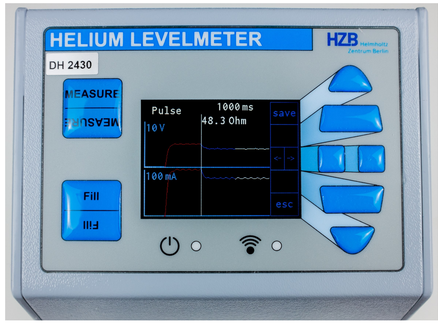
Tom Winkler, Julian Lindner, Bastian Klemke, Peter Wegmann, Klaus Kiefer
Department Sample Environment, Helmholtz-Zentrum Berlin

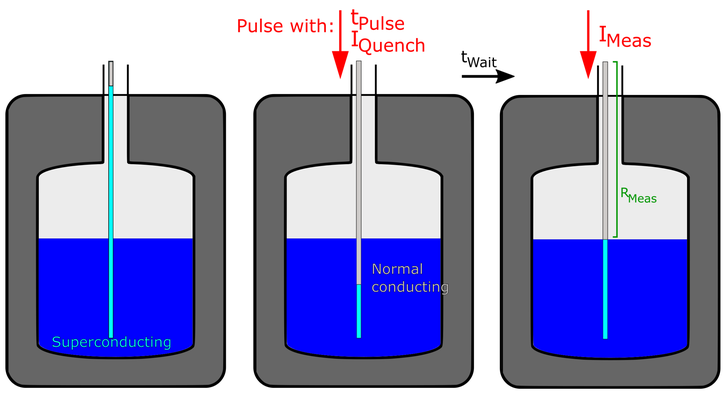
HZB Helmholtz Zentrum Berlin

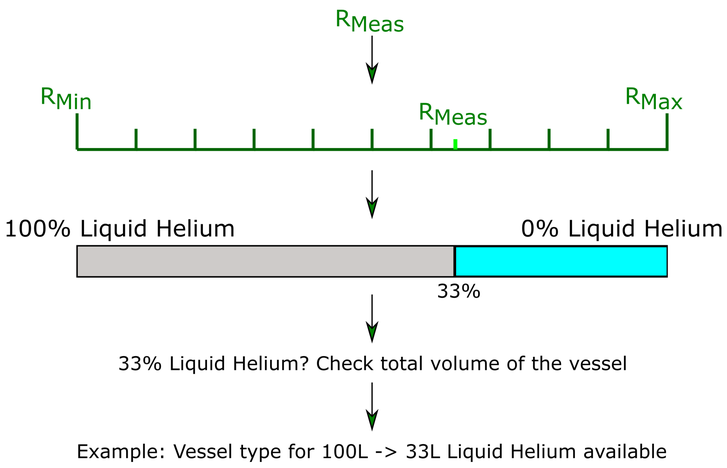
FINDING THE CORRECT PARAMETERS FOR SUPERCONDUCTING HELIUM LEVEL PROBES TO ACHIEVE ACCURATE MEASUREMENTS



ABSTRACT: **Liquid Helium is an important and valuable resource for low temperature cryogenic applications. Automated measurements of Helium levels in storage vessels and cryostats are usually done by measuring the resistance of superconducting level probes. However, for accurate and economical resistive measurements of the Helium level it is required to find and apply optimal parameters. Since there are several free parameters available (such as heating current or pulse length), all of which affect each other, finding the correct ones requires a specific guideline to follow, which will be explained here.**

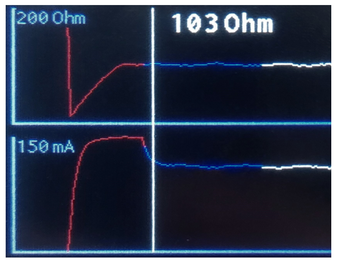
PROBE SETUP AND PARAMETERS

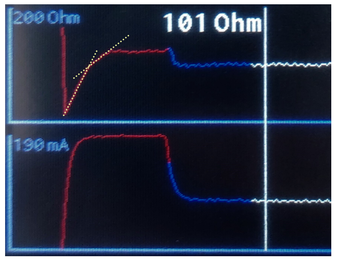




HEATING CHARACTERISTICS

Resistance-time-diagram
Current-time-diagram





Depending on the chosen current two cases must be distinguished:

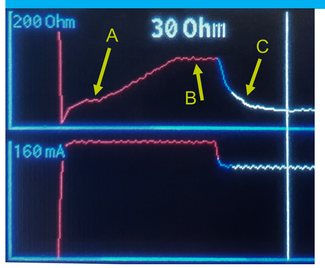
1) Normal operation

- Probe is heated (normal conducting) all above the liquid Helium surface.
- Heating power is insufficient to heat the probe below the liquid Helium surface.

2) Quenching the probe

- Higher currents allow for heating below the liquid Helium surface.
- The slope of R vs. t is less steep in the liquid phase due to higher cooling power from the liquid (see dashed lines).
- The kink in R vs. t defines the resistance corresponcing to the liquid Helium surface position.

POSSIBLE MISTAKES

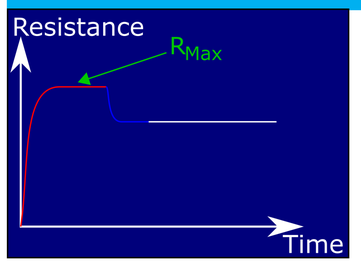


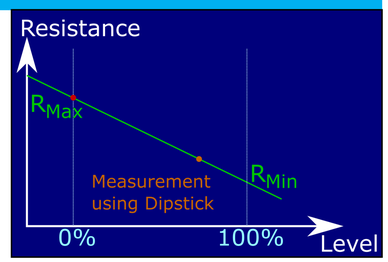
A) Possibility of a mistake of the probe (glue, touch between wire and cladding tube etc.)

B) Unnecessary strong heating

C) Waiting time too short or measurement current too high, equilibrium has not been reached

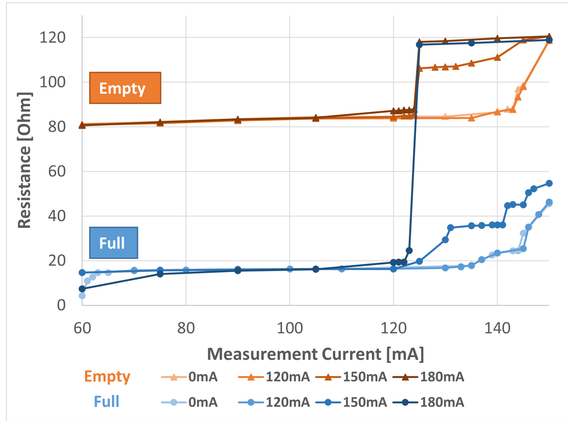
CONNECTING PROBE RESISTANCE AND LEVEL





- The maximum resistance (empty vessel) can be found by quenching the probe by a sufficiently high current.
- A second (normal) resistance measurement at a known level with an appropiate current allows to find the minimum resistance (full vessel) by linear extrapolation.

VARIABLE CURRENTS



Dependence of the measured resistance on applied heating and measurement current