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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.]
RAA2P4200R0100	Rotary	Single	1	74 x 40	31 / 17	32 / 16	1.60	±0.110

Table 2. Chip Characteristics

Chip	Coil Type	Interface	Internal Resolution
RAA2P4200	Single Coil	I2C	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 RAA2P4200 itself.

Table 3. Sensor Characteristics

L_{TX}	R_L	C_{TX}	F_{TX} meas.
1.5 µH	1.5 Ω	1750 pF	2.76 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	0x0000	0x0000	0x0000	0x0000	0x0000
10h	0x0000	0x0000	0x0000	0x00B0	0x0FFF	0x0000	0x0206	0x0000
20h	0xC401	0x0800	0xFD19	0x0000	0x0000	0x0000	0xC9C9	0x1580
30h	0x8175	0x0000	0x4000	0x4000	0x0000	0x0000	0x09DE	0x0000
40h	0x9122	0x3422	0x4403	0xD496	0xA357	0x78F6	0x3890	0xEC9A
50h	0xB509	0xDC55	0x1ED4	0xF40E	0xF125	0x3E22	0x4503	0x64A9
60h	0xC259	0x7B16	0x28B3	0x089C	0xB62A	0x1C5E	0x1ED5	0xF3FE
70h	0x0FFF	0x0000	0x0FFF	0x0000	0x0000	0x0780	0x3FFF	0x0000
80h	0x0000	0x0000	0x0001	0x0000	0x0000	0x0000	0x0000	0x0625

1.4 Sensor Board

Figure 1. displays the sensor board layout, consisting of one transmitter coil, two receiver coils, the RAA2P4200 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.

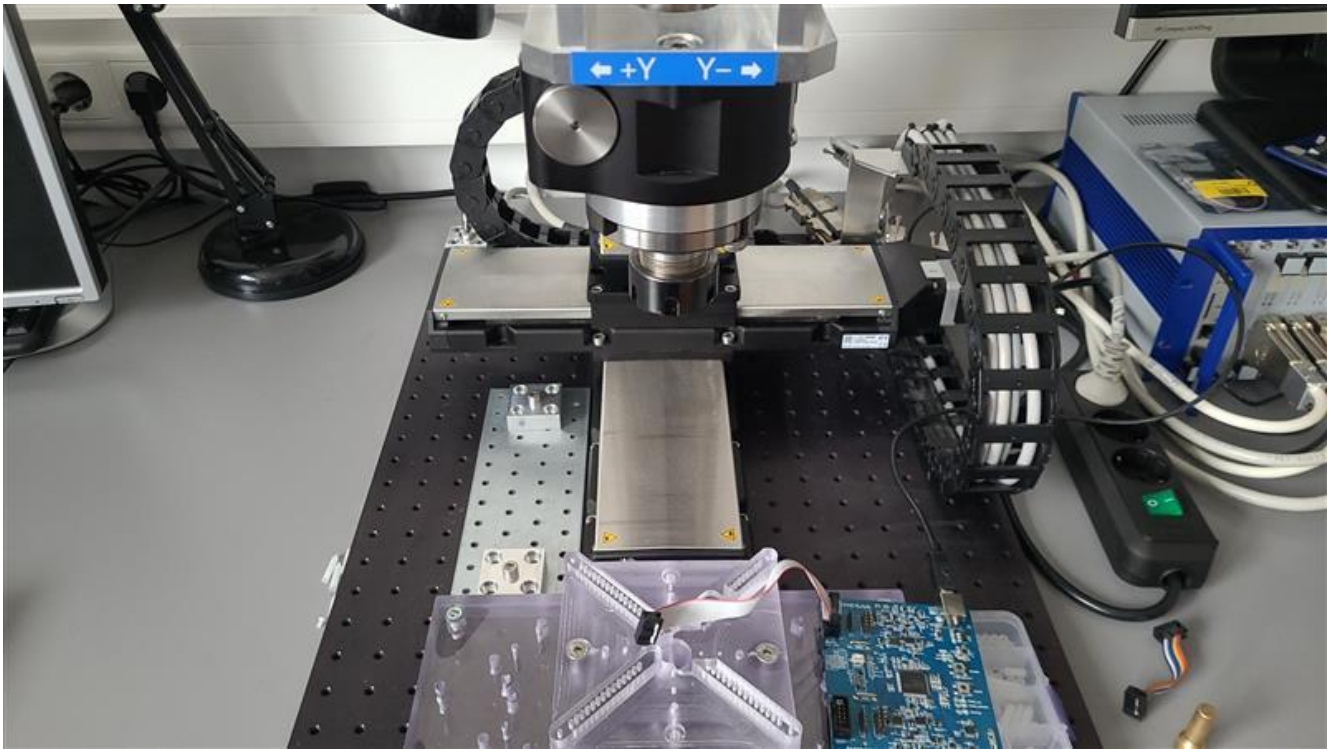

Figure 3. Setup

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

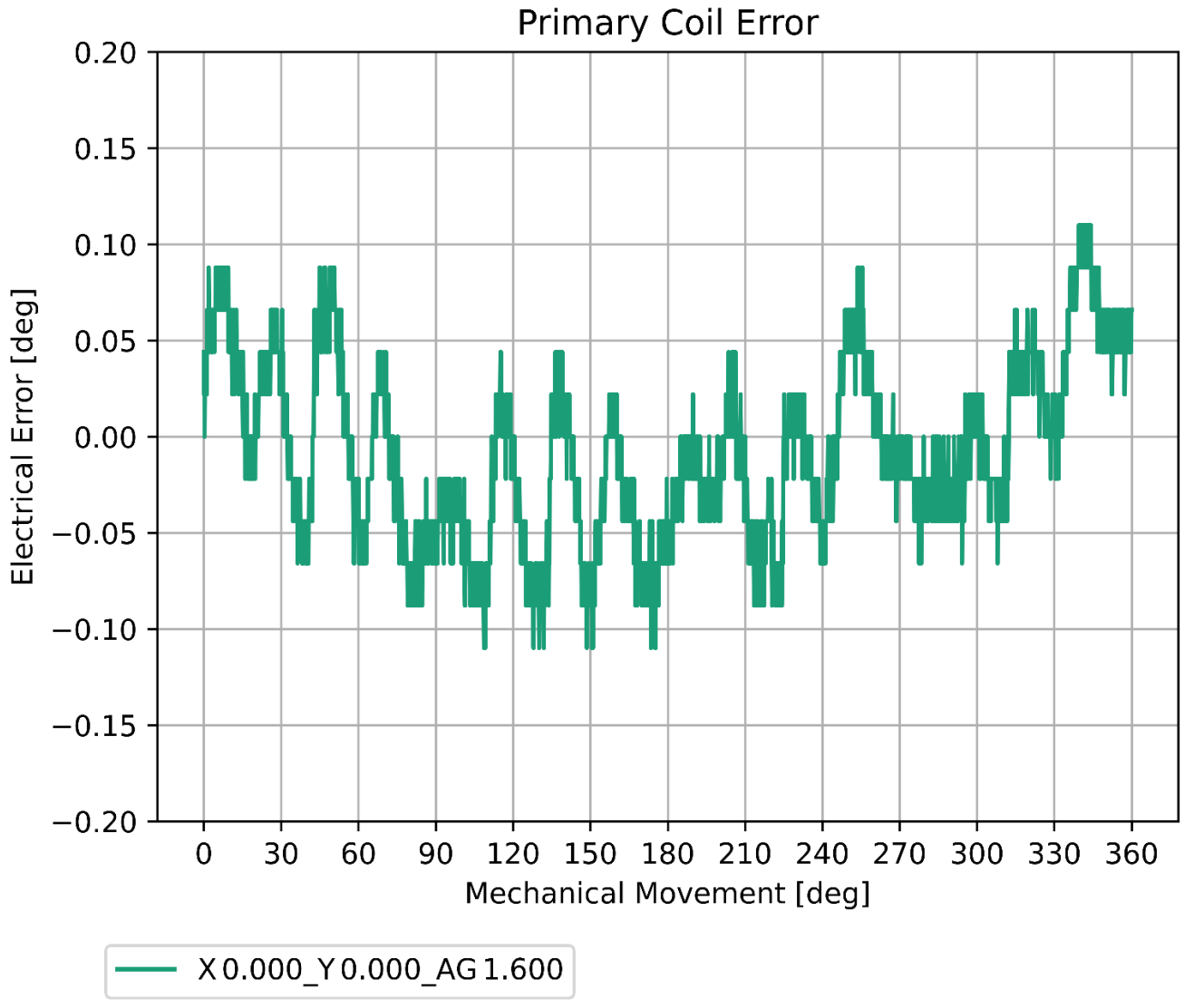

Figure 4. Primary Coil Error

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.

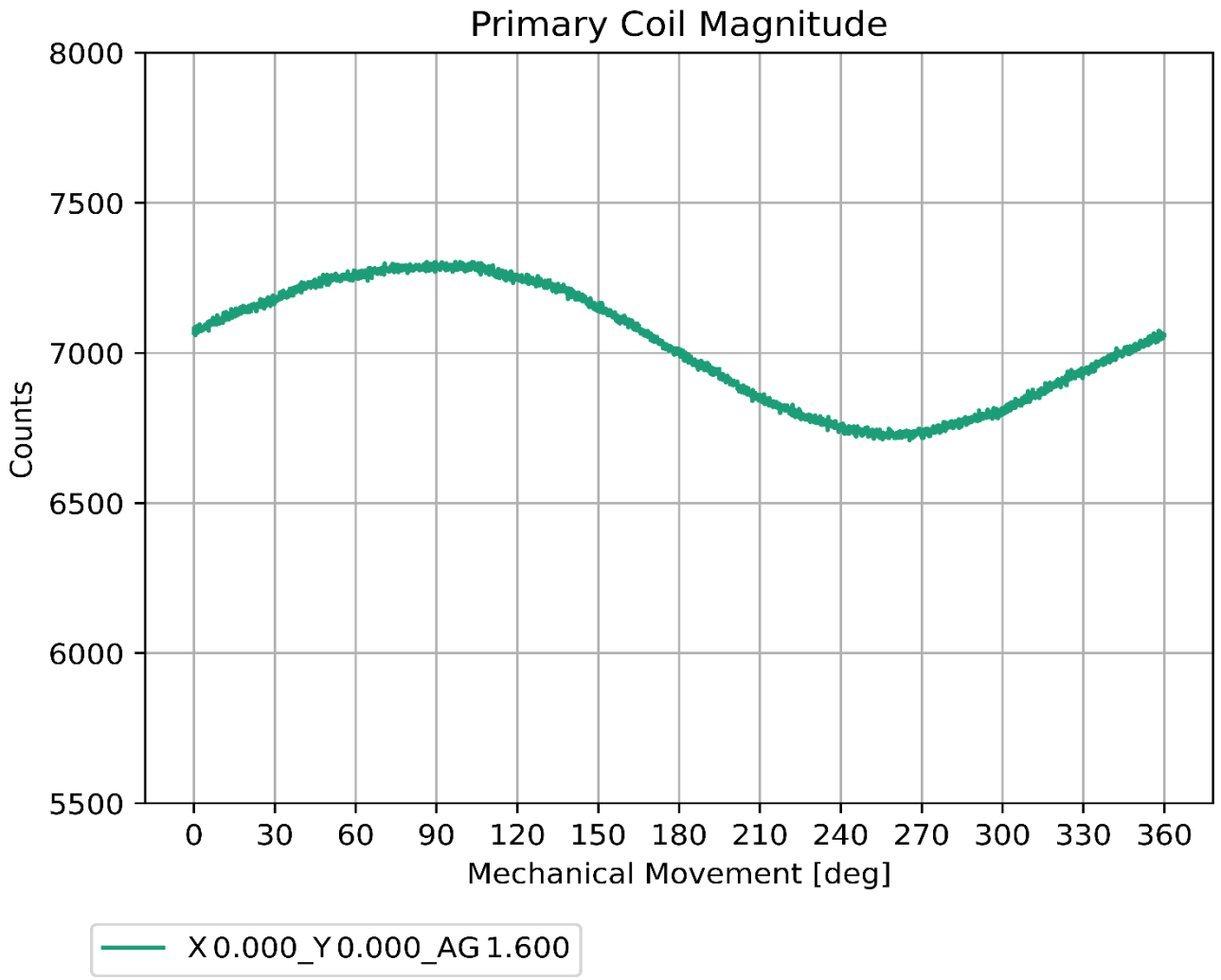

Figure 5. Primary Coil Magnitude

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.

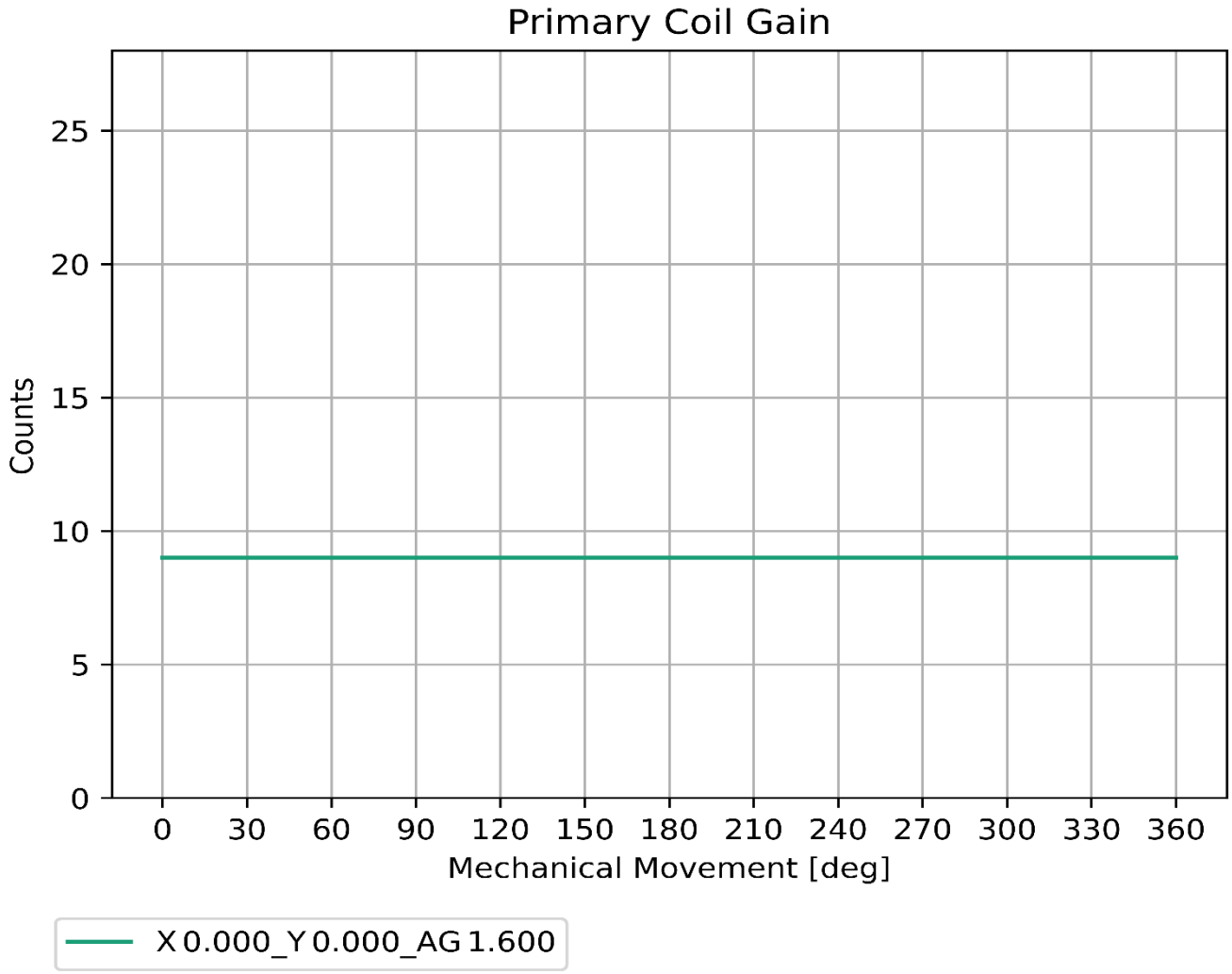

Figure 6. Primary Coil Gain

4. Revision History

Revision	Date	Description
1.0	Mar. 27, 25	Initial release.

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