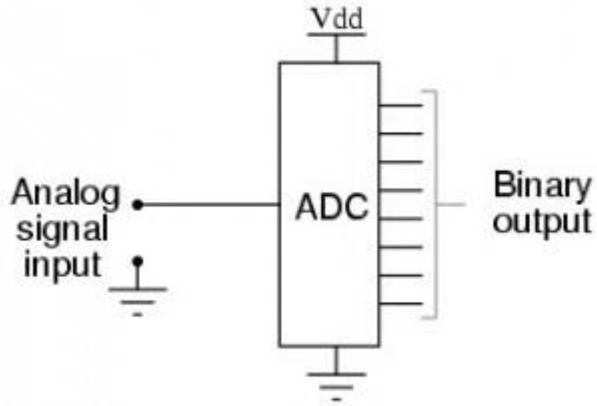
Analog to digital converter

A converter that is used to change the analog signal to digital is known as an analog to digital converter or ADC converter. This converter is one kind of integrated circuit or IC that converts the signal directly from continuous form to discrete form. This converter can be expressed in A/D, ADC, A to D. The inverse function of DAC is nothing but ADC. The analog to digital converter symbol is shown below.

The process of converting an analog signal to digital can be done in several ways. There are different types of ADC chips available in the market from different manufacturers like the ADC08xx series. So, a simple ADC can be designed with the help of discrete components.

The main features of ADC are sample rate and bit resolution.

- The sample rate of an ADC is nothing but how fast an ADC can convert the signal from analog to digital.
- Bit resolution is nothing but how much accuracy can an analog to digital converter can convert the signal from analog to digital.



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One of the major benefits of ADC converter is the high data acquisition rate even at multiplexed inputs. With the invention of a wide variety of ADC integrated circuits (IC's), data acquisition from various sensors becomes more accurate and faster. Dynamic characteristics of the high-performance ADCs are improved measurement repeatability, low power consumption, precise throughput, high linearity, excellent Signal-to-Noise Ratio (SNR), and so on.
A variety of applications of the ADCs are measurement and control systems, industrial instrumentation, communication systems, and all other sensory-based systems. Classification of ADCs based on factors like performance, bit rates, power, cost, etc.

ADC Block Diagram

The block diagram of ADC is shown below which includes sample, hold, quantize, and encoder. The process of ADC can be done like the following.

First, the analog signal is applied to the first block namely a sample wherever it can be sampled at an exact sampling frequency. The amplitude value of the sample like an analog value can be maintained as well as held within the second block like Hold. The hold sample can be quantized into discrete value through the third block like quantize. Finally, the last block like encoder changes the discrete amplitude into a binary number.

In ADC, the conversion of the signal from analog to digital can be explained through the above block diagram.

Sample

In the sample block, the analog signal can be sampled at an exact interval of time. The samples are used in continuous amplitude and hold real value however they are discrete with respect to time. While converting the signal, the sampling frequency plays an essential role. So it can be maintained at a precise rate. Based on the system requirement, the sampling rate can be fixed.

Hold

In ADC, HOLD is the second block and it doesn't have any function because it simply holds the sample amplitude till the next sample is taken. So the value of hold doesn't change until the next sample.

Quantize

In ADC, this is the third block which is mainly used for quantization. The main function of this is to convert the amplitude from continuous (analog) into discrete. The value of continuous amplitude within hold block moves throughout quantize block to turn into discrete in amplitude. Now, the signal will be in digital form because it includes discrete amplitude as well as time.

Encoder

The final block in ADC is an encoder that converts the signal from digital form to binary. We know that a digital device works by using binary signals. So it is required to change the signal from digital to binary with the help of an encoder. So this is the entire method to change an analog signal to digital using an ADC. The time taken for the entire conversion can be done within a microsecond.