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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.]
RAA2P3226R1601	Rotary	High Res	16 / 1	80 x 40	34 / 13	35 / 12	1.60	±0.029

Table 2. Chip Characteristics

Chip	Coil Type	Interface	Internal Resolution
RAA2P3226	Single Coil	UART	18 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 RAA2P3226 itself.

Table 3. Sensor Characteristics

L_{TX}	R_L	C_{TX}	F_{TX} meas.
1.4 μ H	1.5 Ω	1750 pF	2.64 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	0x00D4	0x0714	0x02C8	0x0907	0x7F92
20h	0x6401	0x0000	0x03FD	0x6401	0x0000	0x0CF2	0xC9C9	0x1580
30h	0x70A5	0x00A5	0x4000	0x4000	0x4000	0x4000	0x06DB	0x0FFF
40h	0xC0E6	0xCD1C	0x3CB2	0x74CD	0x8E5A	0x78B6	0x1880	0x5896
50h	0xB5AA	0x3C47	0x21D3	0xF19E	0x00E8	0xD31D	0x3D22	0xD4D4
60h	0x925A	0x78C6	0xC87E	0x5095	0xB4FA	0x9C3C	0x1AD2	0xF15E
70h	0x0FFF	0x0000	0x0000	0x0000	0x0000	0x0072	0x3FFF	0x0000
80h	0x0000	0x0000	0x0001	0x0000	0x0000	0x0000	0x0000	0x082E

1.4 Sensor Board

Figure 1. displays the sensor board layout, consisting of one transmitter coil, four receiver coils, the RAA2P3226 and additional passive components.

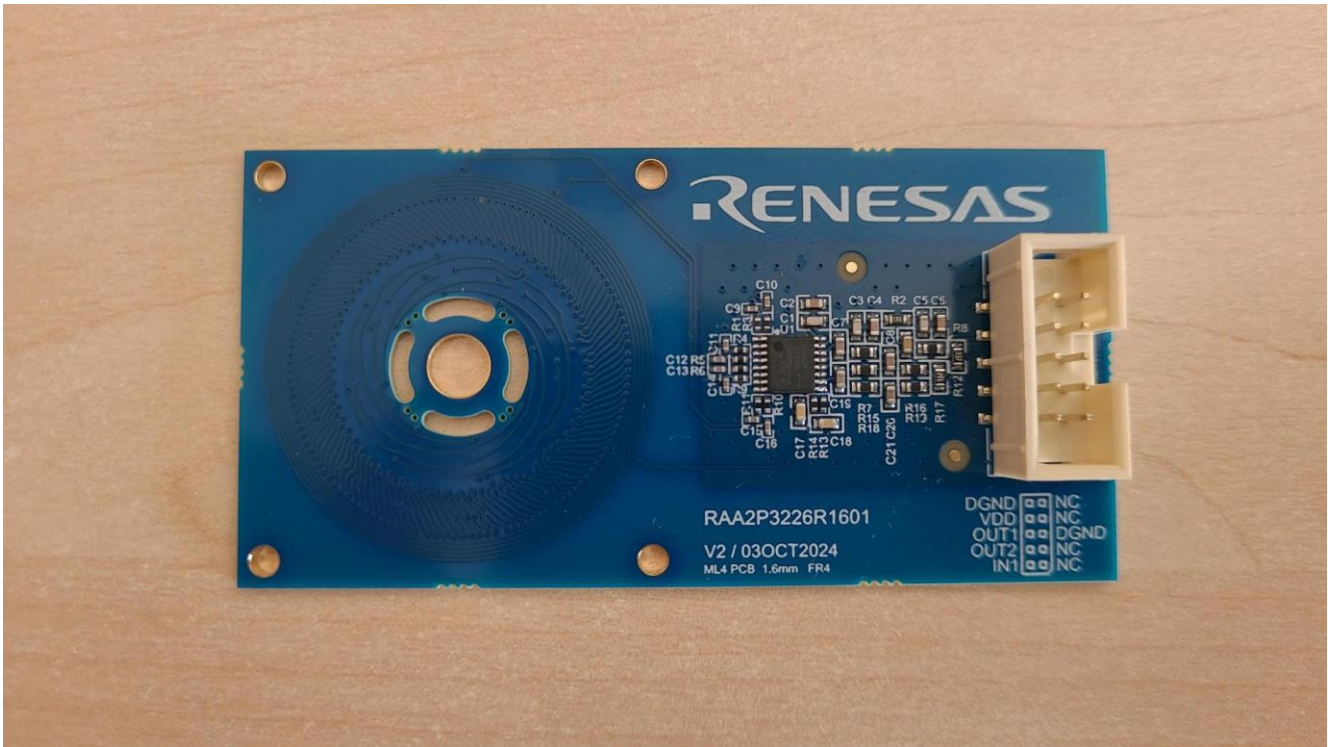


Figure 1. Sensor Board

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 is 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.

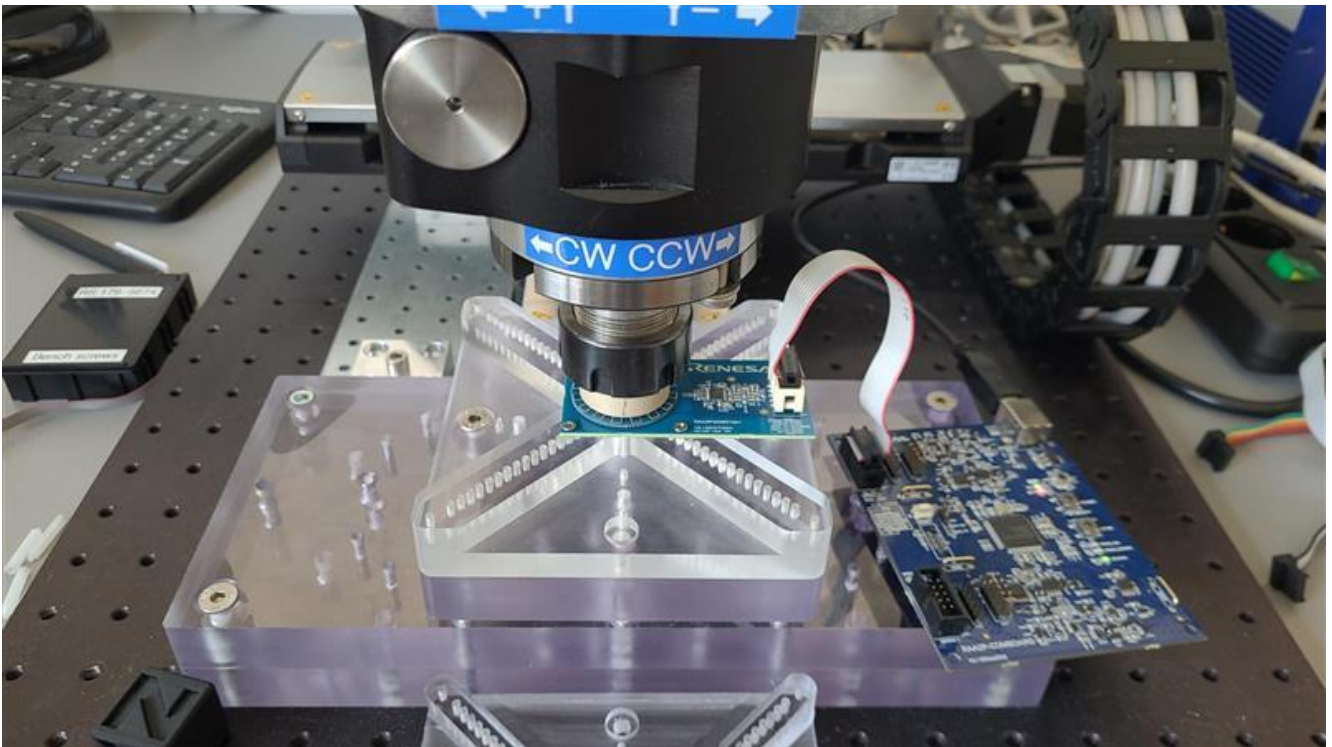


Figure 3. Setup

3. Measurement Results

3.1 Angle Error High Resolution

Both coil offsets were compensated without target, then the design was linearized at nominal position. The plot below displays the error of the high-resolution Angle measured over the given positions. Measurements are taken 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

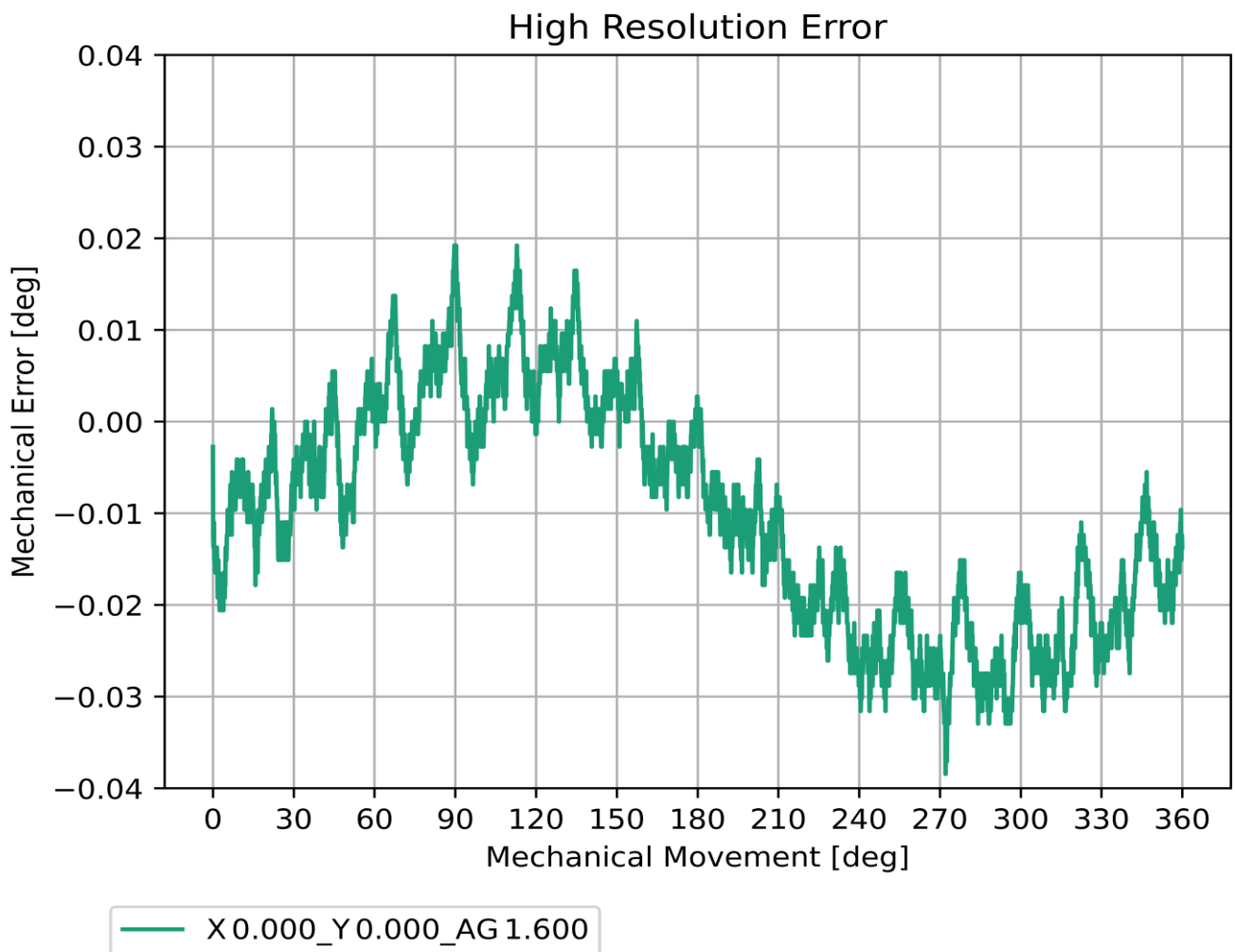


Figure 4. High Resolution Error

3.2 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.

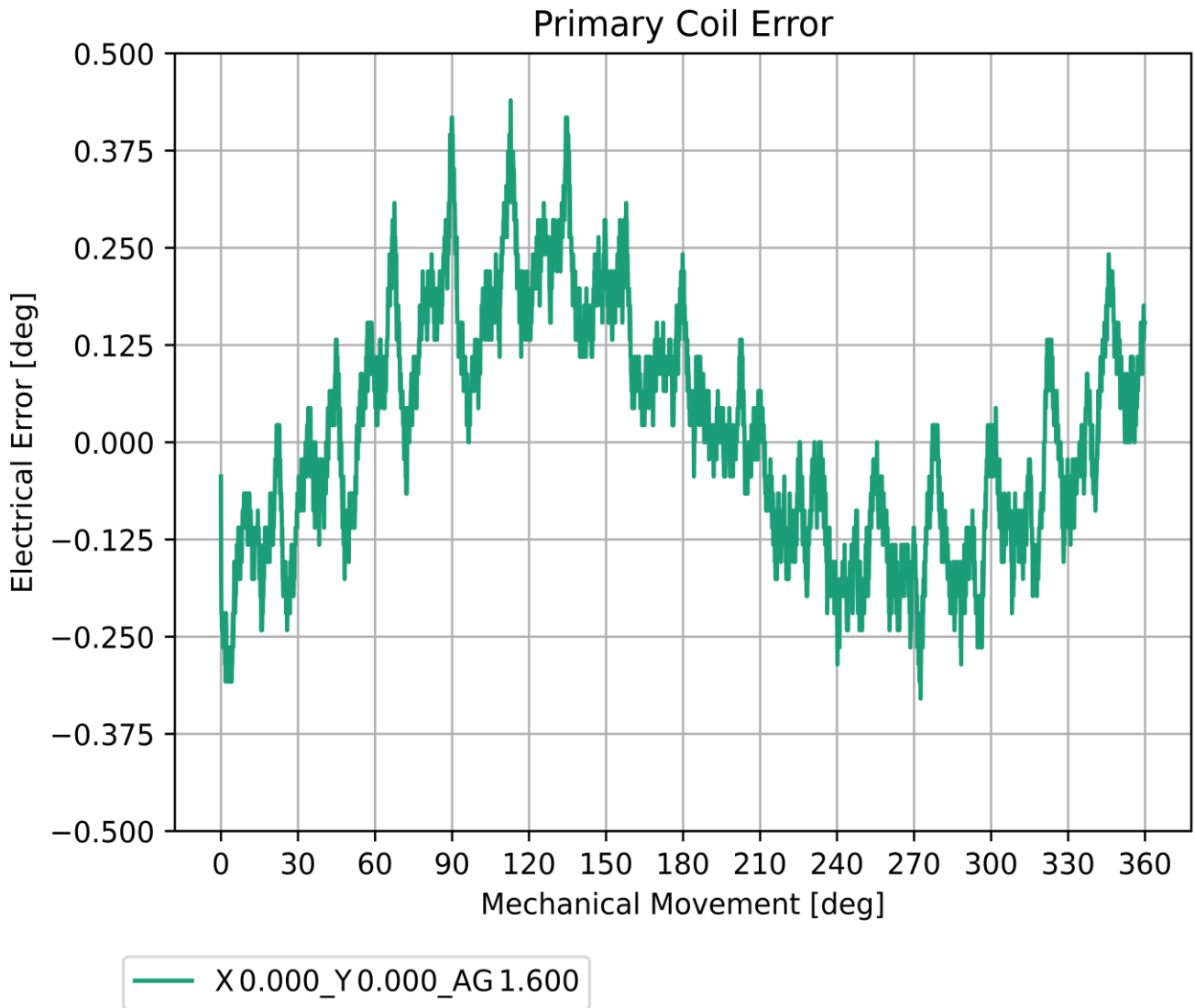


Figure 5. Primary Coil Error

3.3 Angle Error Secondary Coil

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

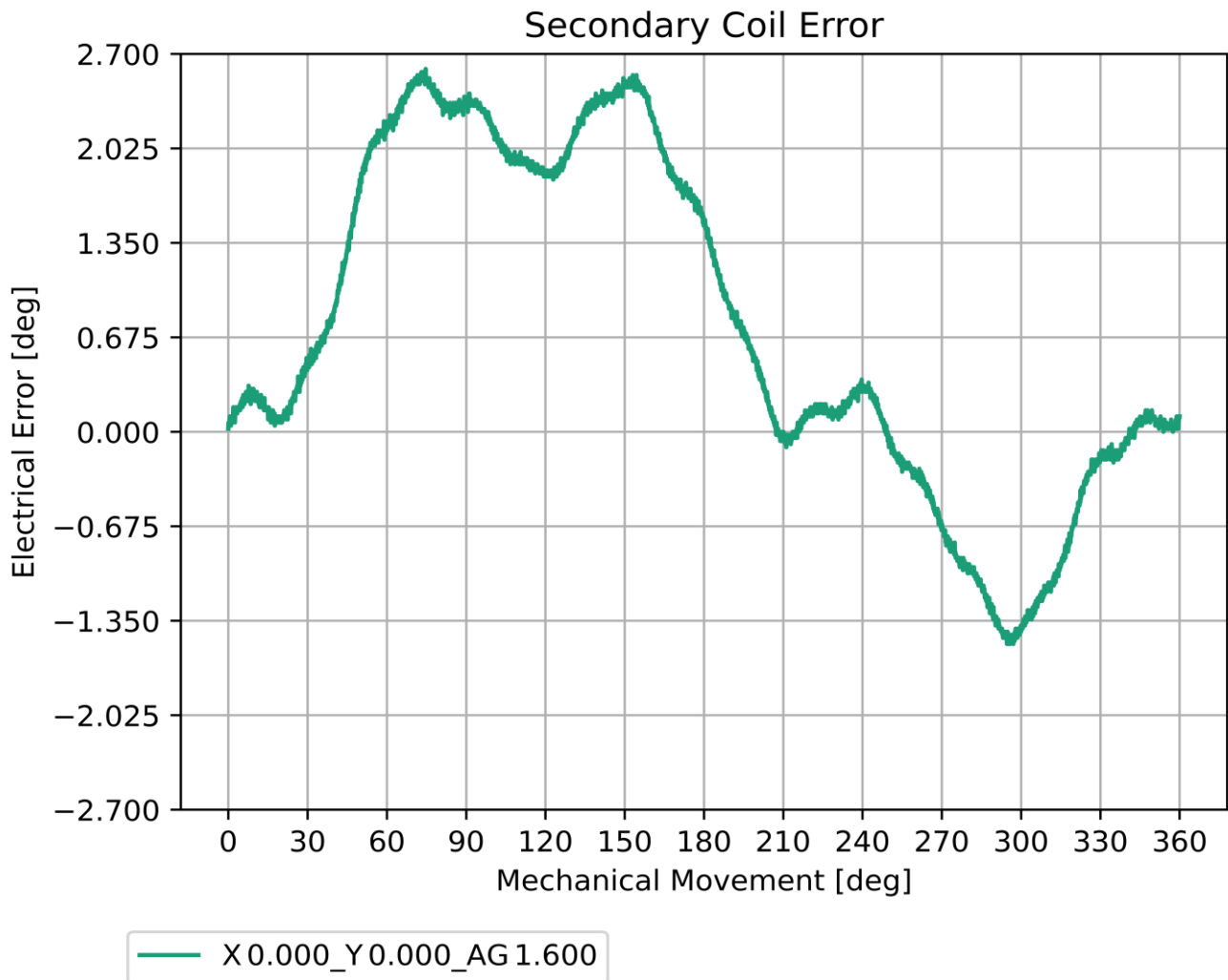


Figure 6. Secondary Coil Error

3.4 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.

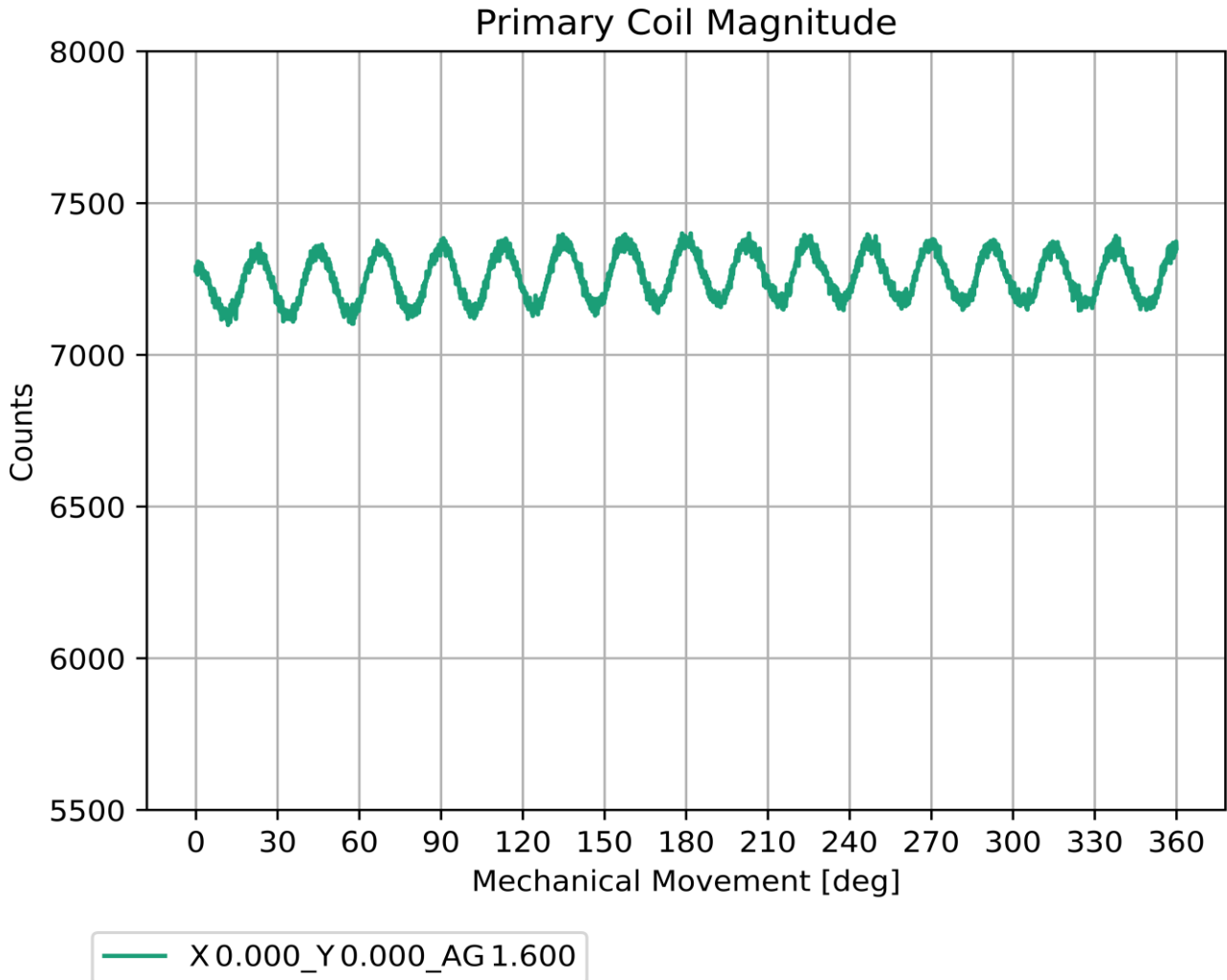


Figure 7. Primary Coil Magnitude

3.5 Magnitude Secondary Coil

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

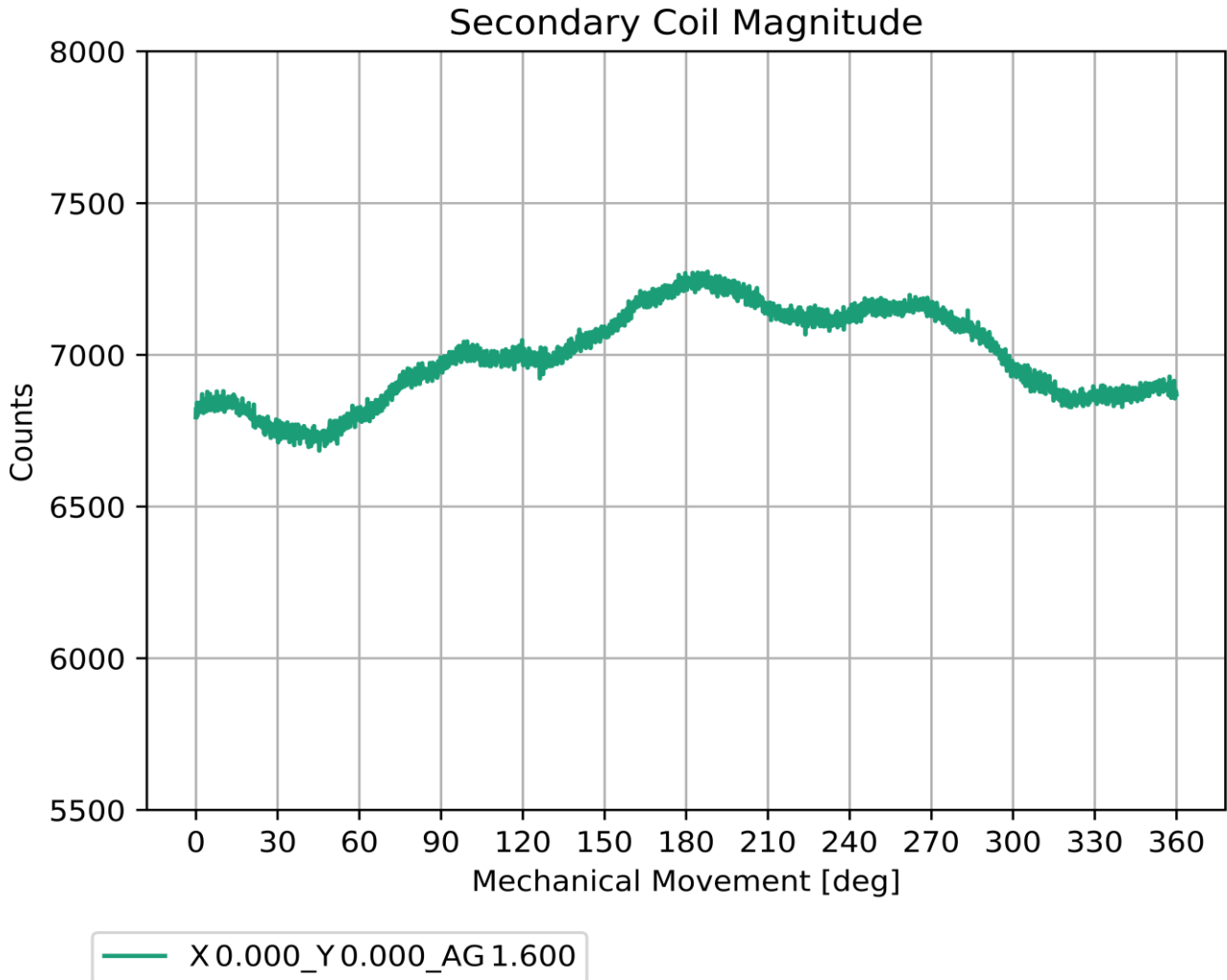


Figure 8. Secondary Coil Magnitude

3.6 Gain Primary Coil

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

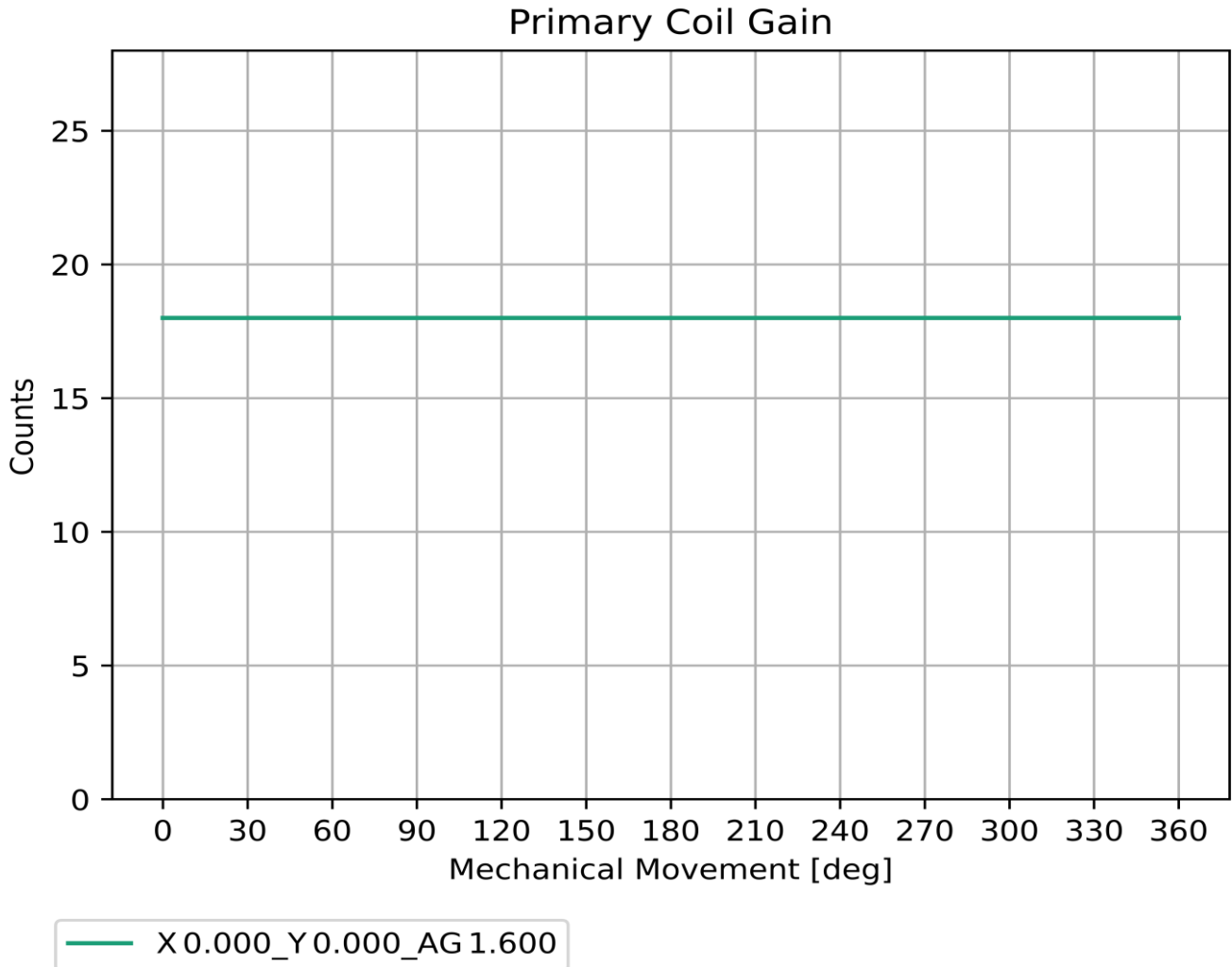


Figure 9. Primary Coil Gain

3.7 Gain secondary Coil

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

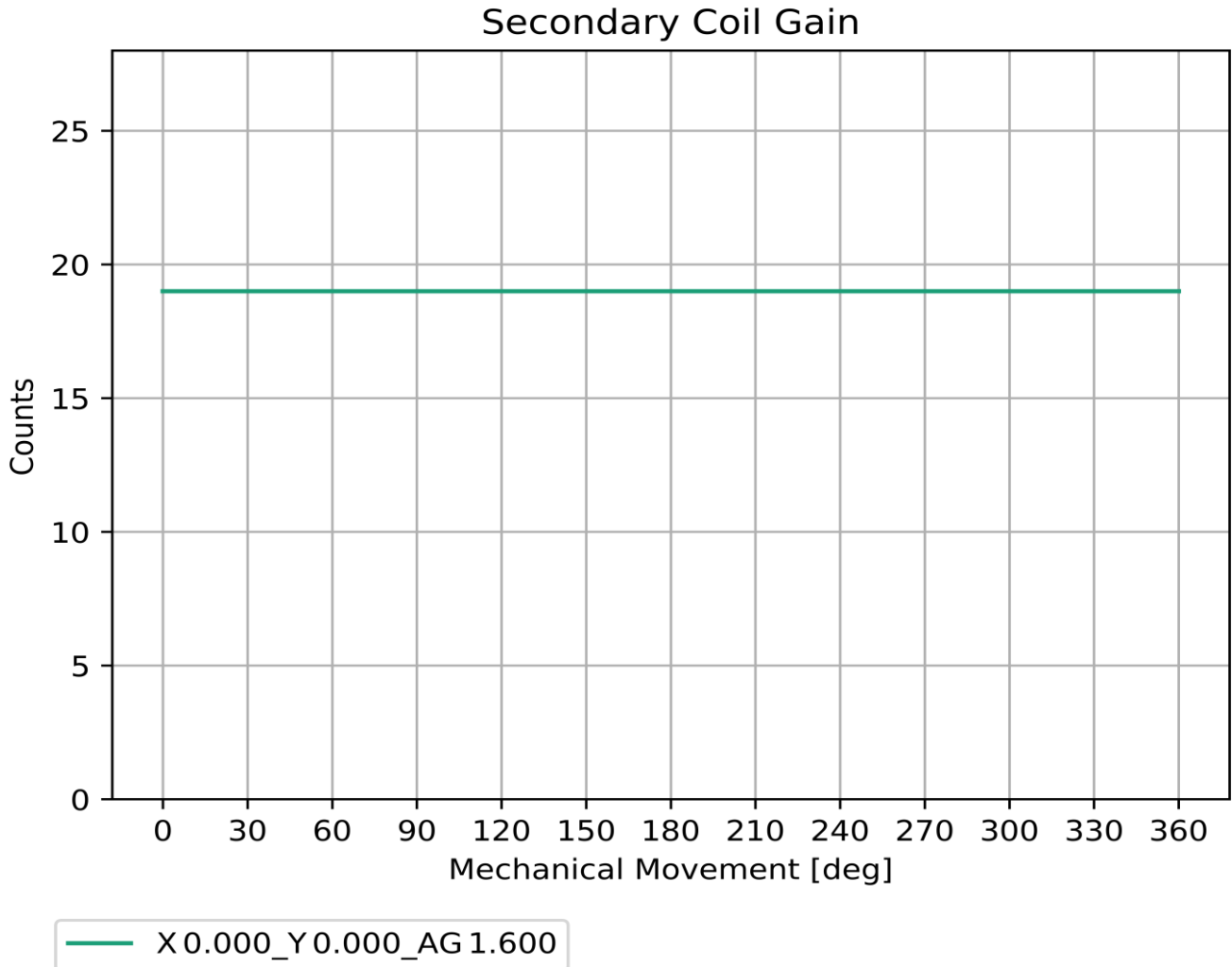


Figure 10. Secondary Coil Gain

4. Revision History

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

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