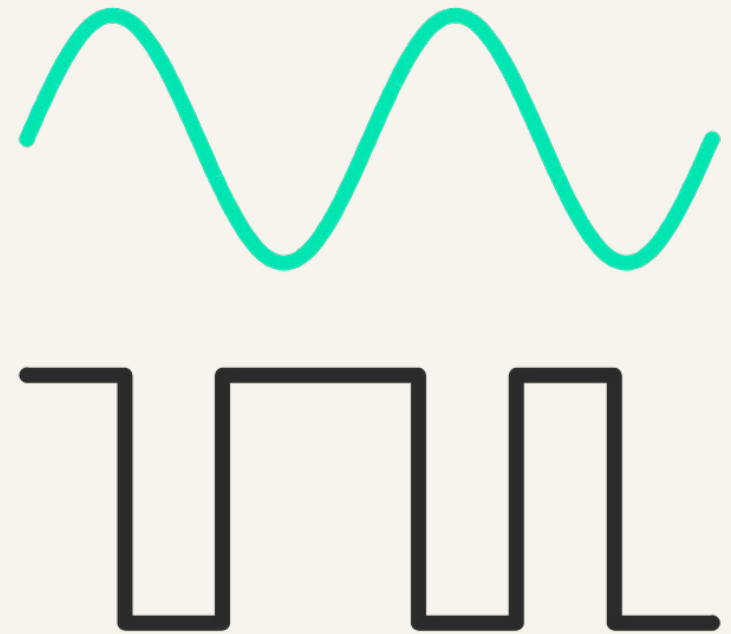


N5 ELECTRONICS • LOGIC

Digital Signals and Logic States

Every circuit in this booklet speaks a language with only two words.

National 5 Practical Electronics



LEARNING INTENTION

To describe the difference between analogue and digital signals, and state the voltages that represent logic 1 and logic 0.

Daily Review

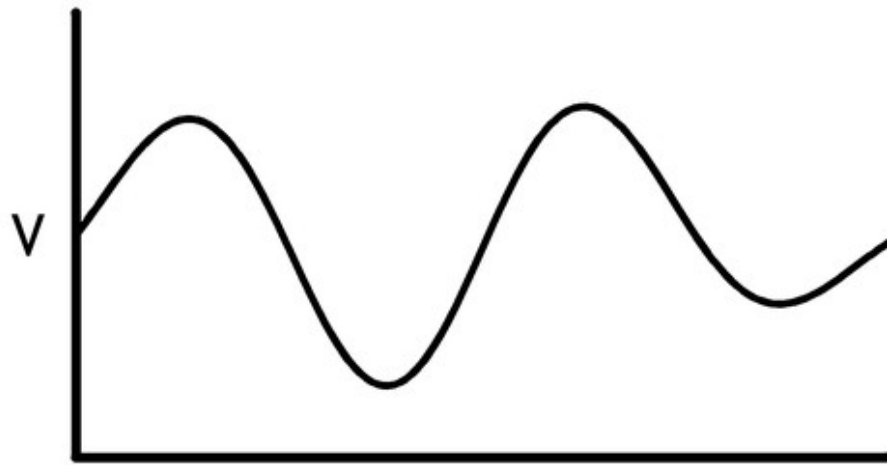
SHOW ME BOARDS

- 1 Which component senses light level?
- 2 State the unit of voltage.
- 3 What does an LED do when current flows through it?
- 4 Why is a resistor placed in series with an LED?
- 5 Name one input device and one output device.

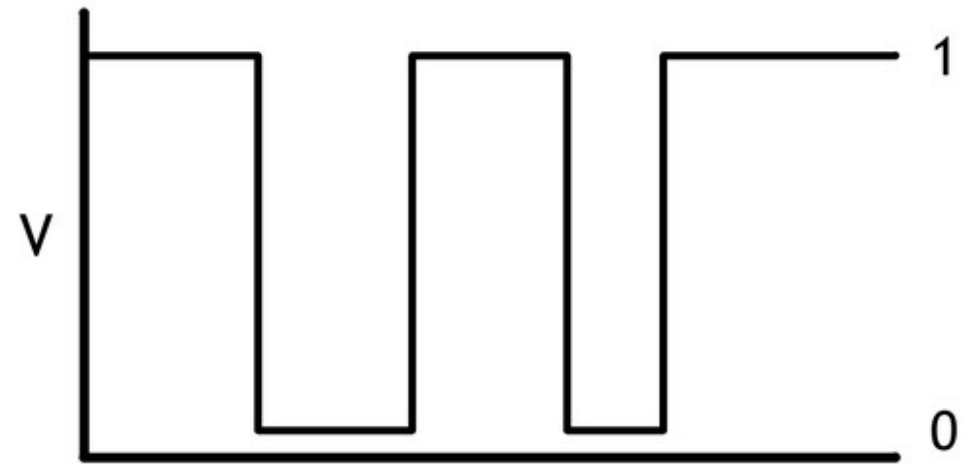
By the end of this lesson...

- 1 I can describe the difference between an analogue and a digital signal.
- 2 I can state the voltage levels that represent logic 1 and logic 0.
- 3 I can sort devices into digital inputs and digital outputs.

Analogue and digital signals



time
analogue signal



time
digital signal

An analogue signal can take any value; a digital signal only two.

Two kinds of signal

	Analogue	Digital
Number of values	many – changes smoothly	two only
Example	voltage across an LDR	a switch: pressed or not pressed

Show Me — Analogue or digital?

SHOW ME BOARDS

- 1 A push switch.
- 2 The voltage across an LDR.
- 3 A car's fuel gauge needle.
- 4 A machine guard: open or closed.
- 5 The loudness of your voice.

Analogue or digital?

SHOW ME BOARDS

EXTRA PRACTICE

- 1 A light that is on or off.
- 2 The temperature of this room.
- 3 An infrared beam: broken or not broken.
- 4 The speed of a spinning motor.
- 5 A key on a keyboard.

Logic states

Logic state	Also called	Voltage in a 5 V system
logic 1	high, on, true	near the supply voltage (about 5 V)
logic 0	low, off, false	near 0 V

Show Me — Logic 1 or logic 0?

SHOW ME BOARDS

- 1 A doorbell button being held down.
- 2 A lamp that is switched off.
- 3 An input at 4.9 V in a 5 V system.
- 4 An input at 0.2 V.
- 5 A relay that is switched on.

Logic 1 or logic 0?

SHOW ME BOARDS

EXTRA PRACTICE

- 1 A buzzer sounding.
- 2 An input at 0.1 V.
- 3 An input near 5 V.
- 4 A motor that is stopped.
- 5 True, high and on all mean logic ...?

Your turn

Write the logic state — 1 or 0 — for each of the six situations.

TASK 1 — Logic states

TASK 1 – Answers

Go over these only after everyone has attempted the task.

Situation	Logic state
A push switch is being pressed.	1
A push switch is not being pressed.	0
A guard sensor detects that the machine guard is closed.	1
A buzzer is silent.	0
A motor is running.	1
An LDR circuit output is 4.8 V in a 5 V system.	1

Digital inputs and outputs

Digital input devices

push switch, slide switch, limit switch, guard switch, infrared beam sensor

Digital output devices

LED, lamp, buzzer, motor, relay, solenoid

Watch Out

THE MISTAKE

- Logic 0 means exactly 0 V.
- An LDR gives a digital signal.
- Digital devices run on special voltages.

THE CORRECT ANSWER

- Near 0 V counts as logic 0.
- An LDR is analogue – its voltage changes smoothly.
- Same 5 V supply – only two levels are used.

Checkpoint

SHOW ME BOARDS

- 1 State the two values a digital signal can take.
- 2 What voltage represents logic 1 in a 5 V system?
- 3 Is a buzzer an input or an output device – and why?

LOOKING AHEAD

The six logic gates

Six symbols that make every decision a circuit ever takes.

Plenary

SHOW ME BOARDS

- 1 Describe how an analogue signal changes.
- 2 How many values can a digital signal take?
- 3 State the voltage for logic 0.
- 4 Give two other names for logic 1.
- 5 Name two digital output devices.

Plenary

SHOW ME BOARDS

EXTRA PRACTICE

- 1 Sketch a digital signal on your board.
- 2 State the voltage for logic 1 in a 5 V system.
- 3 Give two other names for logic 0.
- 4 Name two digital input devices.
- 5 Analogue or digital: a limit switch?

Extension

- 1 Why do computers use digital signals, not analogue?
- 2 An input sits at 2.1 V. Why is this a problem?
- 3 How could an LDR circuit give a digital output?

- 1 Music on vinyl and streamed music: which is analogue?
- 2 An input sits at 2.5 V. Logic 1, logic 0, or neither?
- 3 Why might near 5 V, not exactly 5 V, be good enough?