

Development and construction of a 2D Laser Scanner

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Contents

1	Introduction	2
2	Prototype calculations	2
3	Acknowledgements	2

1 Introduction

2 Prototype calculations

The main assumptions of the Prototype are a operational voltage of 5V and a maximum laser power of 100mW. The Peltier element can produce a maximum of 3.8V at 8.4W. Assuming linear behaviour ¹, a slope of $S = \frac{3.8V}{8.4W} = 0.45 \frac{V}{W}$ can be calculated. With the maximum laser power of $P_{max} = 100mW = 0.1W$, the Peltier element is expected to produce a maximum of $S \cdot P_{max} = 0.45 \frac{V}{W} \cdot 0.1W = 0.045V$. In order to amplify this signal, an operational amplifier is used (specificially a LM358), with a gain factor of $\beta = \frac{5V}{0.045V} = 111$. Two resistors are used to set this gain, with R_1 connecting the inverting pin to ground and R_2 connecting the output to the inverting pin (the positive lead of the Peltier element is connected to the noninverting pin). The formula describing the op-amp gain is as follows:

$$111 = 1 + \frac{R_2}{R_1} \Leftrightarrow 110 = \frac{R_2}{R_1} \quad (1)$$

With R_2 arbitrarily chosen as 10k Ω , R_1 is 90 Ω , which is rounded to 100 Ω . The resulting gain of $1 + \frac{10000\Omega}{100\Omega} = 101$ is acceptable.

3 Acknowledgements

¹This is most likely untrue but will suffice for the first calculations.