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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 X / Y [mm]	Target Size X / Y [mm]	Air Gap (Nominal) [mm]	Accuracy (Nominal) [mm mech.]
RAA2P4500L100	Linear	Single	1	148 x 22	111 / 11	10 / 8	1.60	±0.092

Table 2. Chip Characteristics

Chip	Coil Type	Interface	Internal Resolution
RAA2P4500	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 RAA2P4500 itself.

Table 3. Sensor Characteristics

L_{TX}	R_L	C_{TX}	F_{TX} meas.
2.7 μ H	2.9 Ω	650 pF	3.1 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	0x16AC	0x2338	0x0400	0x0000	0x0000
10h	0x0000	0x0000	0x0000	0x00A0	0x0714	0x02C8	0x0206	0x0000
20h	0xC401	0x0800	0x0C23	0x0000	0x0000	0x0000	0xC9C9	0x1580
30h	0x8175	0x0000	0x4000	0x4000	0x0000	0x0000	0x0BF4	0x0000
40h	0x80BB	0xA014	0x3CE2	0xB49D	0x8155	0x7136	0xD8DE	0x9F96
50h	0xB6BA	0xFC7A	0x9DD4	0xF44E	0xF000	0x2E07	0x3712	0x4438
60h	0x7350	0x7146	0x98D8	0xF797	0xBCDA	0xCCD3	0x6BDB	0xFFFF
70h	0x0FFF	0x0000	0x0FFF	0x0000	0x0000	0x0780	0x3FFF	0x0000
80h	0x0000	0x0001	0x0000	0x0000	0x0000	0x0000	0x0000	0x0576

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.

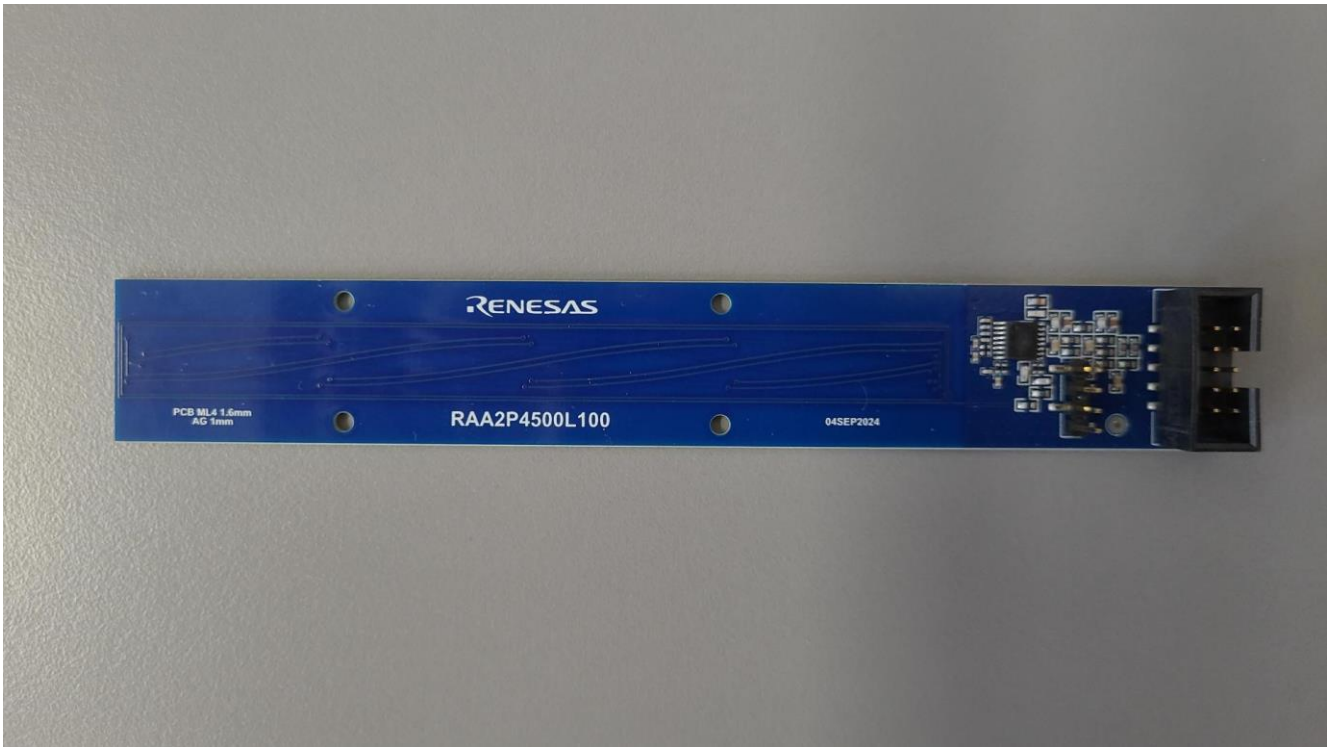


Figure 1. Sensor Board

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 is compared to the rotor position measured by high precision reference encoder.

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

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.

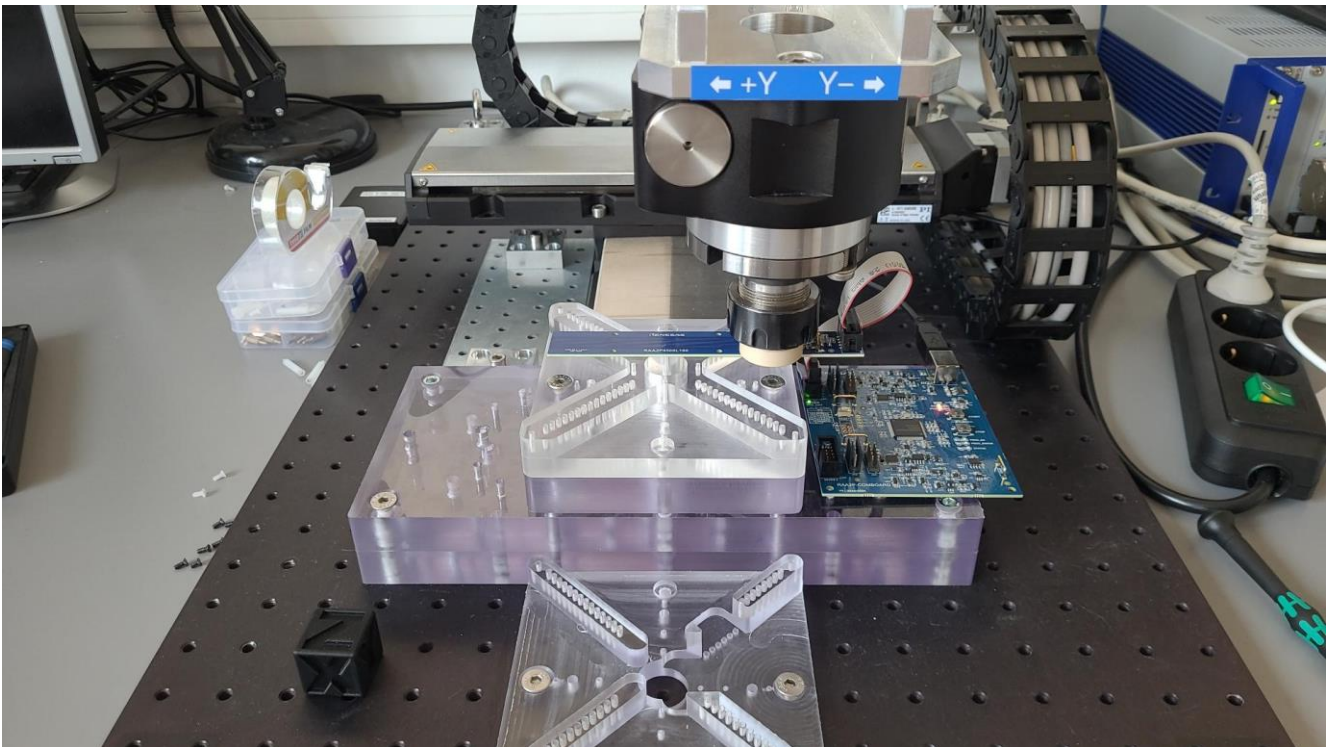


Figure 3. Setup

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

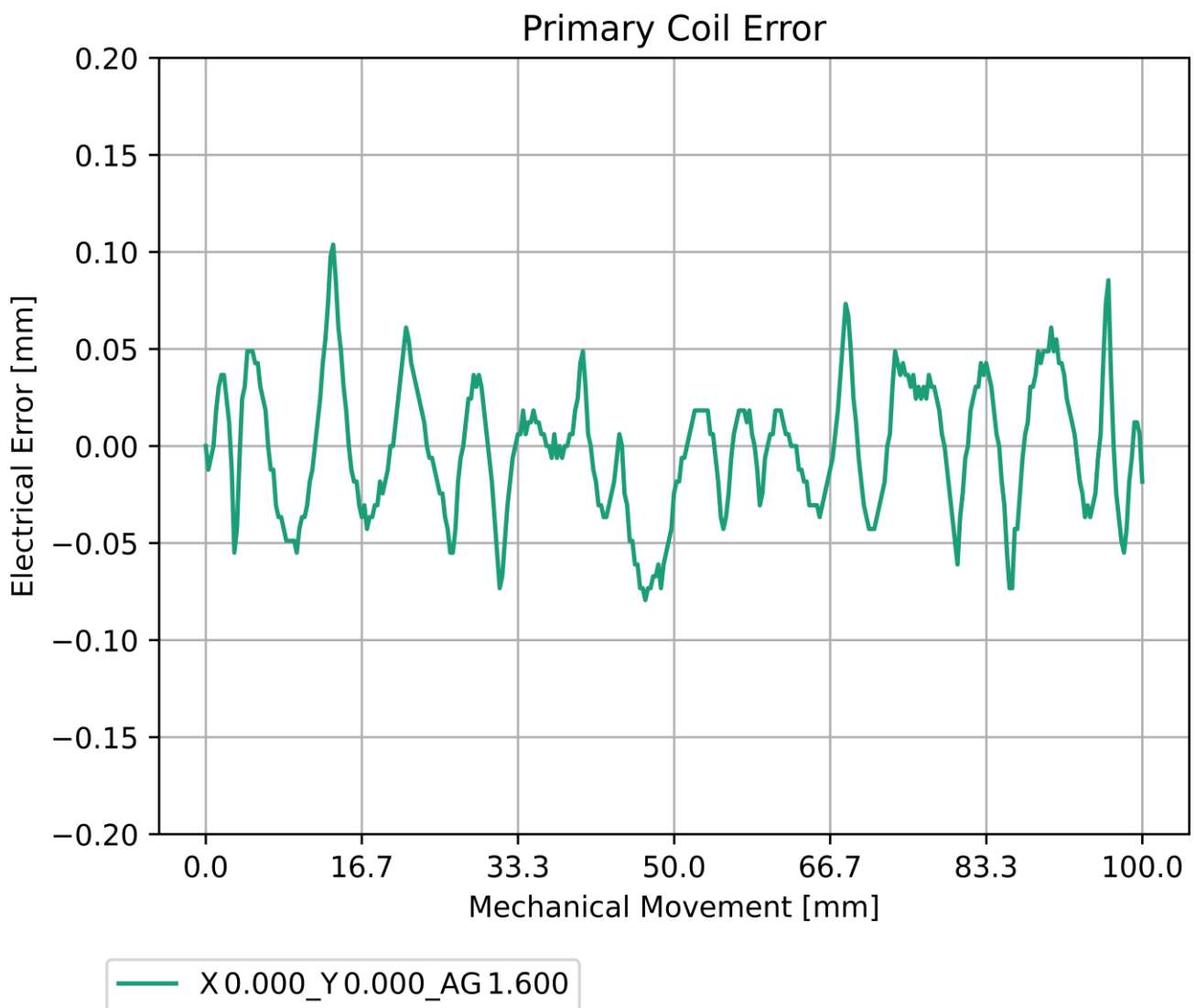


Figure 4. Primary Coil Error

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.

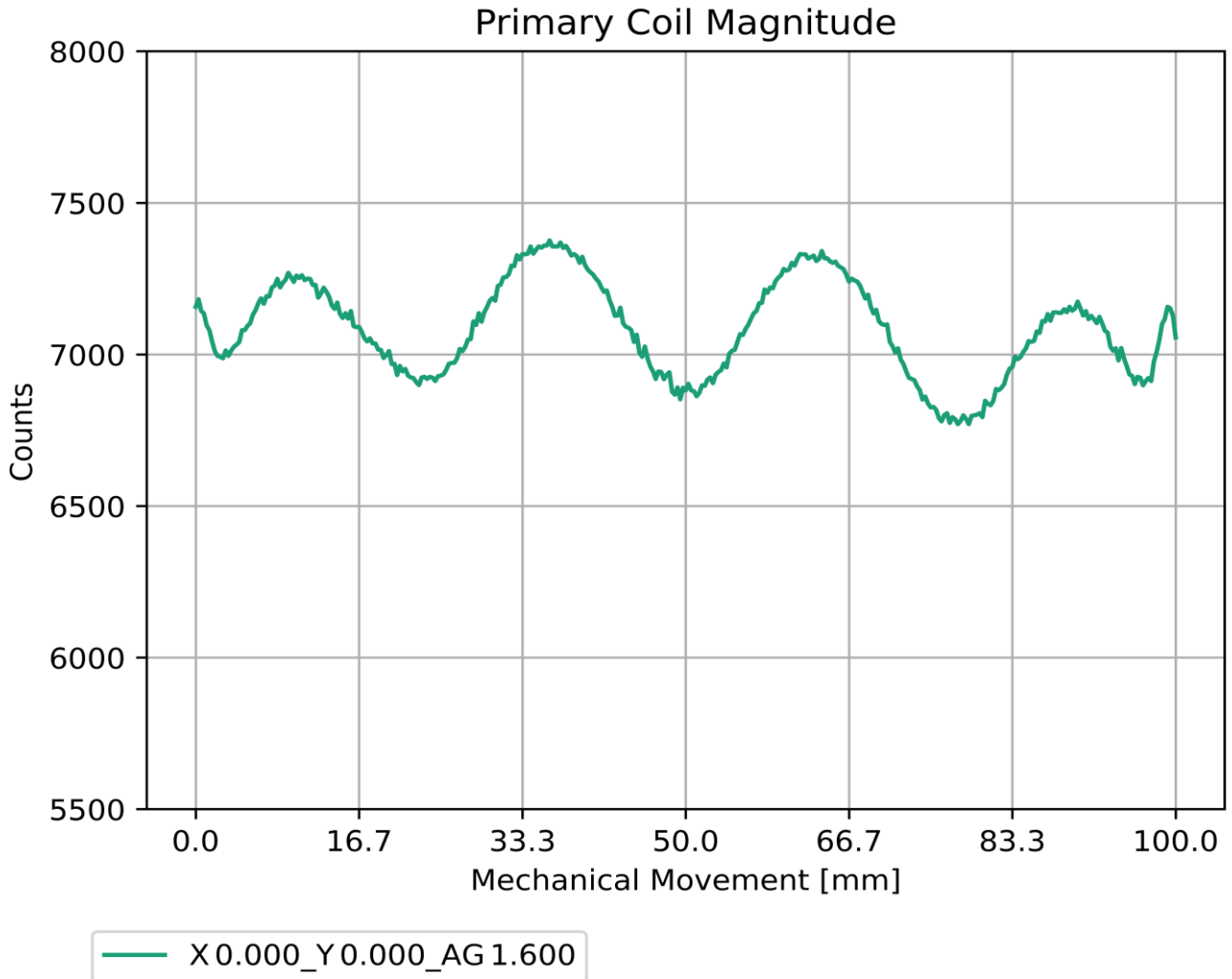


Figure 5. Primary Coil Magnitude

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.

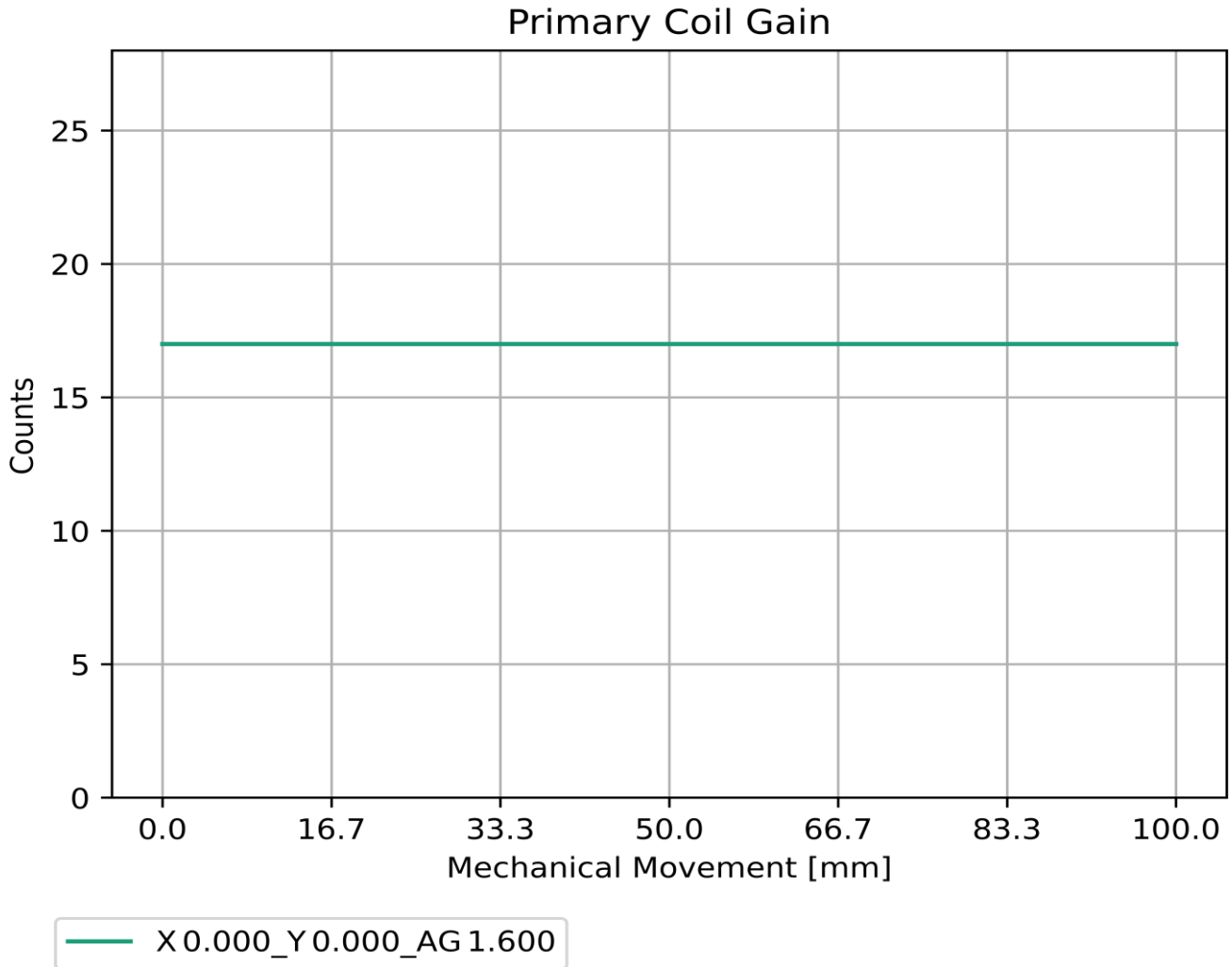


Figure 6. Primary Coil Gain

4. Revision History

Revision	Date	Description
1.0	Nov. 13, 24	Initial release.

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