



MPMS Service Note 1014-401

Magnet Controls and Kepco Troubleshooting

The magnet control system has three major components: the superconducting magnet, the gas/magnet tray, and the Kepco power supply. There are two large resistors on the gas/magnet tray. These resistors sense the current being delivered to the magnet and are used for high and low resolution settings on the magnet.

Follow this procedure to test the integrity of the magnet sense resistors and the charging system. You will be checking specific components of the gas/magnet tray and the power supply connectors. You will be manually setting the current delivered to the magnet as you measure the voltage across each of the magnet current sense resistors. Repeat the resistor test procedure at different currents and magnet polarities.

Checking the Connections

1. Get a voltmeter, paper, and pencil available to record your resistor readings.
2. From the MPMS computer, set the magnetic field to zero.
3. Disconnect the Red lemo connector from the probe so that the probe is isolated from the control console.
4. Remove the top cover of the MPMS console to expose the gas/magnet tray. If you are facing the front of the console, the gas/magnet tray is located to the right of the magnet power supply.
5. At the rear of the gas/magnet tray is a large terminal block with four large leads going to it. Locate the two contacts labeled **Magnet +** and **Magnet -**. See Figure 1.
6. Using a piece of wire that can handle 50 Amps (#10 or larger), short the **Magnet +** and **Magnet -** leads.
7. Make sure all the cables are securely fastened on the rear of the gas/magnet tray. These are the cables that connect to the Kepco power supply, to the rear of the gas/magnet tray, and all of the 1822 connector cables.
8. Verify that the shunt amplifier board on the gas/magnet tray is securely seated. The shunt amplifier is the board that is vertically seated on the right edge of the gas/magnet tray.

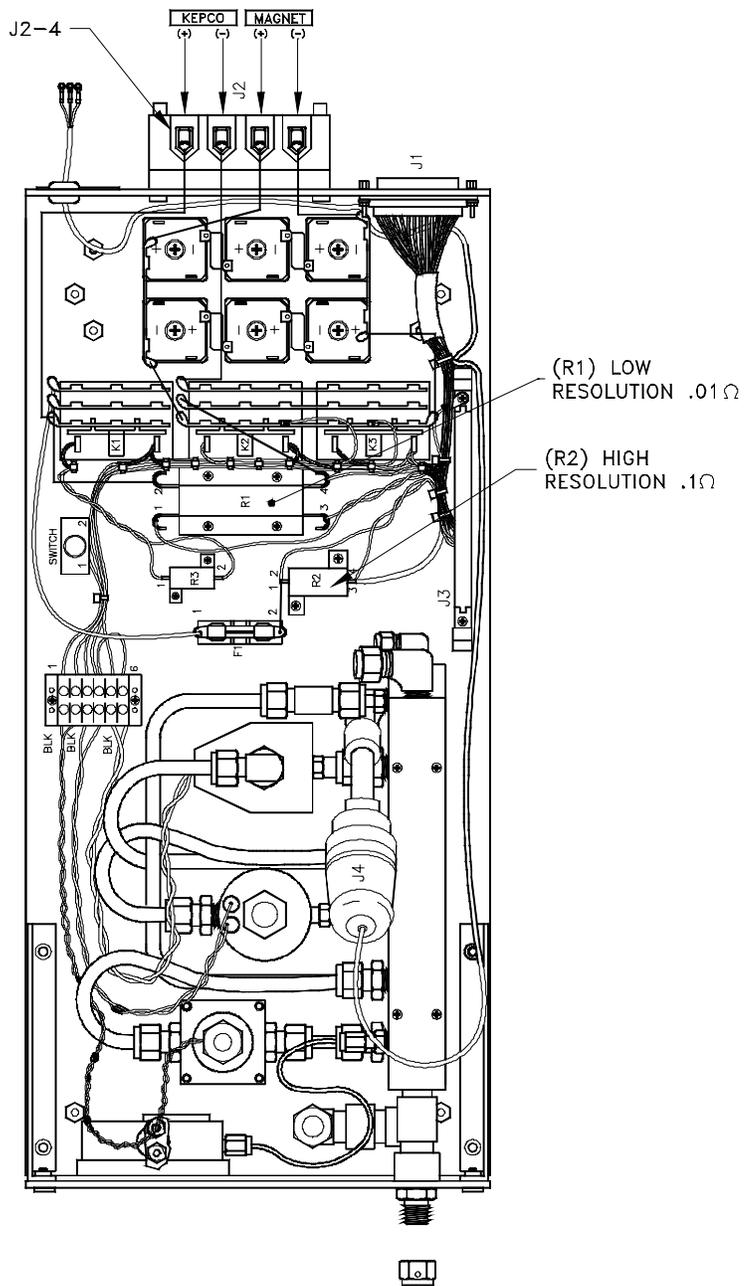


Figure 1. Magnet Controls

Checking the Magnet Sense Resistors with the Magnet Disconnected

The magnetic field is determined by the amount of current delivered to the magnet. The following equations describe this relationship. If you have identified a field range at which the charging problem begins, you may want to determine the current that corresponds to this field value. Note, however, that this is not necessary to perform this procedure.

If your B/I Ratio is 2200.00 and a field of 1 KG (1000 Gauss) is requested, the system will require a current of:

$$\frac{B}{I} = 2200.0 = \frac{1KG}{XAmps} = \frac{1000Gauss}{XAmps}$$

So, for a 1000 Gauss field the current will be set to:

$$I = \frac{1000gauss}{2200.0} = .454Amps.$$

1. Refer to Figure 1 and locate the **High Resolution (R2)** resistor. This is the small-sized resistor located near the middle of the tray (the 0.1 ohm resistor).
2. Connect the voltmeter leads across the small red and black leads of this resistor. There should be no voltage across these leads at this time.
3. On the MPMS MultiVu software, select **Utilities > Diagnostic > Magnet**.
4. Set the **Power Supply** to **ON**. You will hear the power supply come on.
5. Set the Field Polarity to Positive.
6. Leave the **Switch Heater** turned **OFF**. To turn it off, set the current to zero, turn the power off, turn the polarity off, then turn the Switch Heater off.
7. Set the Resolution to High.
8. Move the cursor down to the **Set Current** field and enter **1 Amp**.
9. Watch the voltage reading on your voltmeter and verify that it corresponds to the equation $V=IR$ where R is 0.1 ohms. Record this voltage value.
10. Repeat steps seven and eight at 2 and 3 Amps. Note any unusual behavior or unpredicted voltages.
11. Set the current to zero.
12. Set the **Resolution** to **Low**.
13. Locate the **Low Resolution (R1)** resistor on the gas/magnet tray. This is the large-sized resistor located toward the rear of the tray from the High Resolution resistor. This is a 0.01 ohm resistor. See Figure 1.
14. Connect the voltmeter leads across the small red and black low resolution leads.

15. Set the **Current** to 5 Amps and record the voltage across the resistor (remember **R=0.01** now).
16. Set the **Current** to 10, 15, 20, and 25 Amps and record each corresponding voltage.
17. Reset the **Current** to zero.
18. Set the Magnet Polarity to Negative.
19. Repeat steps thirteen and fourteen with the negative polarity.
20. Reset the **Current** to zero.
21. Turn the Power Supply to OFF.
22. Set the Field Polarity to OFF.

Checking the Magnet Sense Resistors with the Magnet Connected

Now you will repeat the previous procedure with the magnet connected. As you do this, be sure to record the voltage and current values displayed on the Kepco power supply in addition to the voltage you read across each resistor.

1. Remove the short across the **Magnet +** and **Magnet –** on the rear of the gas/magnet tray.
2. Reconnect the Red lemo connector to the probe head.
3. On the MPMS MultiVu software, select **Utilities > Diagnostic > Magnet**.
4. Click Switch Heater **ON**. Then, click **Set**.
5. Repeat the procedures of the previous section, **Checking the Magnet Sense Resistors with the Magnet Disconnected**. Be sure to record all readings including the voltage and current displays on the front of the Kepco power supply. To read these gauges, you may need to change the sensitivity setting switches located between the two display gauges. If you notice that the voltage goes to maximum value, discontinue the measurement at that point.

Finishing

Once you have completed all of the above procedures and recorded all of the results, restore the system to its original state.

1. Disconnect the voltmeter.
2. Return the cover to the console.
3. Send the results to Quantum Design Technical Support.