Pins and sockets?

First-time users will be unsure about alignment of the pins on the in-plane (IP) and out of plane (OOP) boards to the sockets on the FMR probe, so the photo will help. The IP board will plug into the sockets outlined in red on the FMR probe, while the OOP board plugs into the sockets outlined in blue. Shown here is the rotator adapter which is necessary to protect the pins on the boards while putting a sample on. To use it, please plug the gold board into the green adapter and plug the adapter into the P150 puck test station (stored in the transport accessories drawer).

Remanent field correction

Saturation field must be at least 5000 Oe above the start field in a sweep, and you should sweep to lower field values.

This will ensure that the PhaseFMR software’s remanent field correction for the PPMS magnet is accurate. Otherwise remanence profile will be in between the up- and down- sweep envelopes. See PhaseFMR app note 2016-01 on this topic.

Peaks occurring near end of sweep

Note that peaks occurring close to end of a sweep will not be properly fit. A design decision was made by NanOsc that any fitting in which Hres-dH/2 or Hres+dH/2 is outside the sweep range is regarded as "baseline" and is removed from the combined “IQ” signal and a new fitting is applied to the remaining signal. It’s always an option to post-process the data in another program if the PhaseFMR software isn’t enough.

Small/Large signals in CryoFMR

Ways of improving signal to noise in samples with weak signals (thin ~nm films, small sample area like nanodot arrays, high damping materials...): increase Modulation Amplitude to 0.45 and the Input Gain to 1000x.

Modulation Amplitude: Max 0.45 corresponds to approximately 125 mArms, which is ~1 Oe peak-peak. The default value can be set in the control below the table. Note: The size of the modulation field should be no larger than 10% of the derivative signal linewidth.

Input Gain and Output Gain: The DAQ voltmeter that reads the two channel outputs FMR I and FMR Q has a resolution of 0.3 mV (see Section 8). The gain should be adjusted so that the measured signal is large compared to this value. To improve signal to noise ratio, prioritize increasing the Input Gain.

Large signals: Max range is +/- 10V. If you see the data is flat near +10 V or -10V, it has saturated the digitizer and the data is junk. Redo the scan with a smaller Input Gain.
Electrical probing in CryoFMR

There are 4 pins that plug the FMR CPW into the CryoFMR probe and are mainly there for alignment. However, they also make electrical connection to the probe and this will allow measurement of voltages like inverse spin Hall effect (ISHE signal can be read by PhaseFMR, see BNC on front panel). One can also apply a voltage or current to affect the sample’s magnetic properties (e.g., multiferroics).

**NOTE:** to protect the wiring of the probe and DynaCool sample chamber, please observe:
- **maximum voltage** = 50 V DC
- **maximum current** = 100 mA

If you want to go above this, please contact Neil. Higher voltages can be used under certain conditions.

The photos show the sockets on CryoFMR probe that these pins in FMR boards connect to. Note that you should **NOT** use pin #4 since this is used for the thermometer. Furthermore, the Rotator/MFP Experiment cable 3084-010-02 is recommended in order to control the thermometer on the MFP probe (see Section 6 below of CryoFMR installation instructions below). When that experiment cable is in place, the pins will be remapped as follows:

<table>
<thead>
<tr>
<th>Pin # at IP or OOP board (see photos below)</th>
<th>Pin # after Rot/MFP Expt cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>- (do not use!)</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>14</td>
<td>10</td>
</tr>
</tbody>
</table>

For example: I would like to apply bias voltage to a sample on the IP board, so I will choose pins **10 and 12** at the board. After plugging in the Rotator/MFP Expt cable and the Grey Lemo Breakout Box (see ETO section) into that, I will connect the voltage source to pins **6 and 8** at the breakout box.
**Dimensions of CPW:** shown below is the IP board, where we see the center conductor is $w = 0.18\, \text{mm}$ and the gap in the ground plane is $0.54\, \text{mm}$. According to Maksymov the magnetic film should be less than a height $w$ from the strip since the B-field falls to about half its value when height $= w$ (note when reading Fig. 7b of the paper the stripline is located at $y=0.3\,* w$ so the sample is only above this height; also, it is a stripline not a CPW but I am assuming that the B-field profile is similar).