



ECAL Power Supply Interface Chassis Update

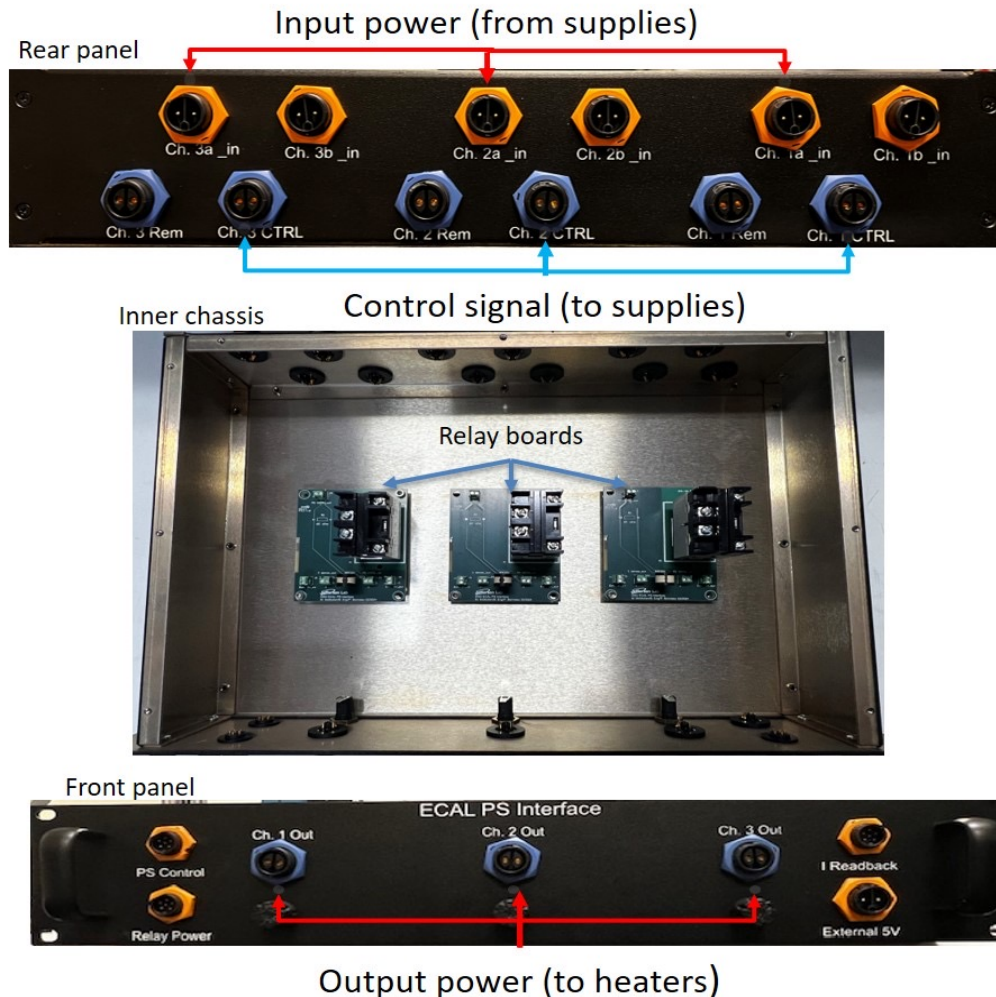
Marc McMullen
Detector Support Group
Wednesday, April 3, 2024

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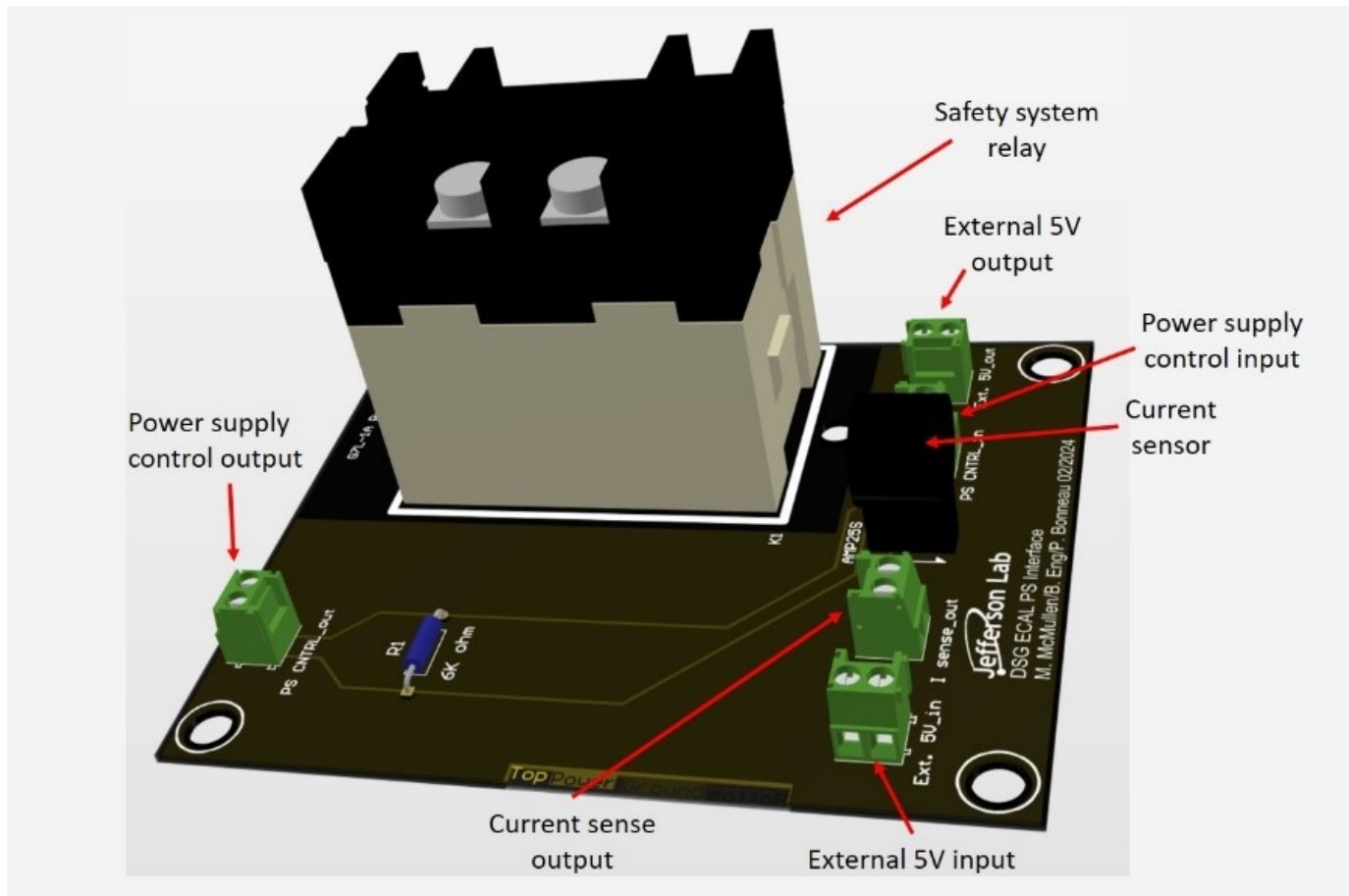
- Panel views
- Power supply interface board
- Internal wiring
- Power supply interface chassis test stand
- ECAL power supply rack system
- Conclusion

Power Supply Interface Chassis Panel Views



- The rear panel connectors connect to the power supplies' output power and power supply control circuit cables
- The front panel connectors connect to the cRIO (control and current readback signals) and provide current to heaters
- The inner chassis holds three circuit boards, each with a relay rated for 20 amps, current sensors, and resistor circuit that prevents the supply from outputting full current if the control voltage is disconnected

Power Supply Interface Board

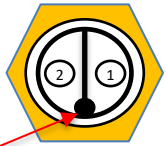


- The relay disconnects the power supply output channel from the heater if the system over-temperature interlocks engage
- The power supply control output connector provides a 0–10 V signal that controls the power supply output level, while a 6-K Ω resistor prevents the supply from outputting full current if the control voltage gets disconnected
- The current sensor uses the Hall effect to measure the current of the power wire as it passes through the sensor and transduces it into a 0–5 V signal
- The sensors are powered by the external 5-V input

Internal Wiring: Heater Power

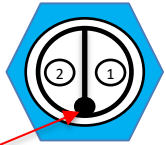


Parts



2 Pin Male (front view)
p/n 23002535-01

Connector orientation tool



2 Pin Female (front view)
p/n 23002635-01

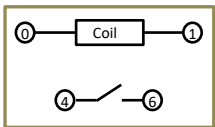
Connector orientation tool



6 Pin Male (front view)
p/n 22006535-01

Connector orientation tool

NO relay



p/n G7L-1A-TUB-J-CB-DC24

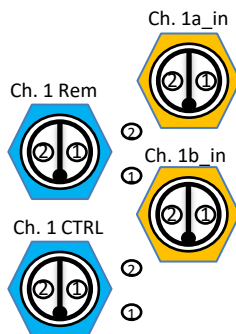
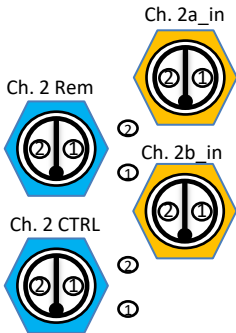
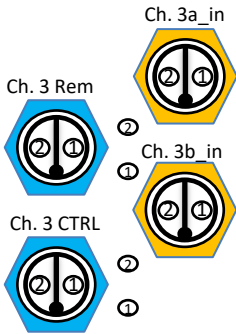
Terminal block



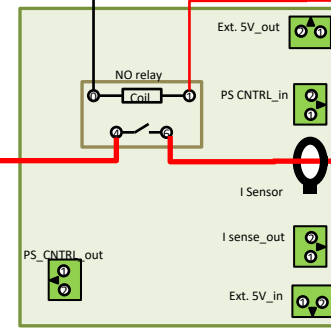
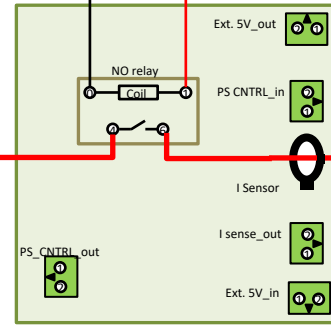
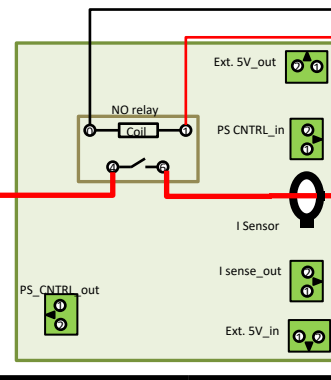
Wire entry marker

Note: Wires enter on marker side

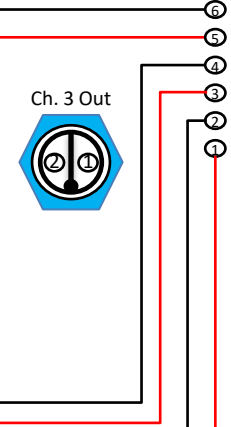
Rear panel connectors



Relay boards



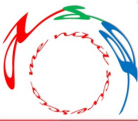
Front panel connectors



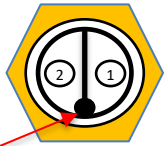
Relay Power

Wiring diagram for the heater power and relay coils

Internal Wiring: Current Monitoring

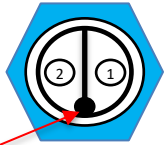


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Connector orientation tool



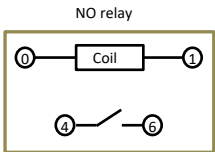
2 Pin Female (front view)
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6 Pin Male (front view)
p/n 22006535-01

Connector orientation tool



p/n G7L-1A-TUB-J-CB-DC24

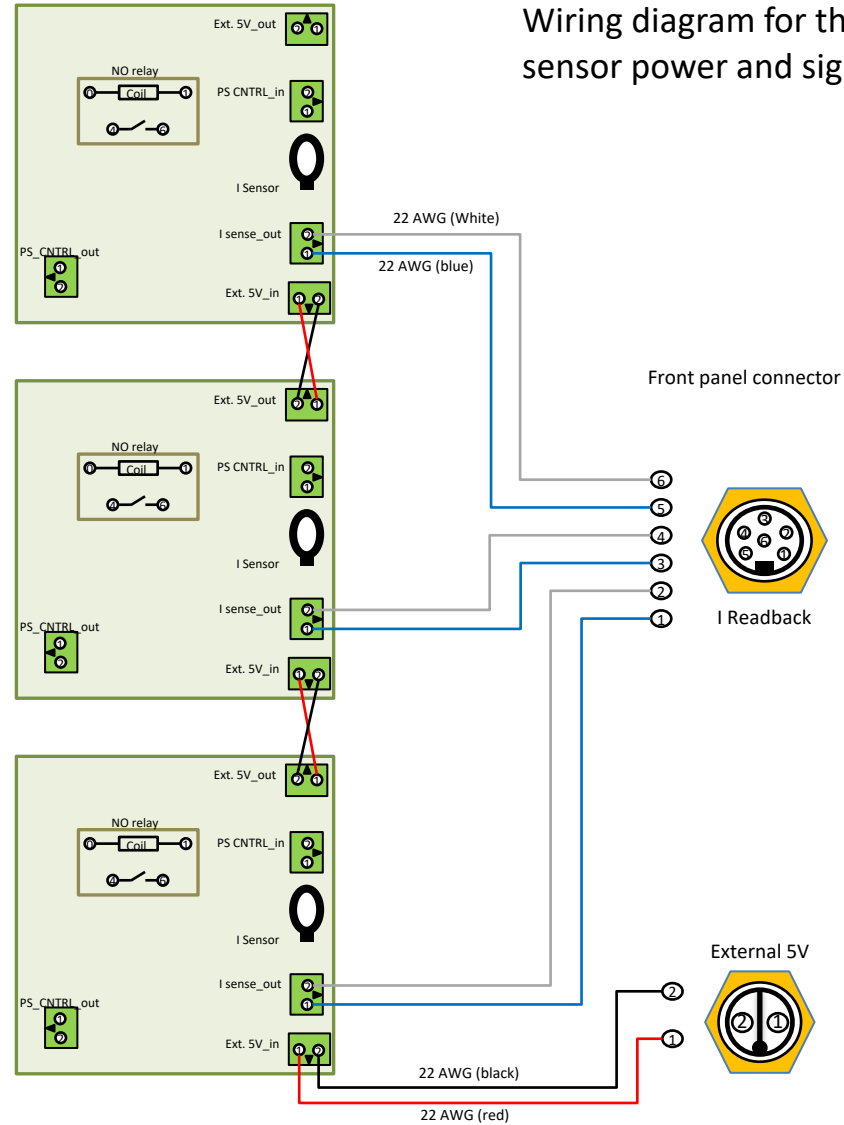
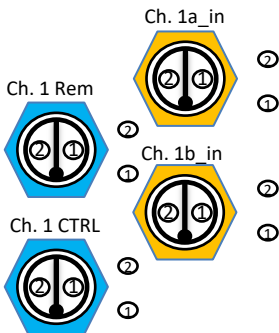
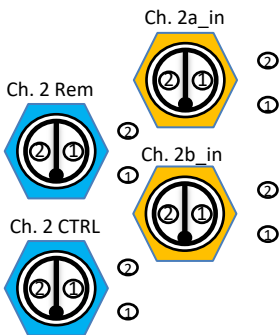
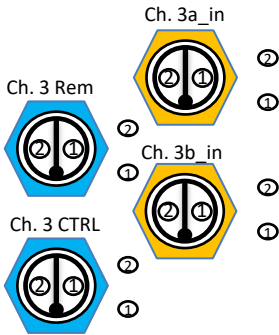
Terminal block



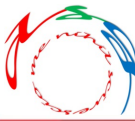
Wire entry marker

Note: Wires enter on marker side

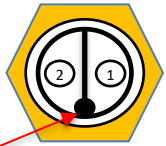
Rear panel connectors



Internal Wiring: Power Supply Control

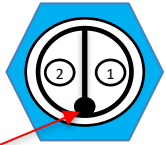


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Connector orientation tool



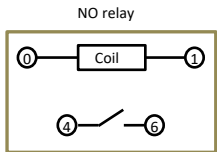
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6 Pin Male (front view)
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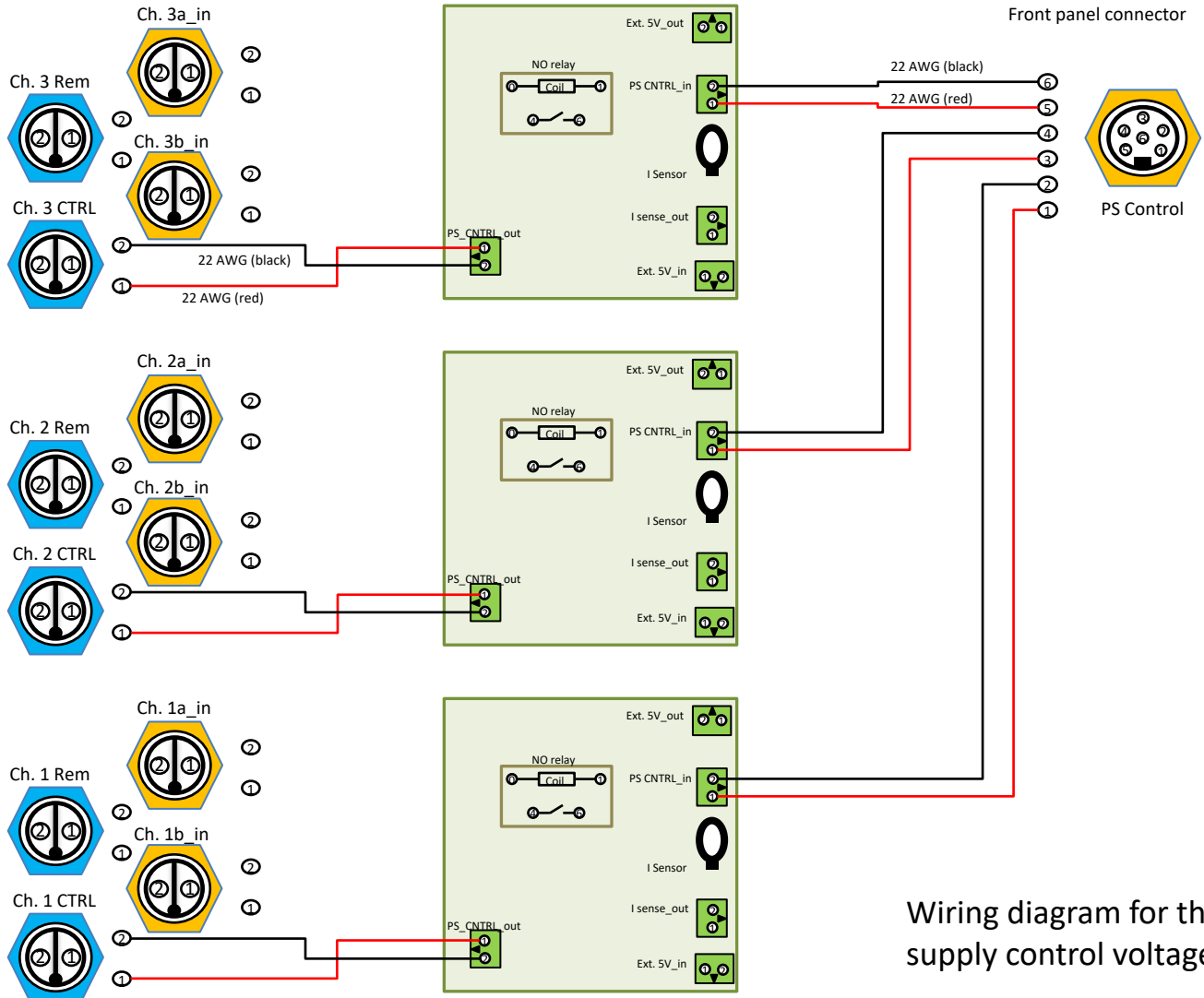
Terminal block



Wire entry marker

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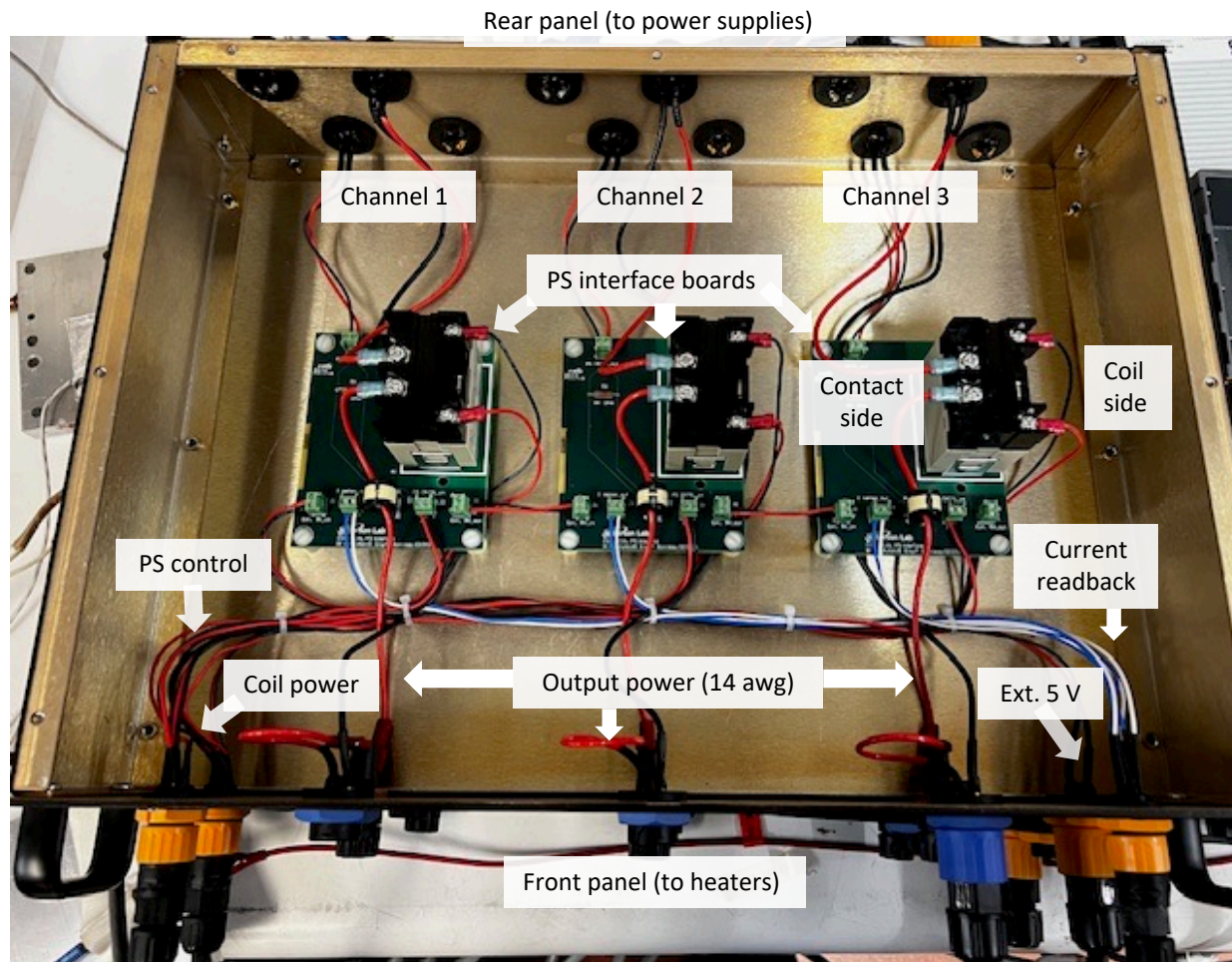
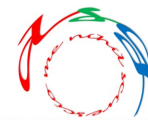
Rear panel connectors



Wiring diagram for the power supply control voltage circuit

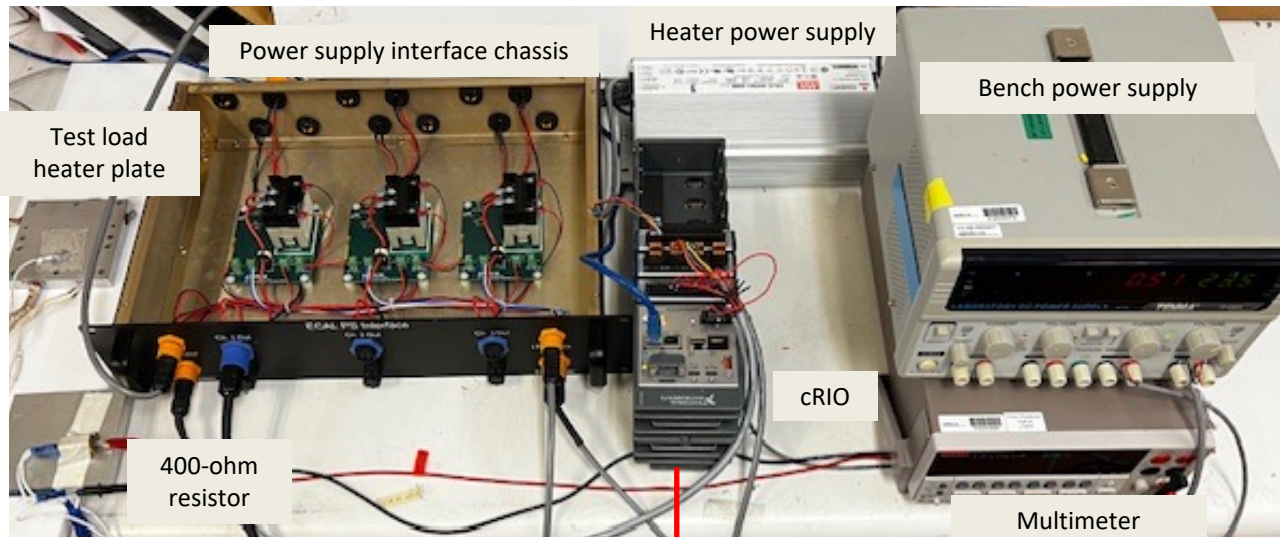


Internal Wiring: Completed Chassis

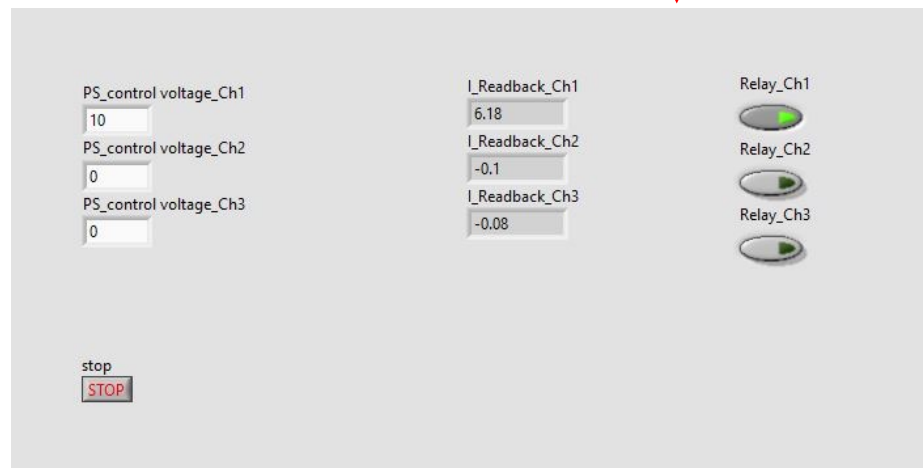


- Two chassis were assembled and wired by Mindy Leffel and tested by Marc McMullen
- All heater power wiring is 14 awg; all other wiring is 22 awg

Power Supply Interface Chassis Test Stand



- Power supply interface chassis under test
- Bench power supply – cRIO and external 5-V power
- 400-Ω resistor – current verification flow (max at 48 V is ~120 mA)
- cRIO – DAQ
- Heater power supply supplies current to load @ 48 V
- Test load heater plate – 8-Ω test load
- Multimeter measures current through 400-Ω resistor



Maximum current flow through the 400-Ω resistor that is in parallel to the test load

LabVIEW test software: Testing channel 1 at 100% current output

ECAL Power Supply Rack System



Top view of rack

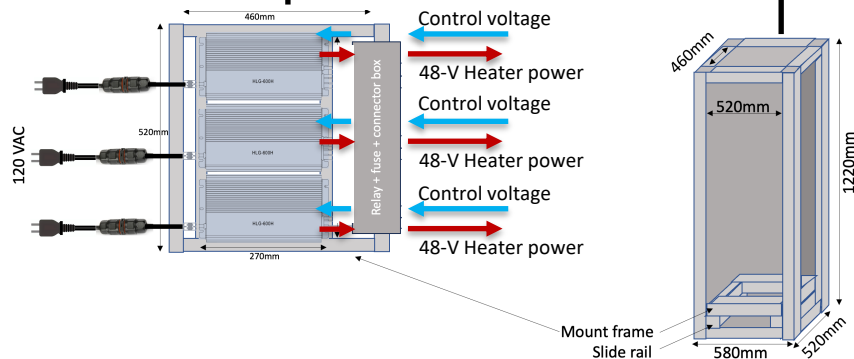


Rear view of rack

Power supply rack system

- Eight rows (95 mm h x 546 mm w x 178 mm d (max))
- Interface chassis will be mounted to vertical rails attached to the front

Interface chassis location



Power supply rack dimensions

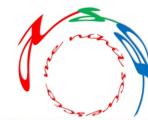
- 24 power supplies per rack
 - 2 racks
 - 48 total
- Three power supplies per interface chassis

Hall A has developed a two-rack system made of extruded aluminum. Each row of supplies will connect to a single power supply interface chassis. To mount the interface chassis, two vertical rails will be added to the front of the rack. The interface chassis will mount using standard rack-mount hardware.

Conclusion



- DSG developed a three-channel prototype system to interface the heater controls, safety system, heaters, and power supplies
 - A PCB was developed to encompass all elements into a single channel
- The chassis system was procured, assembled, and wired
- A test stand was developed to test each channel
 - **All channels tested good**
- DSG will use the prototype to develop a 16-chassis system for the full ECAL heater controls system
 - 48 total channels



Thank You



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Jefferson Lab