Sequence of Operations and Polarities

It is useful to have a specific sequeence of operations to think about:

- Start with the Current Sweeper set for zero output current and the SQUID just Reset so that V_fb is zero and the flux in the SQUID can be thought of as zero.

- Now turn on a small positive output current from the Current Sweeper, positive in the sense that this current will make the top side of R_sample positive wrt its lower side in drawing 31.

- Now what way must things move ?

- The bridge is out of balance because the top side of R_Sample is possitive and there is still no voltage across R_ref (the FB servo has yet to move).

- The bridge's out of balance current must be connected to the Input Coil with the polarity that causes the FB Signal to slew positive, i.e. the FB Signal must slew in the direction that moves the bridge towards balance.

- As the positive FB Signal slew moves the bridge towards balance it reduces the amount of flux that the bridge injects into the SQUID.

- At the same time the increasing positive FB Signal causes the Internal Feedback path to inject an increasing amount of flux into the SQUID that opposes the flux generated by the bridge's out of balance current.

- The FB servo loop will stop slewing when the flux from the bridge is exactly cancled by the flux from the Internal FB path.
  Note that this is short of the point that produces a high enough positive FB Signal voltage to put the bridge into exact balance.

- I assume that the stopping point of the FB servo loop is determined by the relative "gains" of the bridge path and the Internal FB path as described earlier.

- Because the SQUID's FB servo loop stops slewing at a point with a smaller FB Signal voltage than is required to bring the bridge into exact balance, the simpler equation for R_sample shown earler will under estimate the true value of R_sample.

- For: R_sample = 20 mOhm, R_Ref = 100 uOhm, R_fb = 2k Ohm, TTR = 10:1, I_sweeper = 25 uA, and V_fb = 10 Volts, the difference in the value of R_sample between the exact and simpler equations is about 5%. This difference is a function of R_sample and grows as R_sample increases in value.