

Instrumentation and Control Technician (2026) Formula Sheet

LEVEL 2

Note: This formula sheet is provided as a resource. The sheet may not include all necessary formulas and may contain formulas not required for this exam. Apprentices must apply the formulas to demonstrate their understanding.

Measurement unit abbreviations

α	temperature coefficient (alpha)
A	area
c	capacitance
C	capacitor/capacitance
CM	circular mil
D	diameter
E	voltage
f	frequency
I	current
k	resistance coefficient
L	inductor/inductance, length
p	resistivity
P	true power
R	resistor/resistance
RC	resistor-capacitance
t	temperature
VA	apparent power
VAR	reactive power
W	true power
X	reactance

Constants

π	3.14
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#	Description	Full Formula	Abbreviated
1.	Current	$\sqrt{\frac{\text{power}}{\text{resistance}}}$	$I = \sqrt{\frac{P}{R}}$
2.	Current	$\frac{\text{power}}{\text{voltage}}$	$I = \frac{P}{E}$
3.	Current	$\frac{\text{voltage}}{\text{resistance}}$	$I = \frac{E}{R}$
4.	Power	voltage x current	$P = E \times I$

5.	Power	resistance x current ²	$P = R \times I^2$
6.	Power	$\frac{\text{voltage}^2}{\text{resistance}}$	$P = \frac{E^2}{R}$
7.	Resistance	$\frac{\text{voltage}}{\text{current}}$	$R = \frac{E}{I}$
8.	Resistance	$\frac{\text{voltage}^2}{\text{power}}$	$R = \frac{E^2}{P}$
9.	Resistance	$\frac{\text{power}}{\text{current}^2}$	$R = \frac{P}{I^2}$
10.	Voltage	resistance x current	$E = R \times I$
11.	Voltage	$\frac{\text{power}}{\text{current}}$	$E = \frac{P}{I}$
12.	Voltage	$\sqrt{\text{power} \times \text{current}}$	$E = \sqrt{P \times R}$
13.	Resistance	$\frac{\text{resistance coefficient} \times \text{length}}{\text{circular mil}}$	$R = \frac{kL}{CM}$
14.	Capacitors in Series	$1 / (1/\text{capacitor}_1 + 1/\text{capacitor}_2 + 1/\text{capacitor}_3, + \dots)$	$C_T = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots}$
15.	Capacitors in Parallel	$\text{capacitor}_1 + \text{capacitor}_2 + \text{capacitor}_3, + \dots$	$C_T = C_1 + C_2 + C_3 + \dots$
16.	Resistors in Series	$\text{resistor}_1 + \text{resistor}_2 + \text{resistor}_3, + \dots$	$R_T = R_1 + R_2 + R_3 + \dots$
17.	Resistors in Parallel	$1 / (1/\text{resistor}_1 + 1/\text{resistor}_2 + 1/\text{resistor}_3, + \dots)$	$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots}$
18.	Inductors in Series	$\text{inductor}_1 + \text{inductor}_2 + \text{inductor}_3, + \dots$	$L_T = L_1 + L_2 + L_3 + \dots$
19.	Inductors in Parallel	$1 / (1/\text{inductor}_1 + 1/\text{inductor}_2 + 1/\text{inductor}_3, + \dots)$	$L_T = \frac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \dots}$
20.	Capacitive Reactance	$\frac{1}{2 \times \pi \times \text{frequency} \times \text{capacitance}}$	$X_C = \frac{1}{2\pi f c}$

21.	Inductive Reactance	$2 \times \pi \times \text{frequency} \times \text{inductance}$	$X_L = 2\pi fL$
22.	Time Constant		$\text{Tau (r)} = RC$ $\text{Tau (r)} = \frac{L}{R}$ $\text{Tau (r)} = 63.2\%$
23.	Rectifiers	1 - Θ half - wave rectifier : maximum value x 0.318 1 - Θ half - wave rectifier : root mean squared x 0.45 1 - Θ full - wave rectifier : maximum value x 0.637 1 - Θ full - wave rectifier : root mean squared x 0.90 3 - Θ half - wave rectifier : maximum value x 0.827 3 - Θ half - wave rectifier : root mean square x 1.17 3 - Θ full - wave rectifier : maximum value x 0.955 3 - Θ full - wave rectifier : root mean square x 1.35	$V_{MAX} \times 0.318$ $V_{RMS} \times 0.45$ $V_{MAX} \times 0.637$ $V_{RMS} \times 0.90$ $V_{MAX} \times 0.827$ $V_{RMS} \times 1.17$ $V_{MAX} \times 0.955$ $V_{RMS} \times 1.35$
24.	Apparent Power	$\sqrt{\text{true power}^2 + (\text{inductive reactive power} - \text{capacitance reactive power})^2}$	$VA = \sqrt{P^2 + (VAR_L - VAR_C)^2}$
25.	RLC Series Circuit (Total Voltage)	$\sqrt{\text{resistive voltage}^2 + (\text{inductive voltage} - \text{capacitive voltage})^2}$	$E_T = \sqrt{E_R^2 + (E_L - E_C)^2}$
26.	RLC Series Circuits (Impedance)	$\sqrt{\text{resistance}^2 + (\text{inductive reactance} - \text{capacitive reactance})^2}$	$Z = \sqrt{R^2 + (X_L - X_C)^2}$
27.	RLC Parallel Circuits (Impedance)	$\frac{1}{\sqrt{\left(\frac{1}{\text{resistance}}\right)^2 + \left(\frac{1}{\text{inductive reactance}} - \frac{1}{\text{capacitive reactance}}\right)^2}}$	$Z = \frac{1}{\sqrt{\left(\frac{1}{R}\right)^2 + \left(\frac{1}{X_L} - \frac{1}{X_C}\right)^2}}$

28.	Total Current	resistive current ² + (inductive current – capacitive current) ²	$I_T = I_R^2 + (I_L - I_C)^2$
29.	Power Factor	$\frac{\text{true power}}{\text{apparent power}} \times 100$	$PF = \frac{W}{VA} \times 100$
30.	Resistance	resistivity x $\frac{\text{length}}{\text{area}}$	$R = \rho \times \frac{L}{A}$
31.	Temperature Resistance	resistance temperature x [1 + temperature coefficient (temperature ₂ – temperature ₁)]	$R_{t_2} = R_{t_1} \times [1 + \alpha_{T1}(t_2 - t_1)]$
32.	Inductive Reactance	$\frac{\text{voltage}}{\text{current}}$	$X_L = \frac{E}{I}$
33.	Circular Mil	diameter ²	cmil = D ²
34.	Frequency	frequency = # of poles x speed / 120	$f = \frac{p \times s}{120}$