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Tables

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.] / [deg el.]
RAA2P3500R0400	Rotary	Single	4	76 x 40	32 / 17	35 / 13	1.60	±0.03 / ±0.12

Table 2. Chip Characteristics

Chip	Coil Type	Interface	Internal Resolution
RAA2P3500	Single Coil	UART	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 RAA2P3500 itself.

Table 3. Sensor Characteristics

L_{TX}	R_L	C_{TX}	F_{TX} meas.
2.2 µH	2.0 Ω	1100 pF	3.9 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	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000
10h	0x0000	0x0000	0x0000	0x00A8	0x0FFF	0x0000	0x0104	0x7F80
20h	0x6401	0x0000	0x0003	0x0000	0x0000	0x0000	0xC9C9	0x1588
30h	0x4035	0x0000	0x4000	0x4000	0x0000	0x0000	0x0E1E	0x0000
40h	0x20BD	0x6224	0x3D43	0x84BF	0xAF57	0x7766	0xE8B2	0xB8A4
50h	0xB949	0x4C57	0xD6CD	0xE5BD	0x20BD	0x6024	0x3D23	0x84BE
60h	0xAE57	0x7756	0xE8B2	0xB8A4	0xB949	0x5C57	0xD6CD	0xE5BD
70h	0x0FFF	0x0000	0x0000	0x0000	0x0000	0x0072	0x3FFF	0x0000
80h	0x0000	0x0000	0x0001	0x0000	0x0000	0x0000	0x0000	0x033A

1.4 Sensor Board

Figure 1. displays the sensor board layout, consisting of one transmitter coil, two receiver coils, the RAA2P3500 and additional passive components.

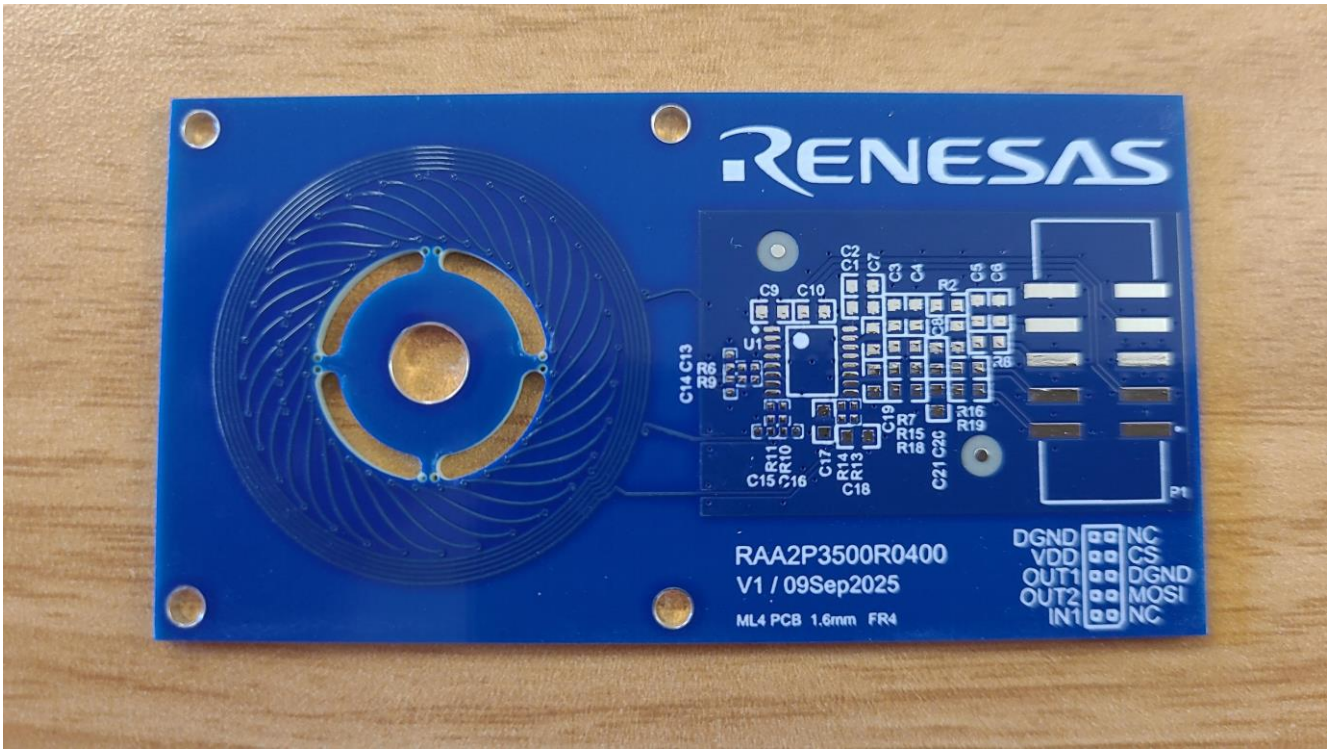

Figure 1. Sensor Board

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.

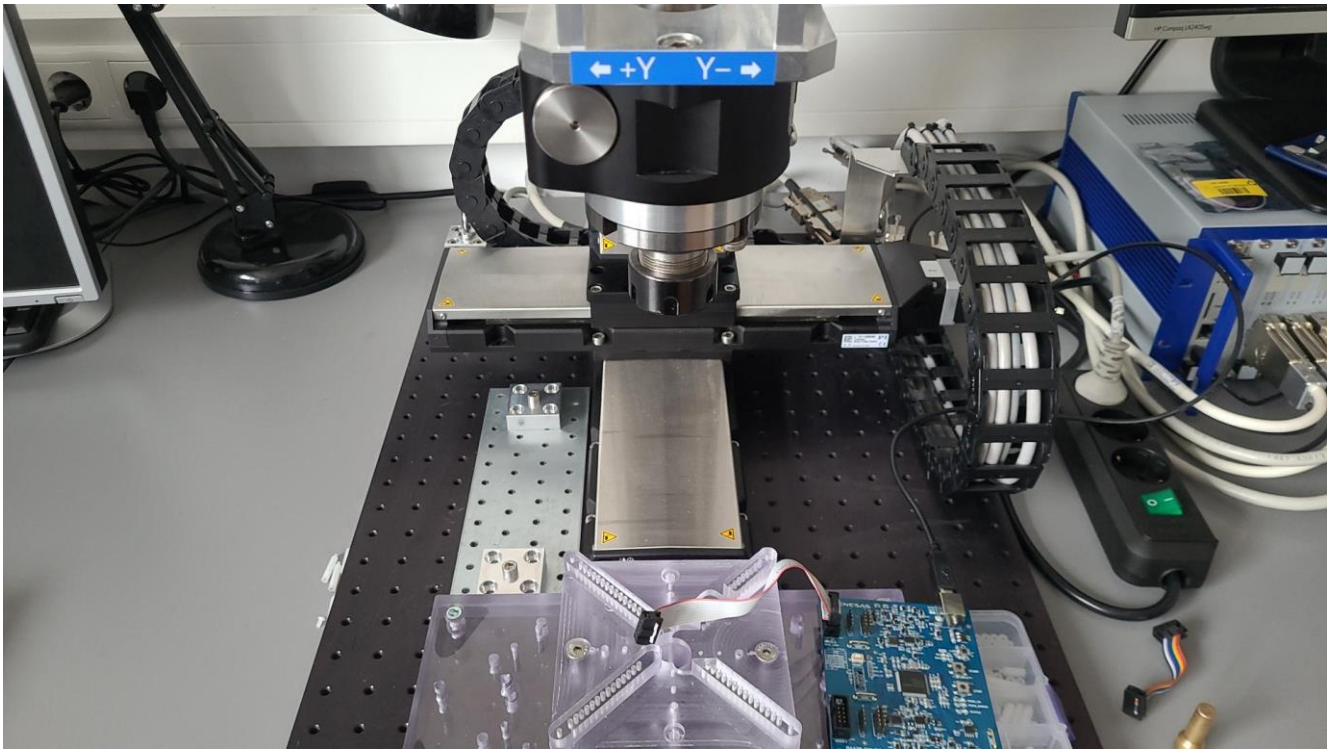

Figure 3. Setup

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

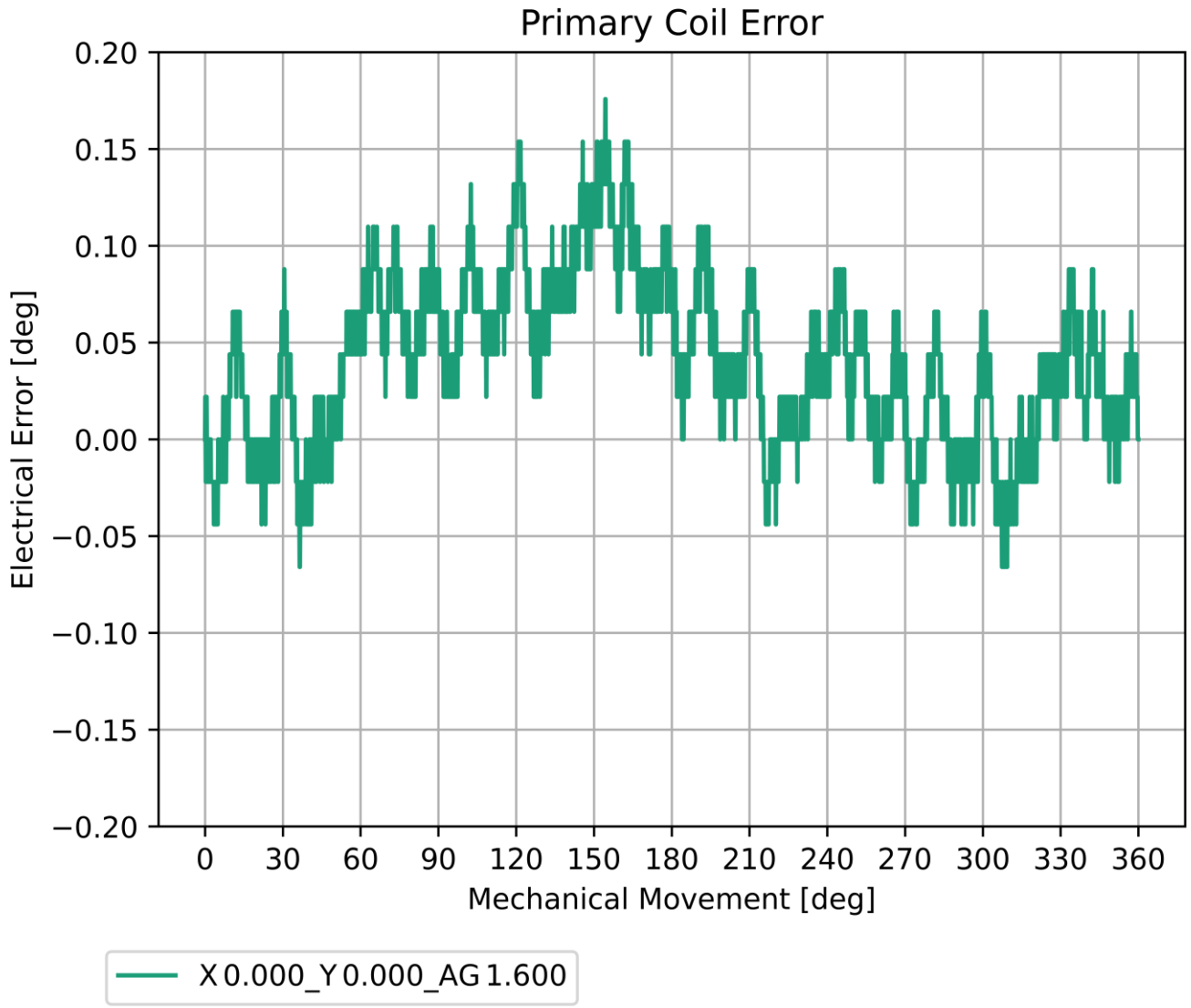

Figure 4. Primary Coil Error

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.

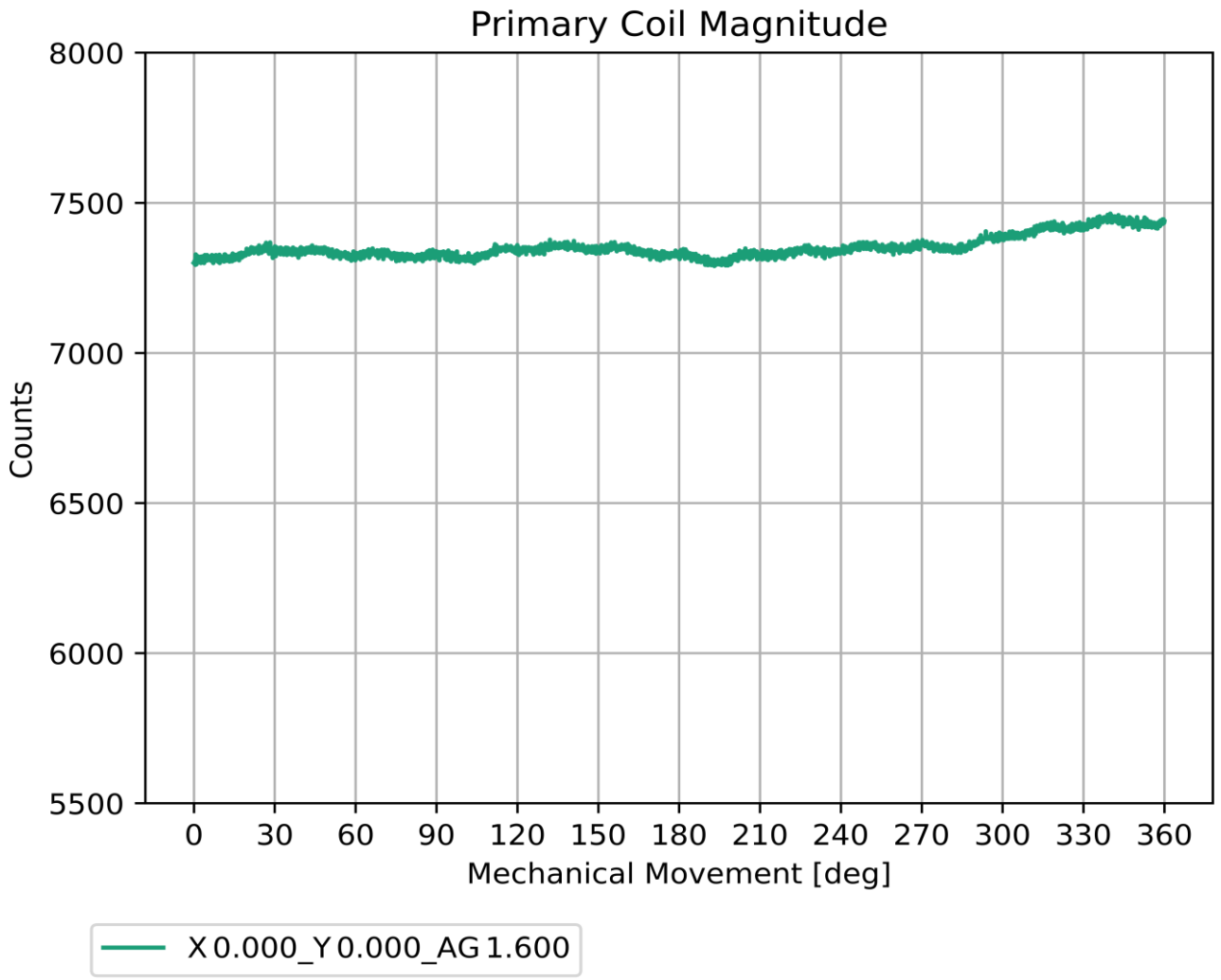

Figure 5. Primary Coil Magnitude

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.

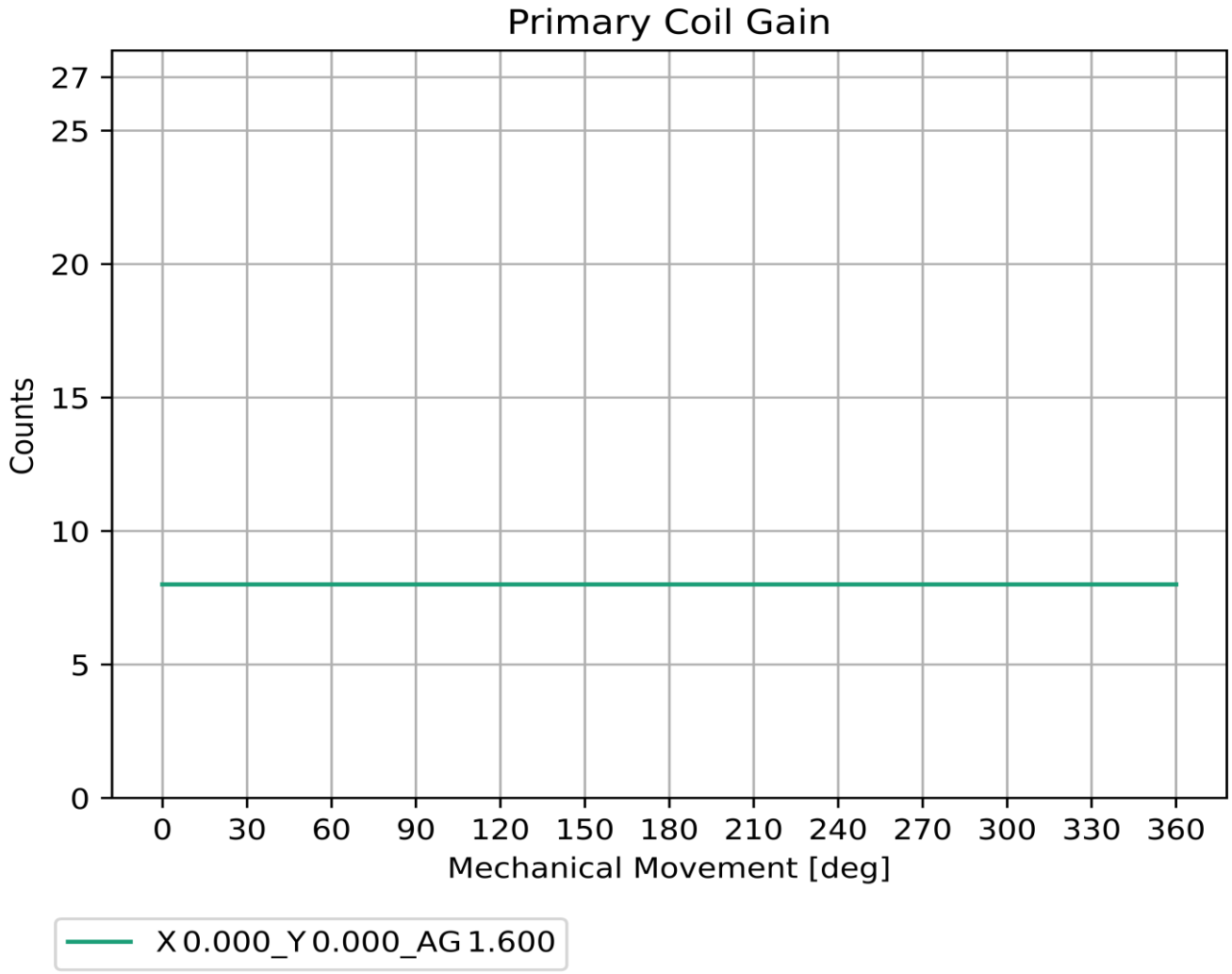

Figure 6. Primary Coil Gain

4. Revision History

Revision	Date	Description
1.0	Dec. 9, 25	Initial release.