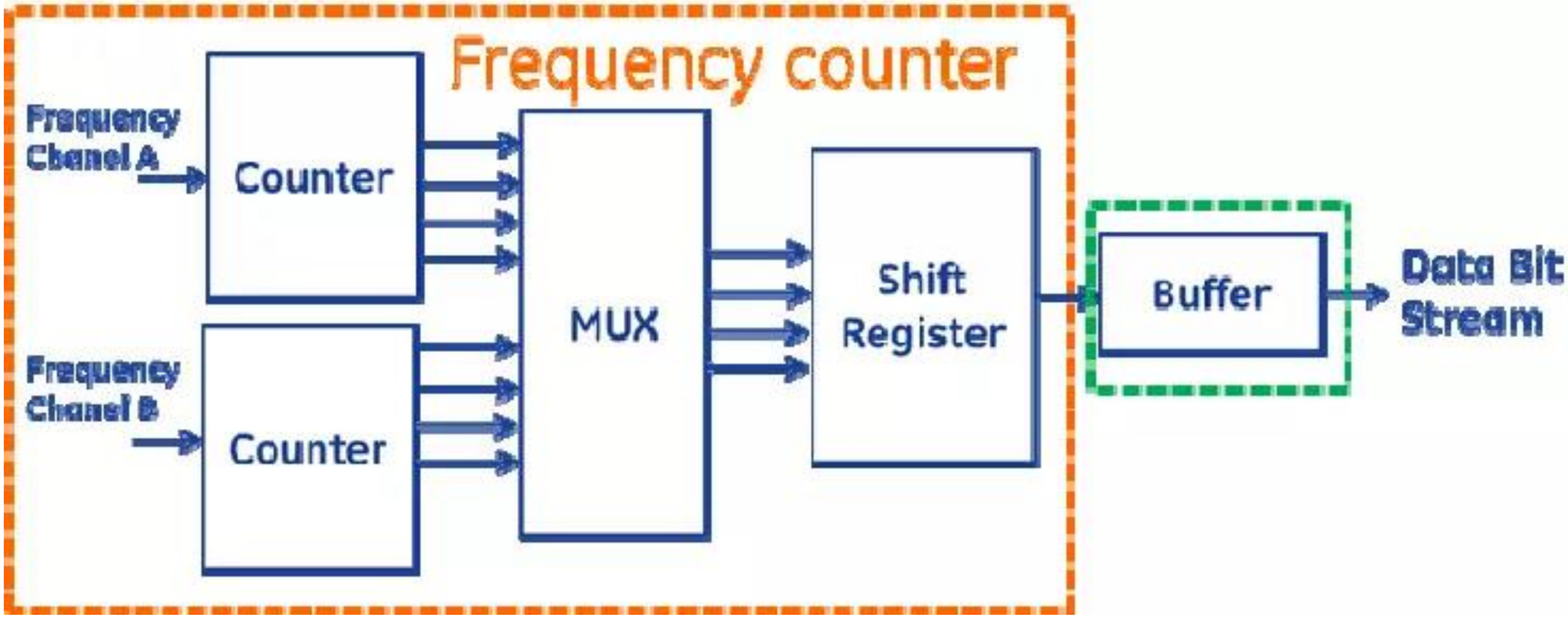
- The frequency counter works on two modes to generate the pulses and time delay. It sets the count of the Pulses from high and low.
- The final count of the pulses takes place. It later collects in timer one, and it denotes the frequency of the vibrations by calculating it.
- The device that converts the resultant value by multiplying it by ten frequency cycles per second converts the value of the pulses in Hz.
- After the whole calculation inside the frequency counter, the frequency of the pulses becomes visible on the LCD or LED.

OPERATING PRINCIPLE OF FREQUENCY COUNTER

A frequency counter works by counting the number of cycles of an input signal within a specific time period. It uses a time base oscillator, which provides a stable ‘clock’ signal, and a counter that accumulates the number of input cycles. The time base’s accuracy determines the accuracy of the frequency measurement.

BLOCK DIAGRAM OF FREQUENCY COUNTER

It contains flip flop, gate, threshold, signal, input conditioning, display, accurate time base, Clock, Latch, and decade dividers.



BLOCK DIAGRAM OF FREQUENCY COUNTER

INPUT

- When the frequency counter, application of low output impedance, and high out in impedance of the input signal takes place, it will convert the signal into a rectangular or square wave by amplifying it to process in the Digital circuit.
- The input in the device signal then buffers and amplifiers. It takes place with the help of the input condition and thresholds inside the counter.
- At this stage, to control the counting of the additional pulses that may occur with noise at the edges, the Schmitt Trigger is used.

BLOCK DIAGRAM OF FREQUENCY COUNTER

CLOCK

- Also known as an accurate time base, the Clock is an integral part of the block diagram, which helps reduce the various timing signals at time intervals.
- The Clock denotes and controls the timing signals with the help of a crystal oscillator, and then it further applies to decade dividers.

BLOCK DIAGRAM OF FREQUENCY COUNTER

FLIP FLOP AND DECADE COUNTER

The incoming and Clock signals generate pulses that are fat to the decay dividers to divide the clock signals. After splitting the signals, the output of the movement then shows in the flip flop. It then produces the enabling Pulse for the main AND Gate.

GATE

After the flip flop produces the pulse and enables accurate pulses, the input generated is applied to the Gate to create a series of pulses denoting the time interval precisely. If the input signal is at 1 Hz, the Gate may open, producing 1 million pulses as output signals.

BLOCK DIAGRAM OF FREQUENCY COUNTER

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LATCH OR COUNTER

- After the Gate generates the output, it feds to the frequency counter to count the occurring number of pulses from the input signal, the Latch holds the movement while displaying the figures.
- The counter, on the other hand, measures the Pulses. Overall, the counter and the Latch hold the Pulses for about ten stages.

DISPLAY

- The Ledge and counter provide the output that the display delivers in the readable format. The frequency of the signal is then visible in LED or LCD. All the information related to the decade counter and other related details become visible on display.

TYPES OF FREQUENCY COUNTER

Frequency counters can be divided into three main types:

- **Direct Count Frequency Counter:** This is the simplest type, which counts the number of input cycles during a specific time interval. It provides the frequency directly but has a limited range and accuracy.
- **Reciprocal Frequency Counter:** These counters measure the time for a certain number of cycles and then calculate the frequency. They offer better accuracy, especially at lower frequencies.
- **Microwave Frequency Counter:** These are designed for high frequencies, typically in the GHz range. They often use prescalers to reduce the frequency before it is measured, ensuring accuracy even at these high frequencies.

FEATURES OF FREQUENCY COUNTER

Modern frequency counters often incorporate additional features to enhance their functionality and ease of use:

1.Frequency Ratio Measurement: Some counters can measure the ratio of two frequencies. This is useful when comparing the frequencies of two signals or calibrating other frequency-generating devices.

2.Period Measurement: Besides frequency, some counters can measure the period of the signal, which is the time it takes for one cycle to complete.

3.Data Interfaces: Many counters offer USB, Ethernet, or other data interfaces for connecting to a computer. This allows for remote operation, data logging, and integration into automated test systems.

References

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2. Sawhney A K., “Course in Electrical, Electronic Measurements and Instrumentation”, Shree Hari Publications, 2021(Unit IV-V).
3. Patranabis D, “Principles of Industrial Instrumentation”, Mc-Graw Hill Education, 3rd Edition, 2017 (Unit IV-V).

Thank You