Electrical Reference Chart

Watts to amps at common voltages, Ohm's law, electrical units and symbols, energy in kWh and mains supply by country

For: Electricians, engineers, campers and appliance buyers

allunitconversions.com/electrical-conversion-chart
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9 November 2026

EXACT DEFINITION	FORMULA	REVERSE	WORKED EXAMPLE
1 W = 1 V × 1 A = 1 J/s; 1 kWh = 3.6 MJ	P = V × I; V = I × R	I = P ÷ V; R = V ÷ I	A 2,000 W kettle on 230 V draws 2,000 ÷ 230 = 8.70 A

Currents are rounded to 2 decimal places. Tables assume DC or resistive AC loads (power factor 1).

Watts to amps

Watts (W)	Amps at 12 V	Amps at 24 V	Amps at 120 V	Amps at 230 V	Amps at 240 V
5	0.42	0.21	0.04	0.02	0.02
10	0.83	0.42	0.08	0.04	0.04
25	2.08	1.04	0.21	0.11	0.10
40	3.33	1.67	0.33	0.17	0.17
60	5.00	2.50	0.50	0.26	0.25
100	8.33	4.17	0.83	0.43	0.42
150	12.50	6.25	1.25	0.65	0.63
200	16.67	8.33	1.67	0.87	0.83
300	25.00	12.50	2.50	1.30	1.25
500	41.67	20.83	4.17	2.17	2.08
750	62.50	31.25	6.25	3.26	3.13
1,000	83.33	41.67	8.33	4.35	4.17
1,200	100.00	50.00	10.00	5.22	5.00
1,500	125.00	62.50	12.50	6.52	6.25
1,800	150.00	75.00	15.00	7.83	7.50
2,000	166.67	83.33	16.67	8.70	8.33
2,500	208.33	104.17	20.83	10.87	10.42
3,000	250.00	125.00	25.00	13.04	12.50
3,500	291.67	145.83	29.17	15.22	14.58
5,000	416.67	208.33	41.67	21.74	20.83
7,000	583.33	291.67	58.33	30.43	29.17
10,000	833.33	416.67	83.33	43.48	41.67

Amps to watts (circuit and fuse ratings)

Current (A)	Watts at 12 V	Watts at 120 V	Watts at 230 V	Watts at 240 V
1	12	120	230	240
2	24	240	460	480
3	36	360	690	720
5	60	600	1,150	1,200
6	72	720	1,380	1,440
10	120	1,200	2,300	2,400
13	156	1,560	2,990	3,120
15	180	1,800	3,450	3,600

Current (A)	Watts at 12 V	Watts at 120 V	Watts at 230 V	Watts at 240 V
16	192	1,920	3,680	3,840
20	240	2,400	4,600	4,800
25	300	3,000	5,750	6,000
30	360	3,600	6,900	7,200
32	384	3,840	7,360	7,680
40	480	4,800	9,200	9,600
50	600	6,000	11,500	12,000
63	756	7,560	14,490	15,120

Energy use: watts and hours to kWh (units of electricity)

One unit on an electricity bill is 1 kWh. kWh = watts × hours ÷ 1000.

Watts (W)	kWh per hour	Hours per kWh	kWh per day (24 h)	kWh per month at 1 h/day	kWh per year at 1 h/day
5	0.005	200	0.12	0.15	1.8
10	0.01	100	0.24	0.3	3.7
40	0.04	25	0.96	1.2	14.6
60	0.06	16.67	1.44	1.8	21.9
100	0.1	10	2.4	3	36.5
150	0.15	6.67	3.6	4.5	54.8
500	0.5	2	12	15	182.5
1,000	1	1	24	30	365
1,500	1.5	0.67	36	45	547.5
2,000	2	0.5	48	60	730
2,500	2.5	0.4	60	75	912.5
3,000	3	0.33	72	90	1,095
7,000	7	0.14	168	210	2,555

Electrical quantities, symbols and SI units

Quantity	Symbol	Unit	Unit symbol	In other SI units
Electric current	I	ampere	A	SI base unit
Electric charge	Q	coulomb	C	A·s; 1 Ah = 3,600 C
Voltage (potential difference)	U or V	volt	V	W/A = J/C
Resistance	R	ohm	Ω	V/A
Conductance	G	siemens	S	A/V = 1/Ω
Resistivity	ρ	ohm metre	Ω·m	1 Ω·mm²/m = 10^{-6} Ω·m
Capacitance	C	farad	F	C/V
Inductance	L	henry	H	Wb/A = V·s/A
Active power	P	watt	W	J/s = V·A at power factor 1
Apparent power	S	volt-ampere	VA	V × A
Reactive power	Q	var	var	V × A × sin φ
Energy	E or W	joule	J	W·s; 1 kWh = 3.6 MJ
Frequency	f	hertz	Hz	1/s
Magnetic flux	Φ	weber	Wb	V·s
Magnetic flux density	B	tesla	T	Wb/m²
Electric field strength	E	volt per metre	V/m	N/C

Ohm's law and power formulas

Find	From V and I / R	From P and I / V	From P and R
Voltage V (volts)	$V = I \times R$	$V = P \div I$	$V = \sqrt{(P \times R)}$
Current I (amps)	$I = V \div R$	$I = P \div V$	$I = \sqrt{(P \div R)}$
Resistance R (ohms)	$R = V \div I$	$R = V^2 \div P$	$R = P \div I^2$
Power P (watts)	$P = V \times I$	$P = I^2 \times R$	$P = V^2 \div R$
Three-phase power	$P = \sqrt{3} \times V(\text{line}) \times I \times PF$	$I = P \div (\sqrt{3} \times V \times PF)$	PF = power factor (0–1)

Mains electricity by country (nominal)

Country / region	Voltage	Frequency
United Kingdom, Ireland	230 V	50 Hz
European Union	230 V	50 Hz
United States, Canada	120 V (240 V split-phase)	60 Hz
Mexico	127 V	60 Hz
Brazil	127 V or 220 V (varies by state)	60 Hz
Japan	100 V	50 Hz east / 60 Hz west
China	220 V	50 Hz
India	230 V	50 Hz
Australia, New Zealand	230 V	50 Hz
South Africa	230 V	50 Hz

Sources and method

- **BIPM SI Brochure, 9th edition** — Definitions of the SI units, including the kelvin (www.bipm.org/en/publications/si-brochure)
- **NIST Special Publication 811** — Guide for the Use of the International System of Units (www.nist.gov/pml/special-publication-811)
- **IEC 60038** — IEC standard voltages for electricity supply systems

Conversion values on this sheet are generated by the AllUnitConversions conversion library and automatically checked against the exact definitions above before the PDF is produced; reference tables are taken from the sources listed. Interactive version, corrections and more charts: **allunitconversions.com/electrical-conversion-chart**