

# Digital vs. Analog Signals

Read the text, and then answer the questions that follow.

Imagine you are listening to music on your cell phone in your hometown. You find a new song that you love, and you know your cousin who lives across the country would love it, too. So, in a few taps of your fingers, you send the song to your cousin in a text message. In a matter of minutes, she replies to tell you it's her new favorite song.

Sharing music has not always been so easy. Prior to the 1990s, you might have shared a song with your far-away cousin by calling her on the telephone and telling her the title of the song in hopes she could get her hands on a copy of the album or catch it on the radio. The ease with which we are now able to access and share music is thanks to digital signals. **Digital signals** are a more reliable way to encode and transmit information than **analog signals**.

An analog signal is a *representation, or analogy,* of something that you convey with continuous data. A song produced by playing a record is an example of an analog signal. Records are made of a plastic called vinyl. They have microscopic grooves, which the needle on the record player touches.

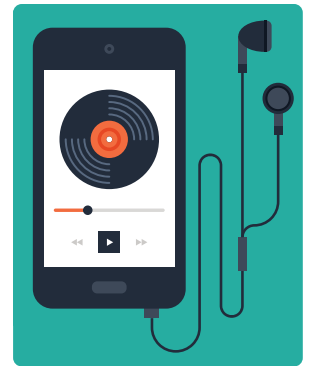


As the needle moves over the microscopic grooves, it moves up and down thousands of times each second, causing vibrations that are then amplified to play a song we can hear. So, a record produces an analog signal made of continuous data. The signal produced can be represented as a smooth wave that describes exactly how the sound changes over time. A radio is another example of a device that uses analog signals. It detects AM and FM radio waves, which make a speaker inside the radio vibrate to produce sound.

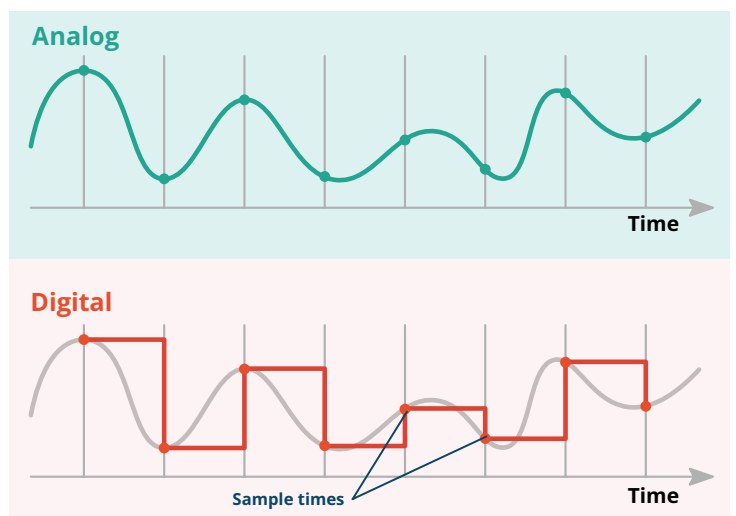
Though analog signals are widely used, they can sometimes be an unreliable way to encode and transmit information. For example, you can't share songs as

quickly or as easily over long distances using records, and if you scratch a record, you permanently distort the sound it produces. Or if you travel too far from a radio tower, you hear static over the radio because the signals deteriorate. When this happens, we say that the signal is *noisy*.

A more reliable way to encode and transmit information is with digital signals. A digital signal is a signal in which continuous data has been translated to a series of noncontinuous digits, like ones and zeros. Why would we want a signal translated into ones and zeros? Because that's how computers read data. Every



song on your cell phone or computer is stored as a long string of ones and zeros, called *binary code*. To store a song digitally, points along sound waves from the song are sampled. Each point is assigned a number based on its amplitude. Those numbers are then translated into a digital code that a computer can read. To turn the digital code back into sound, your cell phone or computer reads the digital code and creates a sound wave to send to the speaker. The speaker then creates sound waves that travel through the air and to your ears.



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Keep going! Read the text, and then answer the questions that follow.

Because digital signals only contain noncontinuous digits, like ones and zeros, they are transmitted as short pulses and can be easily corrected to remove noise. This makes digital signals ideal for transmitting signals over long distances.

Digital technology has transformed our world in many ways. Just think about how many hundreds of songs you can store on a cell phone, which is the size of your hand, versus how much space it would require to store the equivalent amount of music on vinyl records! In the medical field, the transition from hard-copy to digital medical records makes it possible to store vast amounts of patient data in a small amount of space for

easy retrieval and to send a patient’s medical records from doctor to doctor in a matter of seconds. Additionally, digital technology is generally more secure than analog. Medical records, cell phone messages, and other forms of digital information can be *encrypted* before transmission, meaning that the information is scrambled as it travels so that only the intended recipient gets to see it.



How different would modern life be without digital signals?

Based on the reading, answer the questions below.

1. What is the difference between analog and digital signals?

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\_\_\_\_\_

2. Explain how analog signals can be converted to digital signals.

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\_\_\_\_\_  
\_\_\_\_\_

3. Why are digital signals a more reliable and secure way to encode and transmit information than analog signals?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. Name two types of technology that use analog signals and two that use digital signals.

Analog Technology	Digital Technology
1. _____	1. _____
2. _____	2. _____