LDR characteristics

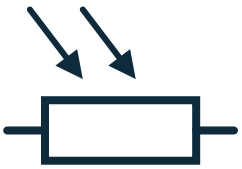
LEARNING INTENTION

We are learning how an LDR's resistance changes with light, and how to read its characteristic graph.

SUCCESS CRITERIA — I CAN

- ☐ state how LDR resistance changes with light level
- ☐ read resistance from a characteristic graph or table
- ☐ use the LDR value in a voltage divider calculation
- ☐ describe the operation of an LDR circuit step by step

What is an LDR?



LDR symbol

An **LDR** (light-dependent resistor) is an **input device**. Its resistance changes with the light level.

More light → less resistance. In the dark its resistance is high. In bright light it is low.

On its own an LDR does nothing useful. Put it in a voltage divider and the light level becomes a voltage.

DATASHEET · LDR

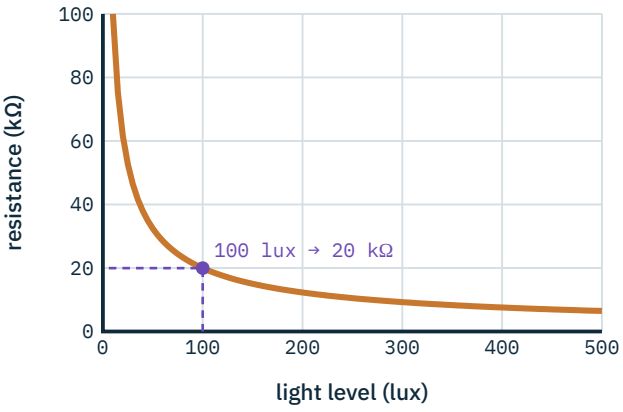
01 Senses: light level.

02 Bright light → low resistance (a few kΩ).

03 Darkness → high resistance (100 kΩ or more).

04 Used in: street lights, night lights, light meters.

Reading a characteristic graph



Characteristic of LDR type NL-7 (fictional)

A **characteristic** shows how a component behaves. For an LDR it shows resistance against light level.

1. Find the light level on the bottom axis.
2. Go up to the line.
3. Go across to the resistance axis.
4. Read the value. Write the unit.

The same data can be given as a table:

Light (lux)	10	20	50	100	200	500
R (kΩ)	100	62	32	20	12	6.5

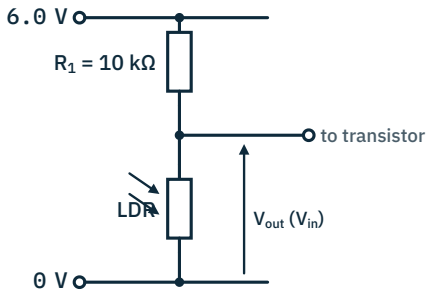
LDR characteristics

WORKED EXAMPLE **Ben Corrach floodlight sensor**

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
V_s = 6.0 V R_1 = 10 kΩ light = 100 lux	V_{out}	read R_{LDR} from graph $R_t = R_1 + R_{LDR}$ $I = V/R$, $V = IR$	R_{LDR} = 20 kΩ (graph) R_t = 10 + 20 = 30 kΩ I = 6.0 ÷ 30 = 0.2 mA V_{out} = 0.2 × 20	**V_{out} = 4.0 V**

Step 1 is always: read the sensor's resistance from the graph or table, with its unit.

Where the LDR goes matters



LDR at the bottom

LDR at the bottom (R_2): dark → LDR resistance up → V_{out} up. Use this to switch on **in the dark**.

LDR at the top (R_1): dark → LDR takes a bigger share → V_{out} down. Use this to switch on **in the light**.

Describing the operation

SIGNAL CHAIN

CONDITION	SENSOR	V_{in}	TRANSISTOR	OUTPUT
Light level falls	LDR resistance increases	V_{in} increases	Switches on	Lamp switches on

Model answer for an LDR at the bottom of the divider. One mark for each link.

SHORT CIRCUIT

× WHAT EXAMINERS SAW

Asked to describe a circuit's operation, many pupils did not refer to the light level, the resistance of the LDR or the voltage V_{in}. They jumped straight to “the lamp comes on”.

√ THE FIX

Follow the Signal Chain, one mark per link: the condition → the sensor's resistance change → V_{in} → the transistor → the output.

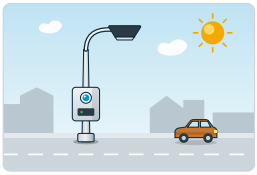
Course report 2026 Q10(a); marking instructions award 1 mark per link.

LDR characteristics

Day and night in numbers

LDR AT THE BOTTOM: DAY V NIGHT

1



Daytime: 500 lux

2

R_{LDR} = 6.5 kΩ
V_{out} = 2.36 V

Low R, low V_{out}

3



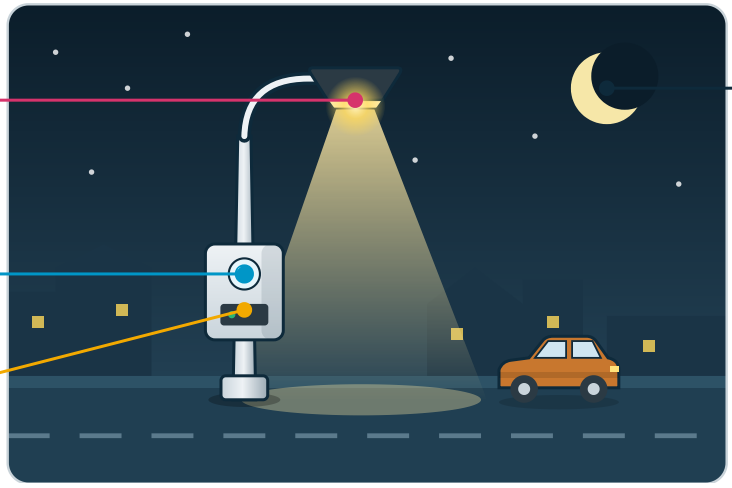
Night: 20 lux

4

R_{LDR} = 62 kΩ
V_{out} = 5.17 V

High R, high V_{out}

Ben Corrach floodlight (fictional)



WORKED EXAMPLE V_{out} in the dark

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
V_s = 6 V R_1 = 10 kΩ (top) LDR (bottom) at 20 lux = 62 kΩ	V_{out}	$V_{out} = V_s \times R_{LDR}/(R_1 + R_{LDR})$	= 6 × 62/72	**5.17 V**

Dark → high R → high V_{out}.

LDR characteristics

WORKED EXAMPLE **Reading the LDR graph backwards**

1 GIVEN	2 FIND	3 FORMULA	4 SUBSTITUTE	5 ANSWER + UNIT
need R = 32 kΩ	light level	across from 32 kΩ to the line, then down	meets the line at 50 lux	**50 lux**

WRONG

Dark → LDR resistance falls

Common error: resistance direction reversed.

RIGHT

Dark → LDR resistance RISES → V_{out} rises

LDR resistance increases as light falls.

REAL ENGINEERING · BEN CORRACH SNOWSPORTS

Ben Corrach (fictional) runs floodlit skiing on winter evenings.

An LDR sensor on the lift hut switches the floodlights on at dusk. Engineers checked its characteristic to choose the fixed resistor, so the lights come on at about 100 lux.



PROBE · QUICK CHECKS

1. What does LDR stand for? _____
2. It gets brighter. What happens to the LDR's resistance? _____
3. Use the table: what is R at 20 lux? _____

LDR characteristics

EXAM READY · 9 MARKS

1 **State** what happens to the resistance of an LDR as the light level increases. **[1]**

2 Use the characteristic graph in these notes. **State** the resistance of the LDR at 50 lux. **[1]**

3 The LDR is the bottom resistor in a divider with V_s = 9.0 V and R_1 = 22 kΩ. At 50 lux, R_{LDR} = 32 kΩ. **Calculate** V_{out}. **[3]**

4 In the circuit, the LDR is the bottom resistor and the transistor switches a lamp. **Describe** the operation of the circuit as it gets dark. **[4]**