

Contactless Current Measurement of Two Conductor Cable

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Overview

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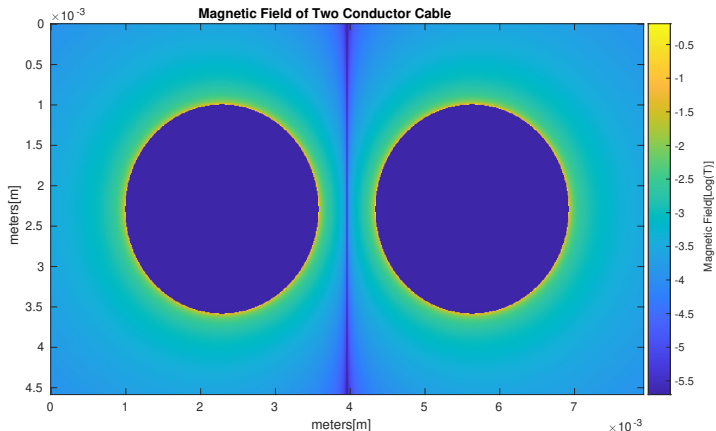
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- Local Sensor
- Control Board

Motivation

Theory: The magnetic field of a two conductor cable is non-negligible but today's current monitors only measure the circle around the entire cable, which sums to zero for a cable with two conductors.



Overview

Goal: Measure the magnetic field at multiple points around a two conductor cable to determine the current.

Specifications:	min	ideal	max	[units]	Notes
ADC Swing	$244\mu\text{V}$	1	1	V	12 bit resolution, 2V range From Datasheet Hall Effect Offset: $V_{CC}/2$
Hall Effect		100		mV/mT	
HE Offset		2.5		V	
Voltage Amp	1	10	100	V/V	

Diagram

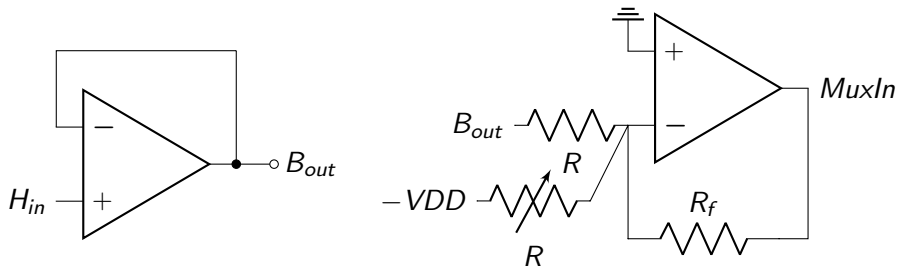


Figure: Final Revision-Rev. 1: Sensor Diagram

This is the diagram of the first revision after the final revision. H_{in} has a $VDD/2$ Offset so the second op-amp subtracts that offset while also amplifying the signal by 10.

Diagram

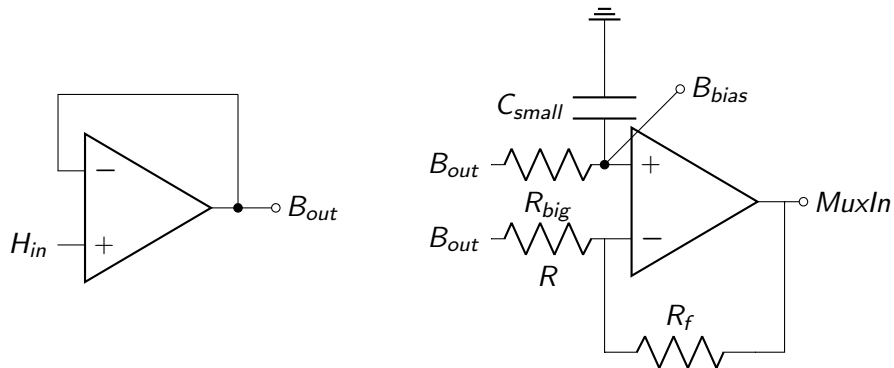


Figure: Final Revision: Sensor Diagram

This is the diagram of the final revision. H_{in} has a $VDD/2$ Offset so the second op-amp has a lowpass filter at the positive terminal to set the bias and it amplifies the signal by 10 in the negative path.

Diagram

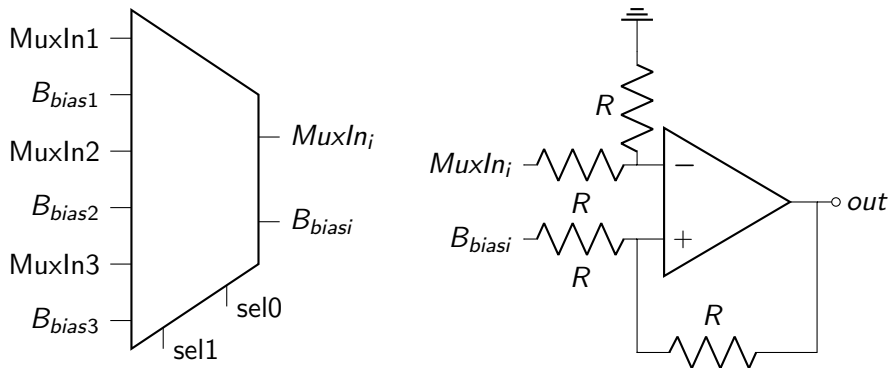


Figure: Final Revision: Control Circuit Diagram

This is the diagram of the Control circuit. First each sensor is connected to the mux and the output is connect to a differential amp to remove any bias's

Diagram

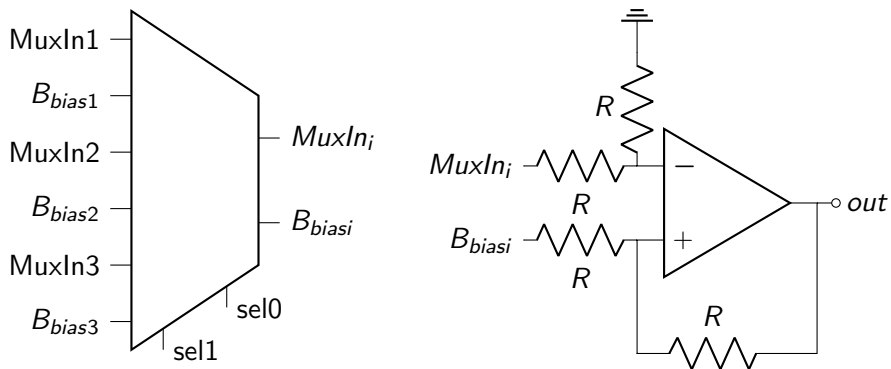


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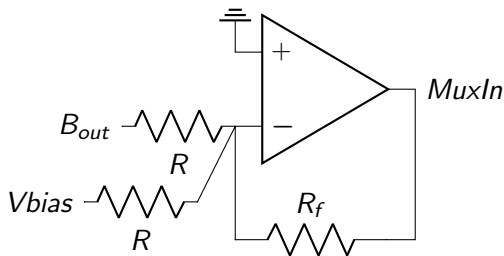


Figure: Last element

This last element just adds the bias required by the PYNQ Z2 ADC which is 1 volt, since it has a 2 volt range from 0V.

Fabrication

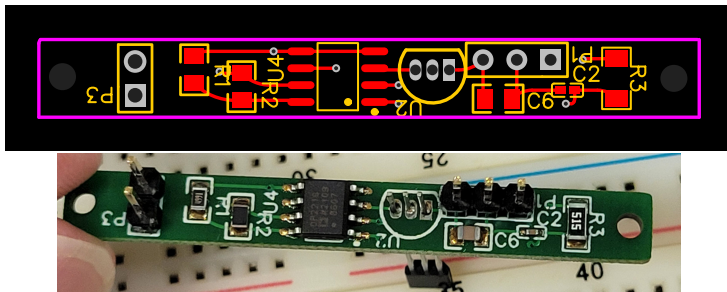


Figure: Fabricated Board

Fabrication

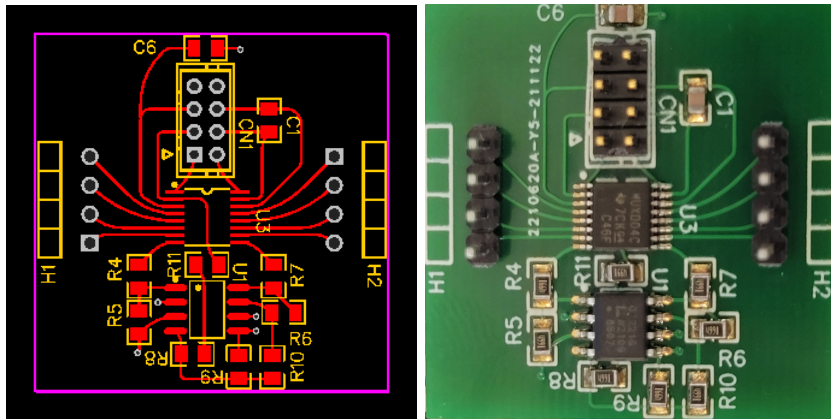


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