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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_1	Rotary	Single	1	97 x 65	61 / 42	62 / 41	1.50	±0.068

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 $\mu$ H	2.0 $\Omega$	1100 pF	2.91 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	0x00AC	0x0FFF	0x0000	0x010F	0x0000
20h	0x6401	0x0000	0x08FD	0x0000	0x0000	0x0000	0xC9C9	0x1588
30h	0x20B5	0x0000	0x4000	0x4000	0x0000	0x0000	0x0B49	0x0000
40h	0xA2F4	0x2835	0x4DA4	0x2597	0x1466	0x7B37	0x1869	0xB491
50h	0xA799	0x8B19	0x71BB	0xD0CC	0xC000	0xFC0B	0x30D1	0x3433
60h	0x9057	0x7906	0xB8B6	0xCF9C	0xC04A	0x9D04	0x0FDF	0xFFFF
70h	0x0FFF	0x0000	0x0000	0x0000	0x0000	0x007A	0x3FFF	0x0000
80h	0x0000	0x0000	0x0001	0x0000	0x0000	0x0000	0x0000	0x0942

## 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.

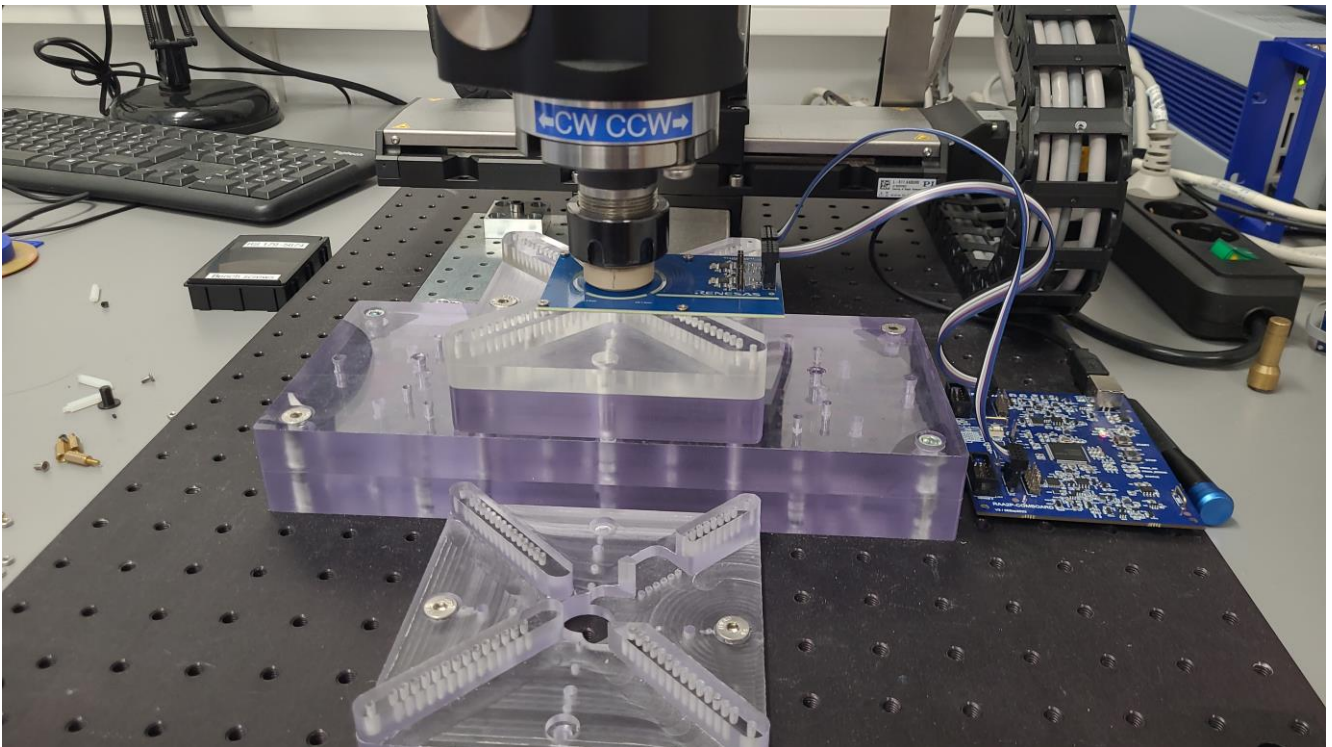


Figure 3. Setup

### 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

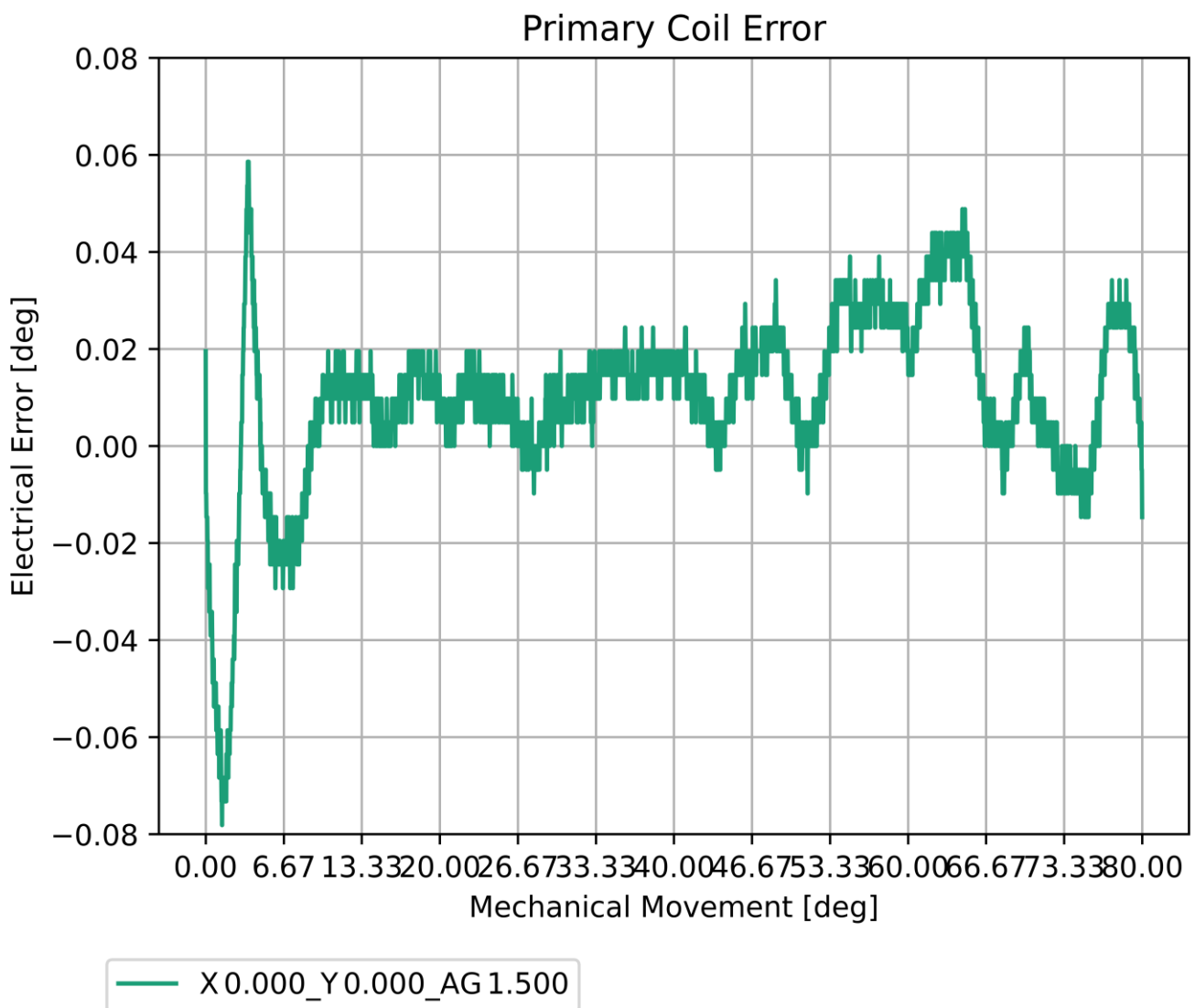


Figure 4. Primary Coil Error

### 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.

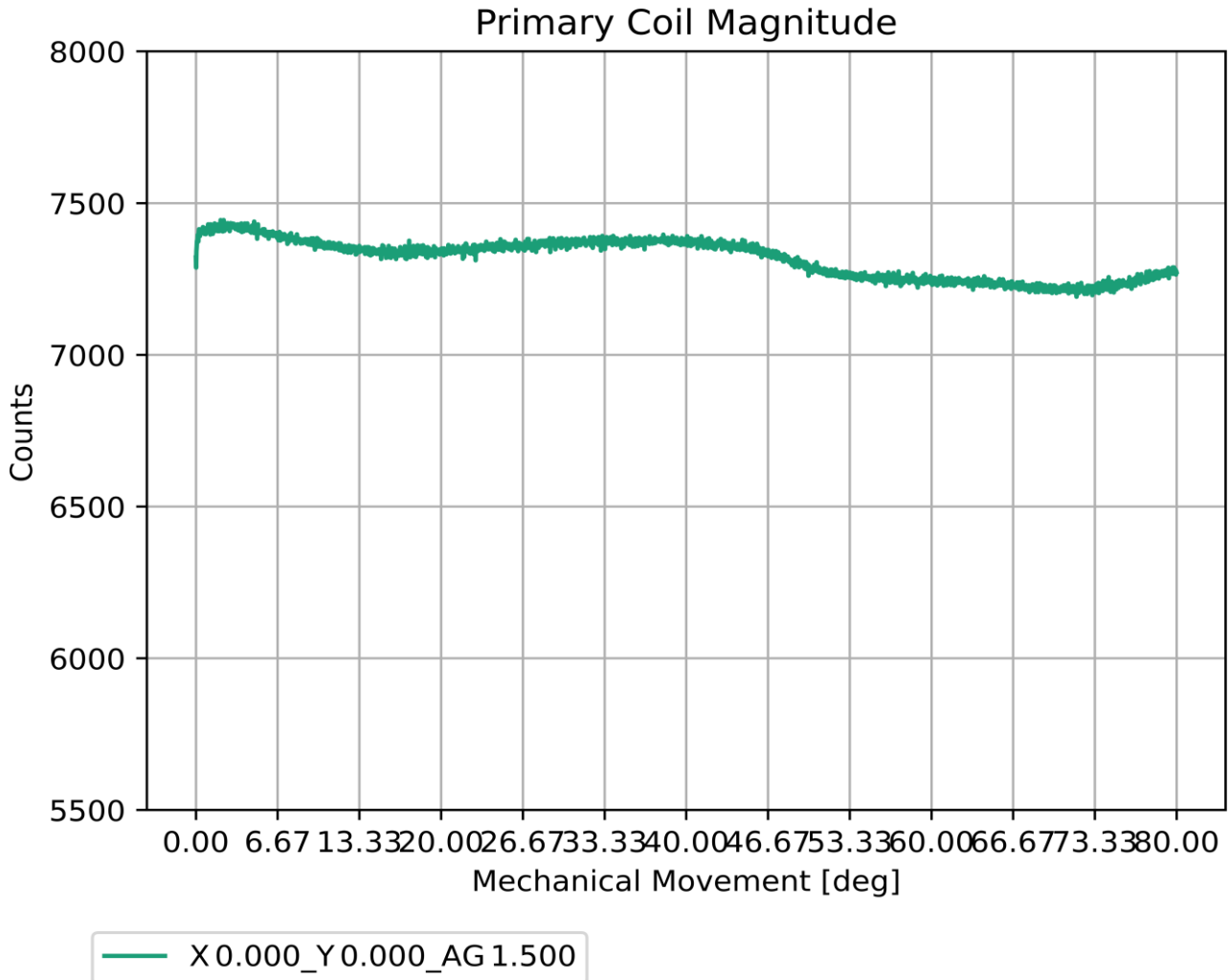


Figure 5. Primary Coil Magnitude

### 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.

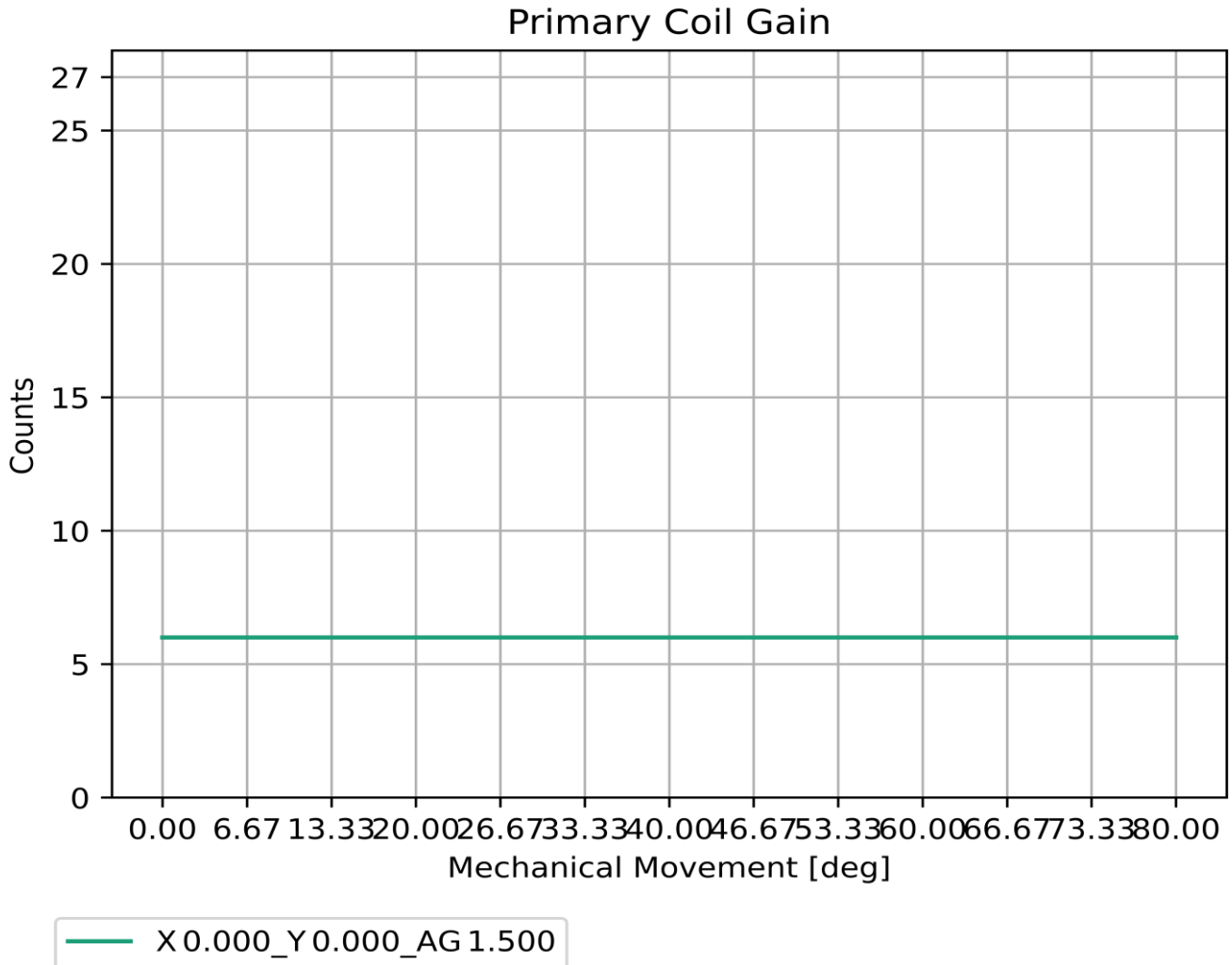


Figure 6. Primary Coil Gain

## 4. Revision History

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

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