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1. Sensor Board Details

Table 1. Sensor Characteristics

Design ID	Design Type	Single / High Res / Redundant	Number of Pole Pairs	PCB Size [mm]	Coil Size DOUT / DIN [mm]	Target Size DOUT / DIN [mm]	Air Gap (Nominal) [mm]	Accuracy (Nominal) [deg mech.]
RAA2P4500A80X2_2	Rotary	Single	1	97 x 65	61 / 42	62 / 41	1.50	±0.063

Table 2. Chip Characteristics

Chip	Coil Type	Interface	Internal Resolution
RAA2P4500	Single Coil	AOUT	14 Bit

1.1 Test Conditions

- Measurements are done in a lab environment at room temperature.
- The supply voltage level is 5V supplied by the measurement Hardware (VDD = 5V)
- The nominal accuracy is measured @ nominal air gap.
- Inductance and the DC resistance of the TX coil are measured using a Smart Tweezer ST5S LCR Meter.

1.2 Tx Coil and Frequency Parameters

Set C_{TX} transmit frequency between 2.2 and 5.6 MHz. To ensure a high-quality factor, a NP0 capacitor was used. F_{TX} was measured by the RAA2P4500 itself.

Table 3. Sensor Characteristics

L_{TX}	R_L	C_{TX}	F_{TX} meas.
2.2 µH	2.0 Ω	1100 pF	2.9 MHz

1.3 Calibration Register Settings

The registers up to 0x32 are for the general operation of the chip.
0x34 to 0x6E contain the offset compensation, linearization and zero point.
Registers in the row 0x70 control options for the upper and lower limits of the magnitude and the position range.
The last row contains customer IDs and spare bits and the CRC checksum at 0x8E.

Table 4. Registers Dump

	0x00	0x02	0x04	0x06	0x08	0x0A	0x0C	0x0E
0h	0x14E0	0x8080	0x0070	0x016B	0x0467	0x0100	0x0000	0x0000
10h	0x0000	0x0000	0x0000	0x00B0	0x0FFF	0x0000	0x010F	0x0000
20h	0x6401	0x0000	0x060F	0x0000	0x0000	0x0000	0xC9C9	0x1588
30h	0x20B5	0x0000	0x4000	0x4000	0x0000	0x0000	0x0345	0x0000
40h	0x32E5	0xD533	0x4AD3	0x5560	0xD061	0x7776	0xE83A	0x5F8E
50h	0xA3E9	0x2AB5	0xFBB4	0xD1BB	0xC000	0x7B08	0x2C11	0x43D8
60h	0x1F4F	0x72B6	0x7865	0x4198	0xBA3A	0xDC5E	0x5BD3	0xFFFE
70h	0x0FFF	0x0000	0x0000	0x0000	0x0000	0x007A	0x3FFF	0x0000
80h	0x0000	0x0000	0x0001	0x0000	0x0000	0x0000	0x0000	0x0CE1

1.4 Sensor Board

Figure 1. displays the sensor board layout, consisting of one transmitter coil, two receiver coils, the RAA2P4500 and additional passive components.

Figure 1. Sensor Board

1.5 Sensor Target

Figure 2. displays the target used during the measurements.

Figure 2. Sensor Target

2. Measurement Setup

2.1 General

All measurements were performed on a 4-axis positioning test bench. During the measurement, the target was moved to a defined position. The rotor position read from the sensor id compared to the rotor position measured by high precision reference encoder.

$$f_{mechanical} = real\ sensor\ position - ideal\ position\ value$$

2.2 Design-Specific Test Setup

Figure 3. displays the test setup, the sensor board and target are mounted on the 4-axis positioning test bench.

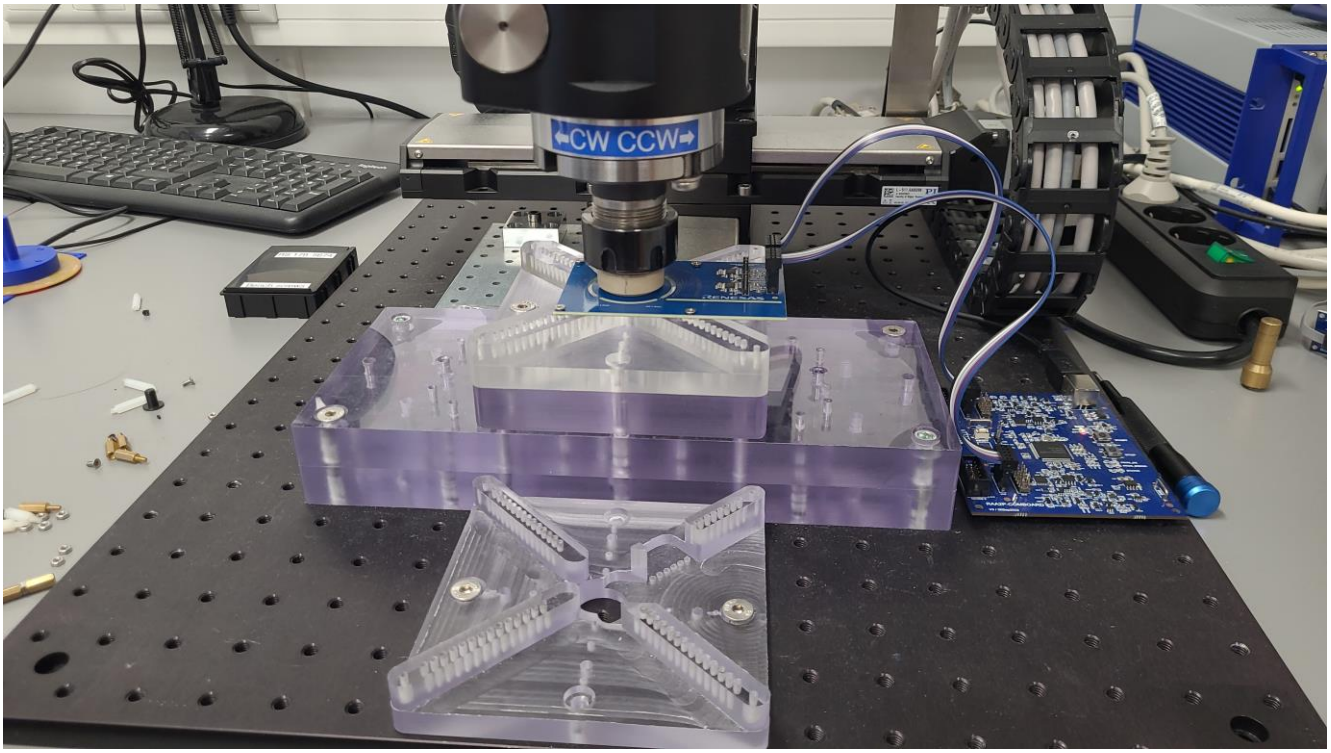

Figure 3. Setup

3. Measurement Results

3.1 Angle Error Primary Coil

The coil offset was compensated without target, then the design was linearized at nominal position. The plot below displays the error of the primary angle measured over the given positions. Measurements are done with the memory settings, as shown in Table 4.

Note: Line Chart Naming: X_.___Y_.___AG_.___

- X = radial displacement in mm
- Y = radial displacement in mm
- AG = Air Gap in mm

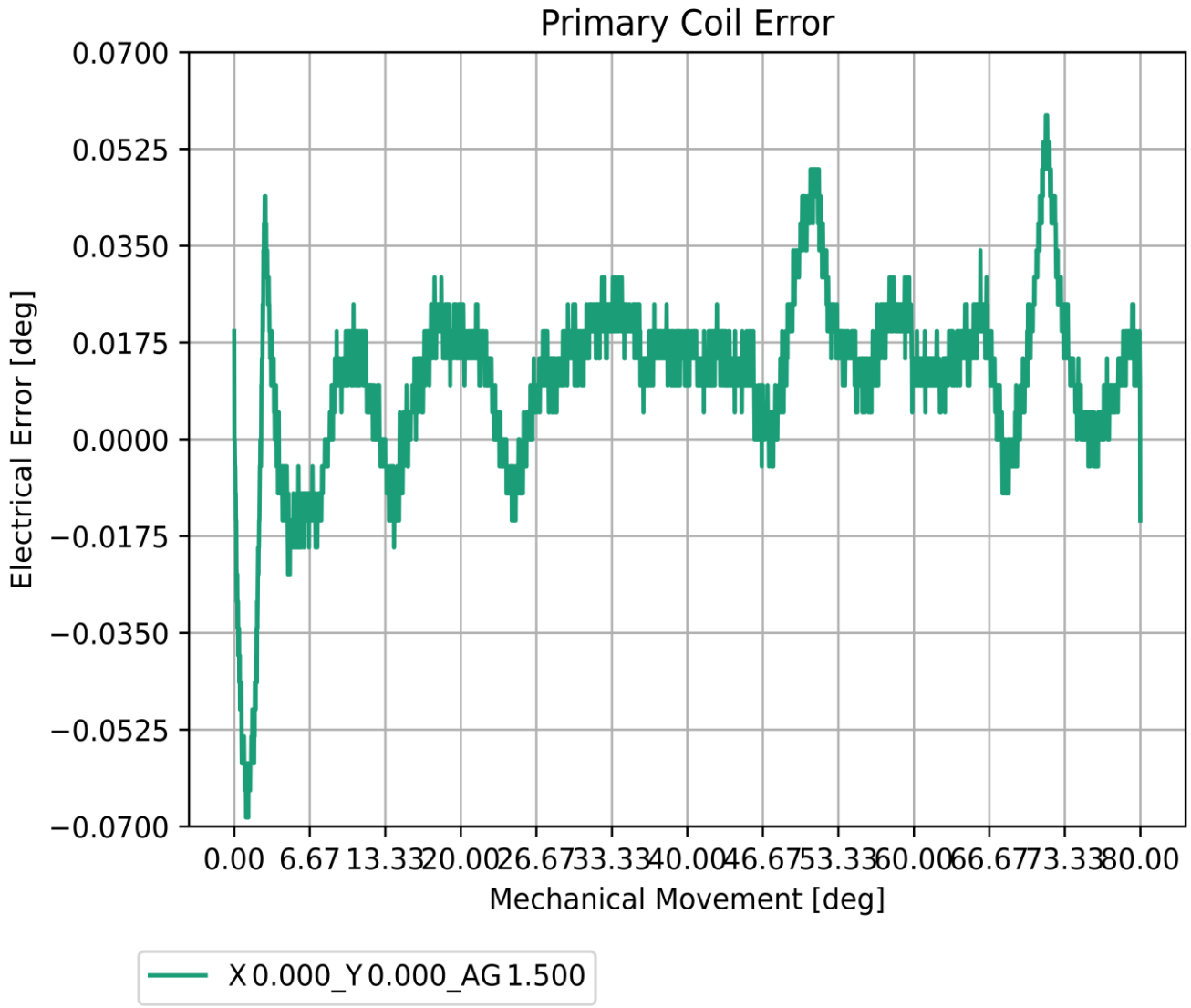

Figure 4. Primary Coil Error

3.2 Magnitude Primary Coil

The plot below displays the primary magnitude measured over the given positions. Measurements are done with the memory settings, as shown in Table 4.

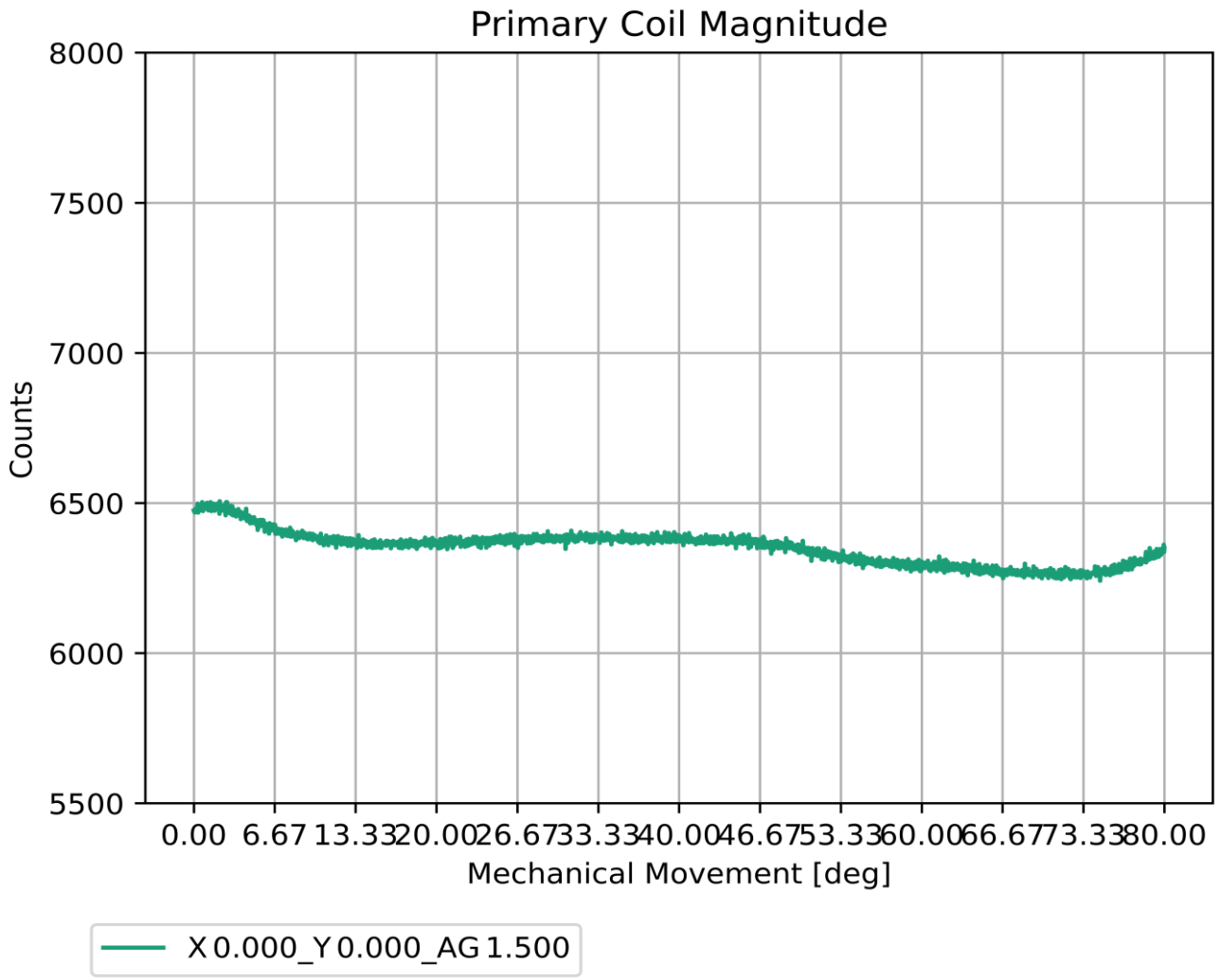

Figure 5. Primary Coil Magnitude

3.3 Gain Primary Coil

The plot below displays the primary coil gain setting measured over the given positions. Measurements are done with the memory settings, as shown in Table 4.

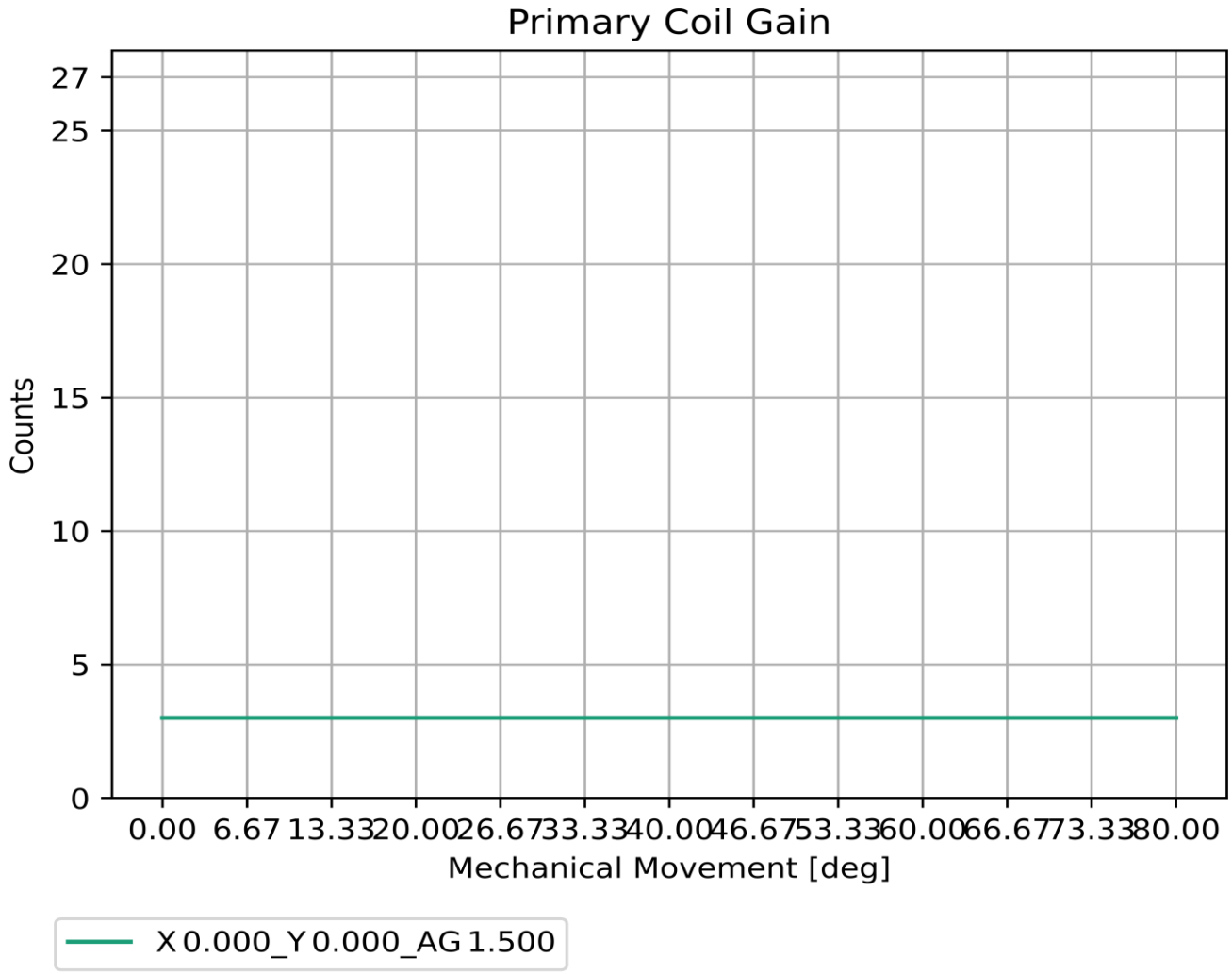

Figure 6. Primary Coil Gain

4. Revision History

Revision	Date	Description
1.0	Jul. 10, 25	Initial release.

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