Mr. SQUID® Operation

The output of my Mr. SQUID® unit is a straight line or a slight curve with no flat region in the center of the trace as shown in the manual. What can I do?

If you do not observe any zero-voltage supercurrent (flat, horizontal region in the V-I characteristic at zero volts), it is possible that the critical current of the junctions has been suppressed by external noise sources or the junctions have trapped magnetic flux. To check this possibility, adjust the oscilloscope to display the V-I characteristic while the probe is cooled in liquid nitrogen. Remove the probe and note what happens to the characteristic as the probe warms. At some point, the curve should suddenly rotate and become nearly vertical. When this happens, turn the bias amplitude to zero and adjust the bias offset to roughly center the oscilloscope display. Now cool the probe again and wait until the probe is sufficiently cold (the display should jump to zero when the SQUID returns to the superconducting state). Now increase the amplitude to display the full V-I characteristic.

If there still is no supercurrent, it is possible that the critical current is being suppresses by ambient Electromagnetic Interference (EMI). A nearby microwave oven, cordless telephone, or other electronic equipment may cause EMI and prevent the SQUID from operating normally. If this is the case, turn off this equipment and try re-cooling the SQUID again.

If the above two steps do not improve operation, another possibility is that the magnetic shield has become magnetized. Demagnetize the shield using a demagnetizing coil (available from Radio Shack, for example), reinstall the shield on the probe and re-cool. If a supercurrent is still not visible, complete the resistance tests below and contact Customer Service at STARCryo for further support.

How should I cool Mr. SQUID® to avoid trapping flux in the junctions?

Connect the X (current) output of the Mr. SQUID® electronics box to the horizontal input on the oscilloscope, the Y (voltage) output to the vertical input on the oscilloscope. Set the FLUX BIAS and CURRENT BIAS offset pots to the 12 O'clock position and turn the AMPLITUDE pot to its fully counter-clockwise position. Select the V-I mode and connect the Mr. SQUID cable to the back of the electronics box, but do not connect the cable to the Mr. SQUID® probe.

Turn on the power to the Mr. SQUID® electronics box, then plug the 9-pin cable into the connector on the Mr. SQUID® probe. Adjust the CURRENT BIAS offset to move the "dot" on the oscilloscope display to roughly the center of the display. It may be helpful to adjust the vertical gain to around 1 V/div.

Cool the Mr. SQUID® probe in liquid nitrogen. Once cold, the "dot" on the oscilloscope display should jump to zero voltage. Now increase the AMPLITUDE to see the SQUID V-I characteristic.

The voltage output of my Mr. SQUID® electronics appears to have a small offset – how can I fix this?

The flat portion of the SQUID V-I characteristic should be at zero volts. If it is not, you can adjust the amplifier offset pot on the amplifier board inside the Mr. SQUID® electronics box. This may be done with the Mr. SQUID® probe cold while monitoring the V-I characteristic. Check the zero setting of the oscilloscope by grounding the input for the voltage channel. Open the cover of the Mr. SQUID® electronics box and locate the trim pot on the amplifier board at the rear panel (there is only one trim pot inside the electronics box). Using a small screwdriver, adjust the trim pot to shift the V-I characteristic until the flat portion of the curve is at zero volts. Replace the cover to the electronics box.

The output of my Mr. SQUID® unit is just 9 Volts all the time. What can I do?

This symptom can have a number of different causes.

1. Inspect the cable connections and make sure they are tight.
2. Try replacing the batteries in the Mr. SQUID® electronics box. Sometimes one of the batteries can be too low yet the battery check light may still indicate that the batteries are good. This is because the battery check circuit looks at the total voltage from the two batteries, but not the balance between the two batteries.
3. If neither of the above helps, then you will need to contact customer support. But before doing so, check the Mr. SQUID® probe itself using a digital voltmeter.

Using a digital voltmeter, measure the resistance, at room temperature and at 77K, of the following pin combinations on the DB-9 connector at the top of the probe.

Terminals	Room-Temp.	Typical RT Values	Liquid Nitrogen	Typical LN Values
Pins 1 and 2				
Pins 3 and 4				
Pins 5 and 6				
Pins 7 and 8				
Pins 1 and 3				
Pins 5 and 3				
Pins 7 and 3				

If the resistance between pins 3 and 4 is higher than 500 Ohms at room temperature, substitute pin 4 for pin 3 for the last three measurements. Have these measurements available when you contact Customer Service.

Repairing Mr. SQUID®

Will STAR Cryoelectronics refurbish Mr. SQUIDs that are out of warranty?

Yes. Contact info@starcryo.com for pricing and information.