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Transducers Formulas

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List of 24 Transducers Formulas

Transducers

1) Area of Detector

$$\text{fx } A = \frac{D_n^2}{D_t^2 \cdot \Delta f}$$

Open Calculator 

$$\text{ex } 4.231405\text{m}^2 = \frac{(2)^2}{(1.375)^2 \cdot 0.5\text{Hz}}$$

2) Capacitance of Amplifier

$$\text{fx } C_{\text{amp}} = C_g - C_t - C_{\text{cable}}$$

Open Calculator 

$$\text{ex } 0.04\text{F} = 0.08\text{F} - 0.03\text{F} - 0.01\text{F}$$

3) Capacitance of Cable

$$\text{fx } C_{\text{cable}} = C_g - (C_t + C_{\text{amp}})$$

Open Calculator 

$$\text{ex } 0.01\text{F} = 0.08\text{F} - (0.03\text{F} + 0.04\text{F})$$

4) Capacitance of Transducer

$$\text{fx } C_t = C_g - (C_{\text{amp}} + C_{\text{cable}})$$

Open Calculator 

$$\text{ex } 0.03\text{F} = 0.08\text{F} - (0.04\text{F} + 0.01\text{F})$$



5) Change in Irradiation

$$fx \quad \Delta H = \frac{\Delta R}{\Delta S}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 30.17241 \text{ W/m}^2 = \frac{35 \Omega}{1.16}$$

6) Change in Resistance

$$fx \quad \Delta R = \Delta H \cdot \Delta S$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 34.8 \Omega = 30 \text{ W/m}^2 \cdot 1.16$$

7) Current Generator Capacitance

$$fx \quad C_g = C_t + C_{amp} + C_{cable}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 0.08 \text{ F} = 0.03 \text{ F} + 0.04 \text{ F} + 0.01 \text{ F}$$

8) Detectivity

$$fx \quad D_t = \frac{R_d}{E_n}$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 1.375228 = \frac{15.1 \text{ A/W}}{10.98 \text{ V}}$$



9) Detectivity of Transducer

$$fx \quad D_t = \frac{snr}{D}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 1.37741 = \frac{15}{10.89m}$$

10) Efficiency of transducer

$$fx \quad \eta_{tr} = \frac{\Delta T}{\Delta T_{rise}}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 1.25 = \frac{20K}{16K}$$

11) Input Signal of Transducer

$$fx \quad D = \frac{V_o}{R_t}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad 10.89595m = \frac{18.85V}{1.73V/m}$$

12) Noise Equivalent of Bandwidth

$$fx \quad \Delta f = \frac{D_n^2}{D_t^2 \cdot A}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$ex \quad 0.503739Hz = \frac{(2)^2}{(1.375)^2 \cdot 4.2m^2}$$



13) Normalized Detectivity

$$fx \quad D_n = (A \cdot \Delta f)^{0.5} \cdot D_t$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$ex \quad 1.992564 = (4.2m^2 \cdot 0.5Hz)^{0.5} \cdot 1.375$$

14) Output Signal of Transducer

$$fx \quad V_o = D \cdot R_t$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$ex \quad 18.8397V = 10.89m \cdot 1.73V/m$$

15) Responsivity of Detector

$$fx \quad R_d = \frac{V_{rms}}{P_{rms}}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$ex \quad 15.11111A/W = \frac{81.6V}{5.4W}$$

16) Responsivity of Transducer

$$fx \quad R_t = \frac{V_o}{D}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$ex \quad 1.730946V/m = \frac{18.85V}{10.89m}$$



17) Rise in Temperature

$$fx \quad \Delta T_{\text{rise}} = \frac{\Delta T}{\eta_{\text{tr}}}$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$ex \quad 16K = \frac{20K}{1.25}$$

18) RMS Incident Power of Detector

$$fx \quad P_{\text{rms}} = \frac{V_{\text{rms}}}{R_d}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$ex \quad 5.403974W = \frac{81.6V}{15.1A/W}$$

19) RMS Noise Voltage of Cell

$$fx \quad E_n = \frac{R_d}{D_t}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$ex \quad 10.98182V = \frac{15.1A/W}{1.375}$$

20) RMS output Voltage Detector

$$fx \quad V_{\text{rms}} = R_d \cdot P_{\text{rms}}$$

[Open Calculator !\[\]\(5abce1a84a655b073239ab33e1199487_img.jpg\)](#)

$$ex \quad 81.54V = 15.1A/W \cdot 5.4W$$



21) Sensitivity of LVDT 

$$fx \quad S_{lvdt} = \frac{V_o}{D}$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$ex \quad 1.730946V/m = \frac{18.85V}{10.89m}$$

22) Sensitivity of Photoresistive Transducer 

$$fx \quad \Delta S = \frac{\Delta R}{\Delta H}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$ex \quad 1.166667 = \frac{35\Omega}{30W/m^2}$$

23) Size of Output Signal 

$$fx \quad V = \frac{snr}{D_t}$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

$$ex \quad 10.90909V = \frac{15}{1.375}$$

24) Temperature Difference 

$$fx \quad \Delta T = \Delta T_{rise} \cdot \eta_{tr}$$

[Open Calculator !\[\]\(06a315363e7801bba8c7489a6694af19_img.jpg\)](#)

$$ex \quad 20K = 16K \cdot 1.25$$



Variables Used














- **A** Detector Area (Square Meter)
- **C_{amp}** Amplifier Capacitance (Farad)
- **C_{cable}** Cable Capacitance (Farad)
- **C_g** Current Generator Capacitance (Farad)
- **C_t** Transducer Capacitance (Farad)
- **D** Input Displacement Signal (Meter)
- **D_n** Normalized Detectivity
- **D_t** Transducer Detectivity
- **E_n** Root Mean Square Noise Voltage of Cell (Volt)
- **P_{rms}** Root Mean Square Incident Power of Detector (Watt)
- **R_d** Detector Responsivity (Ampere per Watt)
- **R_t** Transducer Responsivity (Volt per Meter)
- **S_{lvdt}** LVDT Sensitivity (Volt per Meter)
- **snr** Signal to Noise Ratio of Output Signal
- **V** Output Signal Size (Volt)
- **V_o** Transducer Output Signal (Volt)
- **V_{rms}** Root Mean Square Voltage Output (Volt)
- **Δf** Noise Equivalent Bandwidth (Hertz)
- **ΔH** Irradiation Change (Watt per Square Meter)
- **ΔR** Resistance Change (Ohm)
- **ΔS** Photoresistive Transducer Sensitivity
- **ΔT** Temperature Difference (Kelvin)



- ΔT_{rise} Temperature Rise (Kelvin)
- η_{tr} Transducer Efficiency



Constants, Functions, Measurements used

- **Measurement: Length** in Meter (m)
Length Unit Conversion 
- **Measurement: Temperature** in Kelvin (K)
Temperature Unit Conversion 
- **Measurement: Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement: Power** in Watt (W)
Power Unit Conversion 
- **Measurement: Frequency** in Hertz (Hz)
Frequency Unit Conversion 
- **Measurement: Capacitance** in Farad (F)
Capacitance Unit Conversion 
- **Measurement: Electric Resistance** in Ohm (Ω)
Electric Resistance Unit Conversion 
- **Measurement: Temperature Difference** in Kelvin (K)
Temperature Difference Unit Conversion 
- **Measurement: Electric Field Strength** in Volt per Meter (V/m)
Electric Field Strength Unit Conversion 
- **Measurement: Electric Potential** in Volt (V)
Electric Potential Unit Conversion 
- **Measurement: Potential Gradient** in Volt per Meter (V/m)
Potential Gradient Unit Conversion 
- **Measurement: Irradiation** in Watt per Square Meter (W/m²)
Irradiation Unit Conversion 
- **Measurement: Responsivity** in Ampere per Watt (A/W)
Responsivity Unit Conversion 



Check other formula lists

- [Transducers Formulas](#) 

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