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Power Supply Control Module Safety and User Guide. Specific to the power supply used for the HV suplied to electrodes in flame control experiments.

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Report Title

Power Supply Control Module

ABSTRACT

Power Supply Control Module Safety and User Guide. Specific to the power supply used for the HV suplied to electrodes in flame control experiments.

Power Supply Control Module

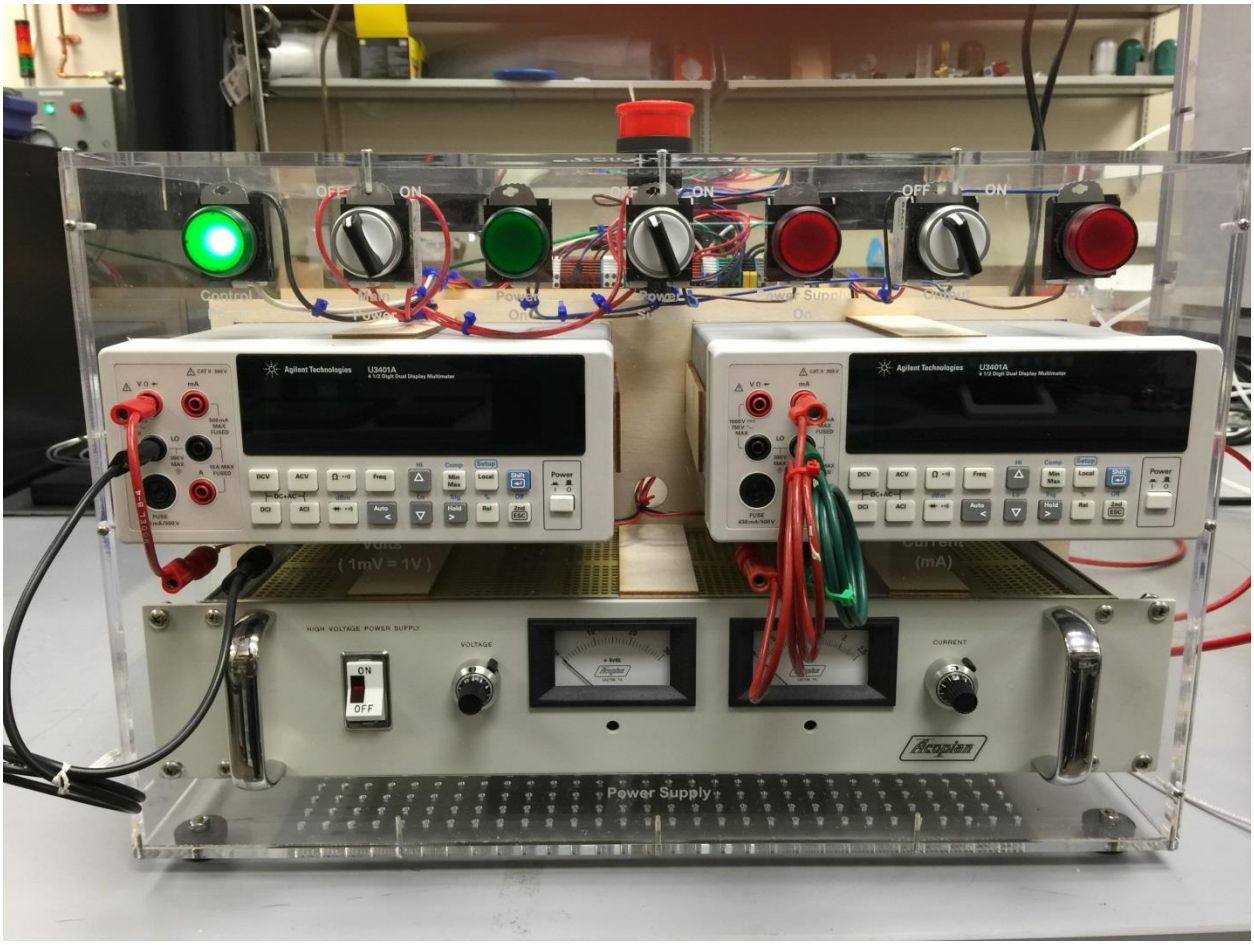
Operating Instructions

Revision 1

February 5, 2015

Designed By: Christopher R Buck

Lab Advisor: Dr. Kevin Lyons



North Carolina State University

Reacting Flows and Turbulent Jets Laboratory

Engineering Building III, Room 1206

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General Information

Equipment

All equipment contained in the control box is UL listed.

Power Supply

Acopian PO30HP2 (UL508 Listed)

For Specifications: http://www.acopian.com/highvolt-acdc-rack-m.html

Multi-Meters

Agilent Technologies U3401A (ANSI/UL 61010-1:2004)

For Specifications: http://www.keysight.com/en/pd-1650614-pn-U3401A/digital-multimeter-4-digit-dual-display?cc=US&lc=eng

Operations

Safety Warnings

Acopian PO30HP2

- The voltages developed by these powers supplies are high enough to cause serious electric shock.
- To minimize risk of shock:
- Make ALL connections before applying input power.
- DO NOT remove high voltage output lead or open the high voltage return lead during operation.
- IN THE ABSENCE OF A SECURE HIGH VOLTAGE RETURN LEAD, TOUCHING

POWER SUPPLY CASE MAY RESULT IN SHOCK.

- Servicing the power supply with input power applied involves substantial risk of shock.
- Performance testing requires special equipment and must be done with extreme caution.
- To prevent power supply damage, DO NOT apply a negative polarity control voltage to the

voltage or current programming terminals.

- Do not route high voltage output lead near input or control wiring.

Agilent Technologies U3401A

Warnings

• Do not exceed any of the measurement limits defined in the specifications to avoid instrument damage and the risk of electric shock.

• Do not defeat power cord safety ground feature. Plug in to a grounded (earthed) outlet.

• Do not use multi-meter in any manner that is not specified by the manufacturer.

• Double-check the multi-meter's operation by measuring a known voltage.

• For current measurement, turn off circuit power before connecting the multi-meter to the circuit. Always place the multi-meter in series with the circuit.

• When connecting probes, always connect the common test probe first. When disconnecting probes, always disconnect the live test probe first.

• Do not measure more than the rated voltage (as marked on the multi-meter) between terminals, or between terminal and earth ground.

• Do not use repaired fuses or short-circuited fuse-holders. For continued protection against fire, replace the line fuses only with fuses of the same voltage and current rating and recommended type.

• Do not service or perform adjustments alone. Under certain conditions, hazardous voltages may exist, even with the multi-meter switched off. To avoid dangerous electric shock, service personnel must not attempt internal service or adjustment unless another person, capable of rendering resuscitation or first aid, is present.

• Do not substitute parts or modify multi-meter to avoid the danger of introducing additional hazards. Return the product to Agilent Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.

• Do not operate damaged equipment as the safety protection features built into this multi-meter may have been impaired, either through physical damage, excessive moisture, or any other reason. Remove power and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to Agilent Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.

Cautions

• Turn off circuit power and discharge all high-voltage capacitors in the circuit before you perform resistance, continuity, diodes, or capacitance tests.

• Use the correct terminals, functions, and range for your instruments.

• Do not measure voltage when current measurement is selected.

- Use the multi-meter with the cables provided.
- Repair or service that is not covered in this manual should only be performed by qualified personnel.

Other

- **DO NOT operate the control module with fewer than 2 technicians present**
- **DO NOT leave the control module unattended when powered on.**
- **All wires/cables coming from the control module should be inspected for wear. Wires/Cables with worn or broken insulation or with exposed copper should be replaced prior to powering up the control module.**
- **The control module should ONLY be serviced by authorized personnel.**
- **Never open the control module while it is energized.**
- **The control module should only be operated by trained personnel.**
- **DO NOT place anything on or under the control module.**

Start-Up Procedure

The following procedure should be followed when starting up the control module. The control module should only be operated by trained personnel:

1. Inspect all wires/cables attached to the control module for signs of wear or exposed copper. If exposed copper is found, the wire/cable should be replaced before proceeding.
2. Check that the control module is securely placed, flat, on a table with capable of supporting the weight 30lbs or more.
3. Check that there is nothing placed on/against/beneath the control module.
4. Check that the all connections to the control module are secured. See Figure 1.

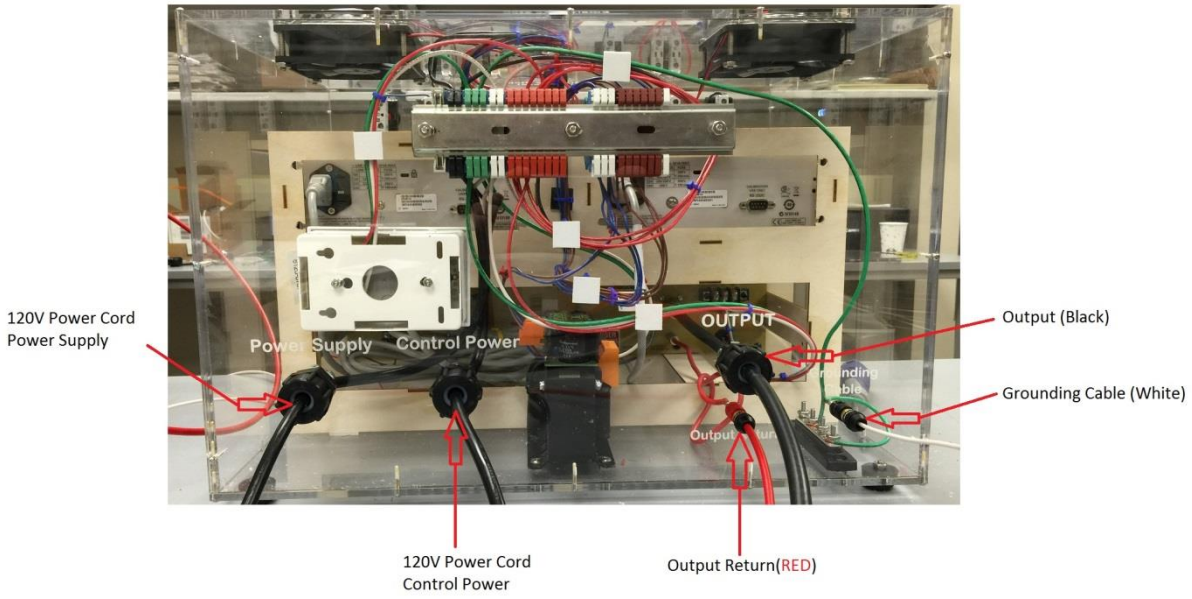

Figure 1: Control Module Back

5. Connect the “Output” and “Output Return” Clamps, black and red respectively, to the experimental apparatus (Figure 2). Ensure that the clamps are securely clamped to the apparatus. Loose connections could accidently become disconnected during the experiment. Also, make sure that the two clamps are not grounded, or directly connected to each other, through the apparatus. **CAUTION: NEVER adjust clamps while the power supply output is turned on. High Voltage can arc from the black output clamp to your body.**

Figure 2: Output and Output Return Clamps

6. Check that the “Main Power” “Power Supply” and “Output” switches are all in the “OFF” position. (Figure 3)

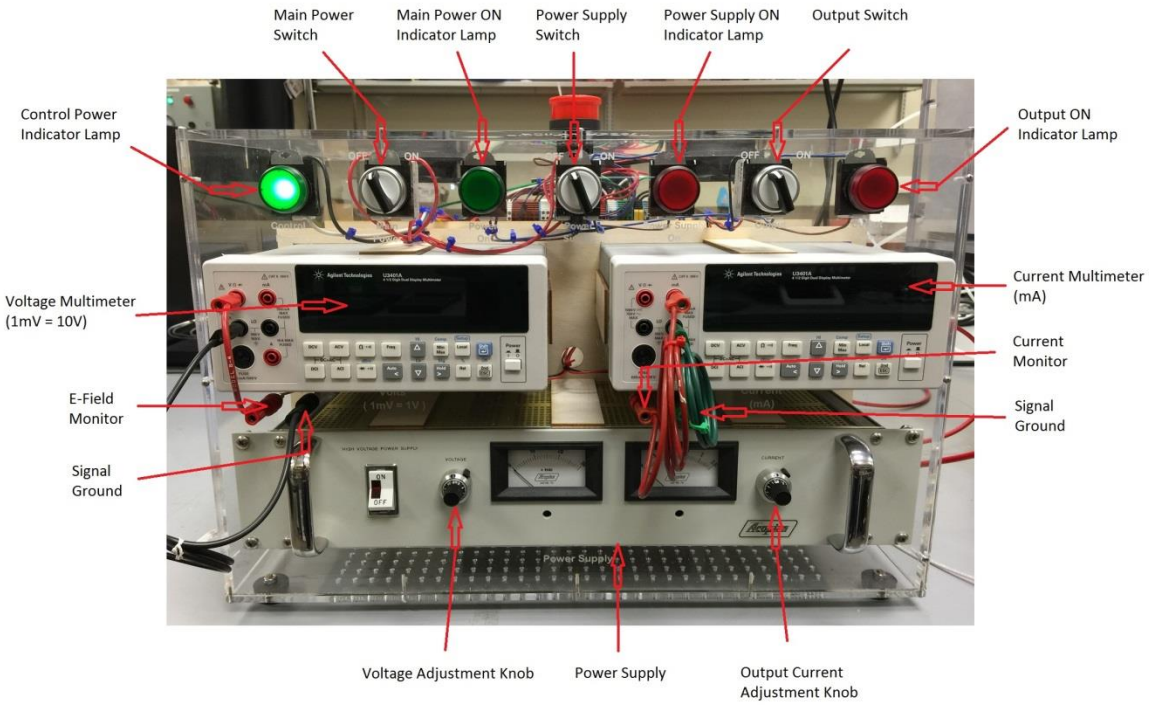

Figure 3: Control Module Front

7. Securely plug the two black 120V/3-prong plugs in to an available 120V outlet. The “Control Power” indicator lamp (Figure 3) will illuminate indicating that the control module is getting power.
8. Recheck that the clamps are securely connected in the desired orientation.
9. Turn the “Main Power” switch to the “ON” position. The “Power On” indicator lamp will illuminate, the multi-meters will power up (Figure 4), and both cooling fans will turn on.

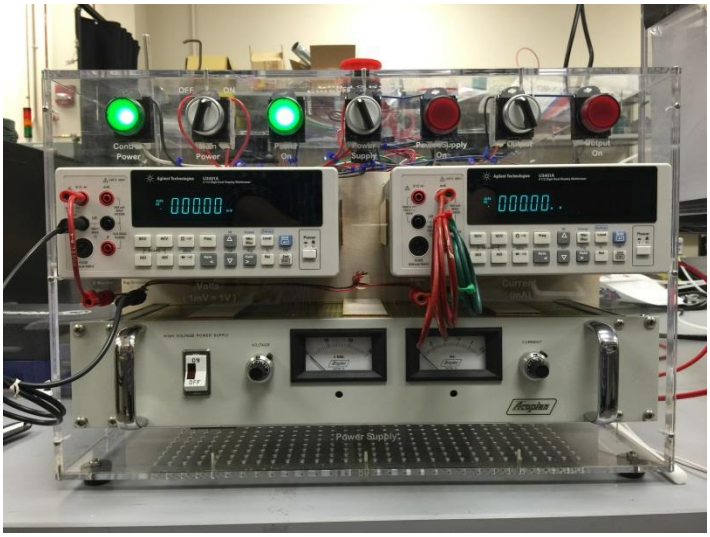

Figure 4: Power Switch "ON"

10. Recheck that the clamps are securely connected in the desired orientation. Adjust the “Voltage” and “Current” adjustment knobs to zero.(See Figure 3 for location)
11. Turn the “Power Supply” switch to the ON position. The “Power Supply On” indicator lamp should become illuminated along with the LED in the on/off switch on the face of the power supply. (Figure 5) No voltage is produced until the “Output” switch is turned to the ON position.

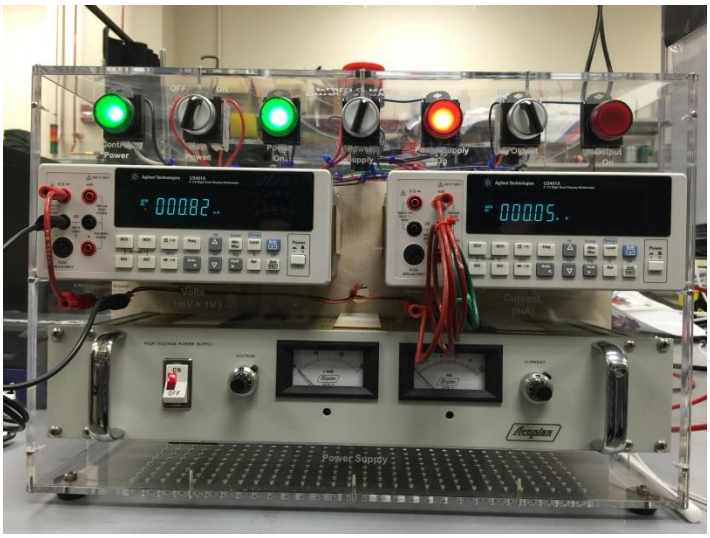

Figure 5: Power Supply "ON"

12. When ready for the electric field to be generated, turn the “Output” switch to the ON position. The “Output ON” indicator lamp will illuminate indicating that the power supply in now sending voltage through the output line.
13. Slowly adjust the “Voltage Adjustment” and “Output Current Adjustment” knobs (Figure 6) until the desired voltage/current is reached as indicated on the multi-meter readouts.

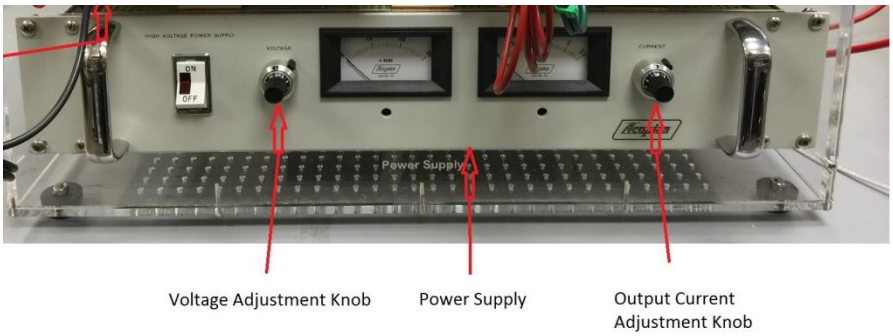

Figure 6 Power Supply Adjustment Knob Locations

Continuous Operating Procedure

In case of emergency, the control module can be shut-down by pressing the emergency stop button located on top of the module (Figure 7). The button will then lock in the pressed position. Before restarting the module, turn all switches to the off position and follow the start-up procedure. The emergency stop requires that you twist the plunger clockwise and allow it to return to the depressed position.

Figure 7 Emergency Stop Button

Turning the Output On and Off

When an electric field is not desired, for any reason, simply turn the "Output" switch to the OFF position. It is not necessary to turn the adjustment knobs if no change in previous electric field strength is desired. (Note: The multi-meters are reading the actual output. Therefore, when the output is turned off, they will read a value of zero (or close to zero). DO NOT touch any metallic objects on the apparatus or the output and output return clamps. A residual charge may be present immediately after switching the output off. If ANY adjustments need to be made to the apparatus, follow the "Apparatus Adjustment Procedure" below.

Apparatus Adjustment Procedure

1. Turn the "Output" switch to the OFF position. The "Output ON" Indicator lamp will turn off.
2. Using the grounding rod (Figure 8) brush all of the metal components, including the output and output return clamps, with the exposed copper at the tip of the rod. The grounding rod is wired directly to ground and will remove any residual charge.

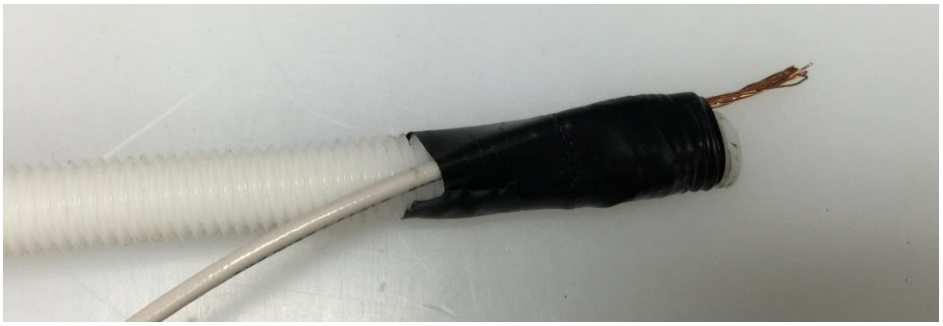

Figure 8: Grounding Rod

3. Make any adjustments to the apparatus.
4. Check that the output and output return clamps are securely clamped to the apparatus.
5. Turn the "Output" switch to the ON position.
6. Continue experiment.

Shut-Down Procedure

On completion of use of the Control Module, the following procedure should be followed:

1. Follow steps 1 and 2 of the "Apparatus Adjustment Procedure" above.
2. Turn the "Power Supply" switch to the OFF position.
3. Turn the "Main Power" switch to the OFF position.
4. Remove the "Output" and "Output Return" clamps from the apparatus and unplug the two cables from the back of the control module.
5. Coil these cables and prepare them for storage.