

High Current Measurement Evaluation with DRV421

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Considerations making high current measurements with DRV421

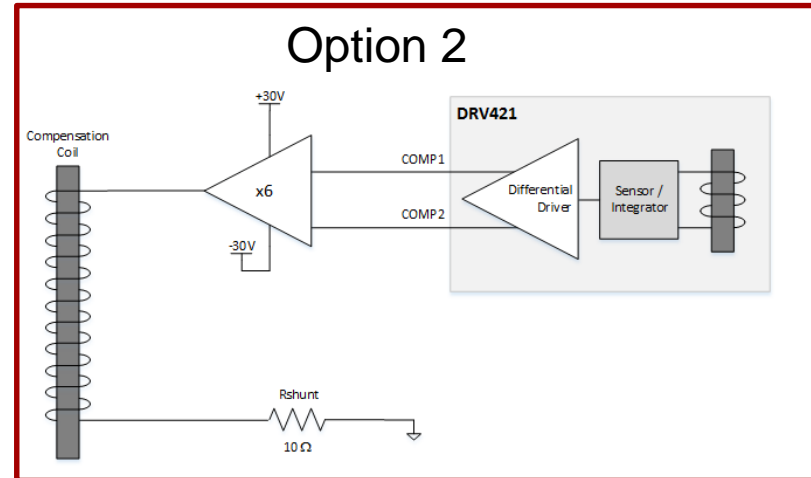
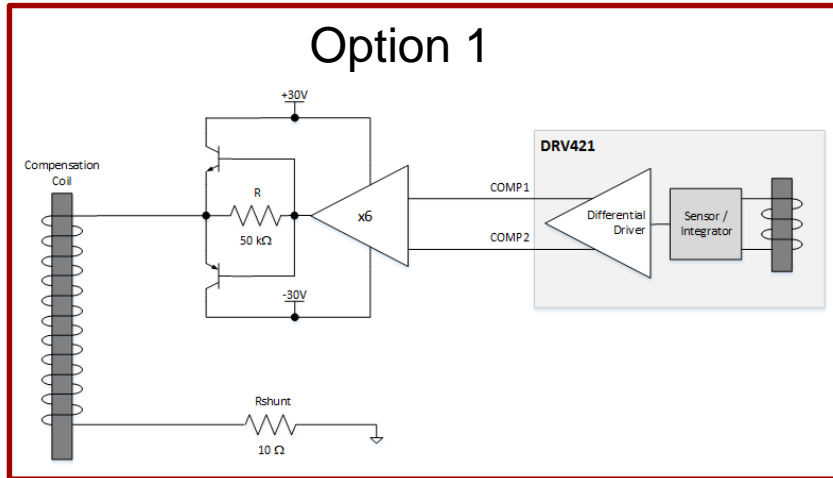
- Output DRV421 has compensation coil drive limited to VDD and GND (typically 5V) and output current limit of 250mA @5V VDD.
- Larger currents require more windings and/or larger compensation currents.
- More windings increases resistance.
- Increasing gauge wire reduces coil resistance.
- Increasing winding and increasing gauge wire may not be enough. Output drive of DRV421 can be increased with additional circuitry.

Lab: High Current Measurement with DRV421

- Core Setup
 - 1500 Turns, 24 gauge compensation Coil
 - 15 Ω Resistance
- Rshunt
 - 10 Ω to GND
- Current Measurement DC
 - 1500 A Measurement (100A with 15 Turns)
- Compensation Current $1500\text{A}/1500\text{Turns} = 1\text{A}$ required
 - DRV421 limited to 250mA output
 - External circuitry required

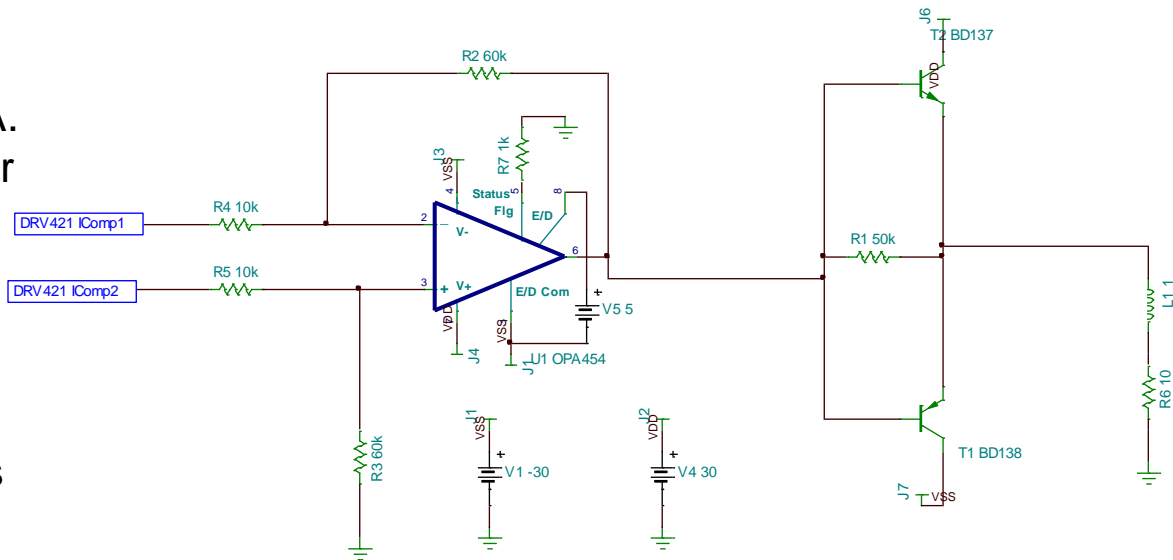
Lab: High Current Measurement with DRV421

- Increase compensation coil drive capability (Voltage and Current)
 - $\pm 30V$ supplies
- Investigated 2 different circuits
 - Option 1: OPA454 or OPA551/OPA552 differential gain of 6 with output transistors
 - Option 2: OPA548 differential gain of 6 drive coil directly



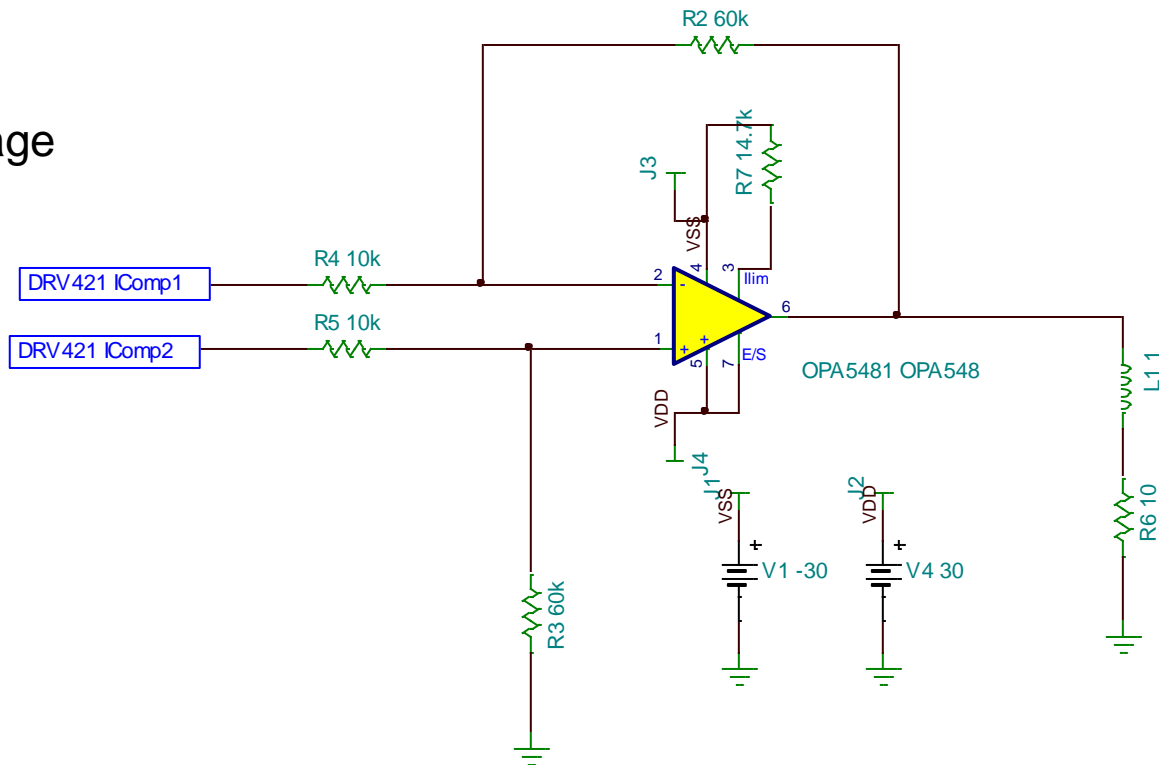
Schematic Option 1

- OPA454 or OPA551/OPA552 can be placed in amplifier location.
- BD137 and BD138 rated to 1.5A. These can be upgraded to larger current transistors.
- R6 (Rshunt) to measure voltage across.
- Advantages
 - Can switch output transistors to meet needs
 - Lower Cost
- Disadvantages
 - More devices



Schematic Option 2

- OPA548 can drive 3A
- R6 Rshunt to measure voltage across.
- Advantages
 - Less components
 - Current limit option
- Disadvantages
 - Cost

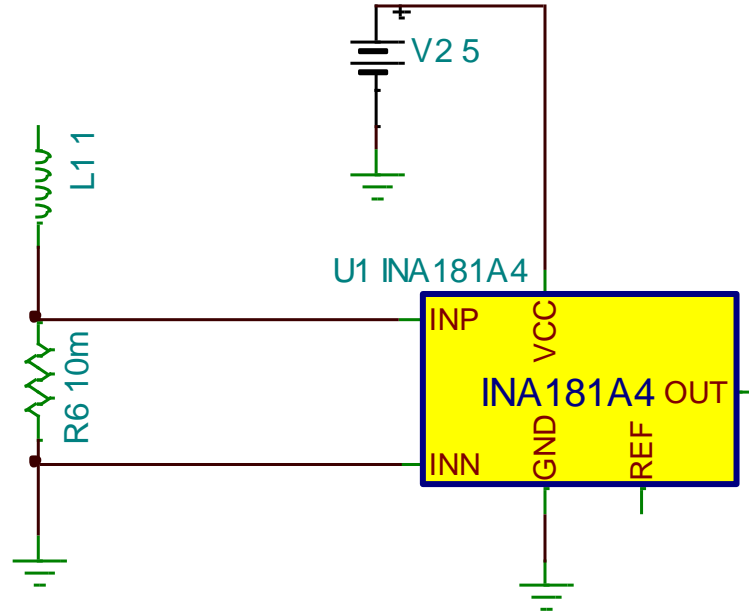


Lab test verified

- Both Schematic options 1 and option 2 where tested and verified.
- 100A DC across 15 windings to simulate 1500A
- Voltage of $\sim 10\text{V}$ across 10Ω load
- Output drive capable for both options.
 - Option 1 with OPA454 and OPA552
 - Option 2 with OPA548

Power Improvement on Rshunt

- Rshunt is large and must meet power rating.
- Decrease Rshunt and add current shunt monitor
- Allows for more windings and/or smaller gauge wire for compensation coil (overall current and power reduction).
- Smaller size components



Summary

- Large currents can be measured with DRV421
- Additional circuitry will be needed to additional number of compensation coil and increased resistance.
 - Voltage capability increase to drive higher resistance
 - Current capability increase to drive higher compensation currents
- Two options proposed verified in lab
- Proposed improvement for Rshunt measurement to reduce power consumption