THE CSA RATIO: WORKING OUT R2 BEFORE YOU MEASURE IT

CAN YOU KNOW R2 BEFORE YOU MEASURE IT?

This is worth real time, because it is how you know whether your reading is right. If you know r_1, you can work out what r_2 should be from the **ratio of the two conductor sizes**.

$$r_2 = r_1 \times (\text{line csa} \div \text{cpc csa})$$

Twin and earth comes in fixed pairings, so the ratios are worth knowing:

CABLE	LINE ÷ CPC	RATIO	TYPICAL CIRCUIT
1.0 / 1.0 mm²	1 ÷ 1	**1**	Lighting
2.5 / 1.5 mm²	2.5 ÷ 1.5	**1.67**	Socket ring
4 / 1.5 mm²	4 ÷ 1.5	**2.67**	Socket radial
6 / 2.5 mm²	6 ÷ 2.5	**2.4**	Cooker
10 / 4 mm²	10 ÷ 4	**2.5**	Shower
16 / 6 mm²	16 ÷ 6	**2.67**	Larger loads

4 MM² LINE WITH A 1.5 MM² CPC, R_1 MEASURED AT 0.3 Ω

Ratio = 4 ÷ 1.5 = **2.67**

r_2 = 0.3 × 2.67
= **0.8 Ω** expected

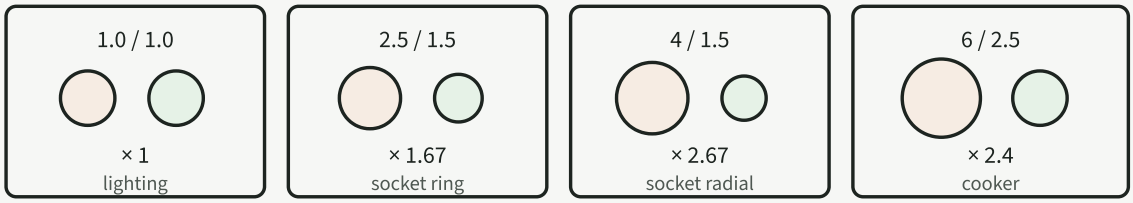
So before the meter goes anywhere near the cpc, you already know you are looking for about **0.8 Ω**. If it comes back at 2 Ω, something is wrong — and you know it immediately rather than three circuits later.

Why the cpc is always the higher number.
Hold a piece of twin and earth and look at it: the copper in the brown is visibly thicker than the bare earth. Less copper means more resistance, so a 1.5 mm² cpc beside a 4 mm² line has **2.67 times** the resistance over the same length.

✋ **Inversely, not directly.** Easy to get backwards. Resistance is **inversely** proportional to cross-sectional area — it **falls** as the conductor gets bigger and **rises** as it gets smaller.

$r_2 = r_1 \times (\text{line csa} \div \text{cpc csa})$

A thinner cpc has more resistance — so r_2 is always the bigger number.



Line in brown, cpc in green. Drawn to scale — the size difference is the whole point.

Know r_1 and you know what r_2 should be before the meter tells you. If the measured r_2 is a long way off the ratio, something is wrong.

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