ams

Eval Kit Manual

AS5601

Adapter Board

AS5601-SO_EK_AB

Table of Contents

1 Introduction

The adapter board allows an easy and fast evaluation of the AS5601 rotary magnetic position sensor in the lab or together with an existing system. This small factor board is fully assembled with AS5601 position sensor and its necessary external components. All relevant signals are available on a dual-row 2.54mm 4-pin header footprint and can be easily wired to an existing application.

The AS5601 is an easy-to-program magnetic rotary position sensor with incremental quadrature (A/B) and 12-bit digital outputs. Additionally, the PUSH output indicates fast airgap changes between the AS5601 and magnet which can be used to implement a contactless pushbutton function in which the knob can be pressed to move the magnet toward the AS5601.

The I²C interface is used for configuration and user programming of non-volatile parameters in the AS5601.

2 Kit Content

This kit contains following material listed in Table 1. Additional material can be found on our webpage.

Table 1:
Kit Content

No.	Item	Description	Info
1	AS5601-SO_EK_AB		
2	AS5000-MD6H-1	Reference Magnet	Find the datasheet online at http://ams.com/eng/AS5000-MD6H-1

3 Getting Started

The AS5601 adapter board is ideal for rapid setup of a contactless encoder knob. Additionally to the adapter board, a sensor magnet in a mechanical setup is required. A reference magnet comes with the kit.

3.1 Adapter Board Pin-Out

The pin-out of the adapter board is shown in Table 2. For additional information on the AS5601 pins refer to the product datasheet.

Table 2:
Adapter Board Pin-Out

Header	Pin	Symbol	Description	Info
J3	1	SCL	I2C Clock	Use R3 if pull-up is required
J3	2	SDA	I2C Data	Use R4 if pull-up is required
J3	3	GND	Ground	
J3	4	VDD	Positive Power Supply	
J2	1	VRG	LDO Pin in 5V	Leave open in 5V mode. Pull to VDD using

Header	Pin	Symbol	Description	Info
			Mode	J1 in 3.3V Mode
J2	2	B	Output Pin	Quadrature incremental signal B
J2	3	A	Output Pin	Quadrature incremental signal A
J2	4	PUSH	Output Pin	Contactless pushbutton function output

4   Adapter Board Description

The AS5601 is connected over the dual-row 2.54mm 4-pin header footprint. Connect the desired pins of the AS5601 using the headers and resistors.
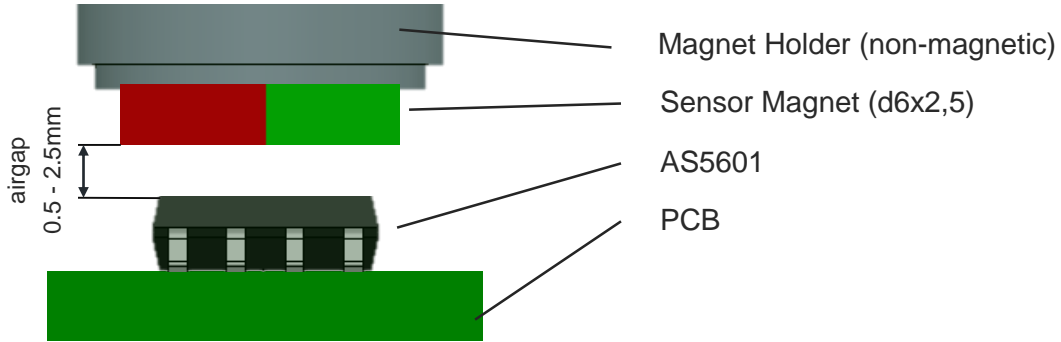
Figure 1:
Adapterboard Description

Short J1 to operate in 3.3V mode

I2C pull-up resistors
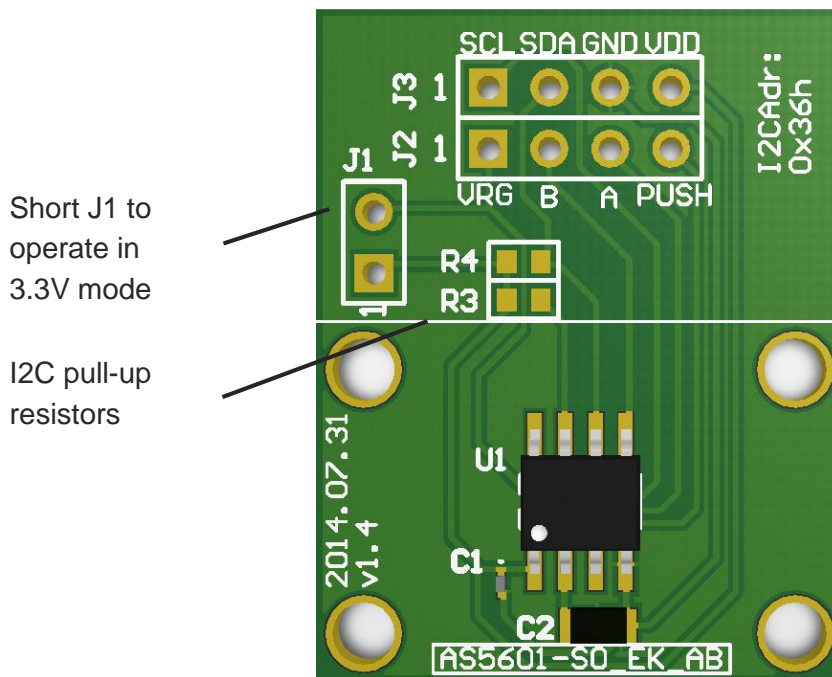
5   Mechanical Setup

To set up a contactless potentiometer a magnet holder and a magnet are needed to be used with the AS5601 position sensor on a PCB. The configuration is shown in Figure 2.

Figure 2:
Mechanical Configuration

The magnet should be aligned by reading the output of the AGC register of the AS5601. For optimal alignment, the AGC value is in the middle of the AGC range.

Note: If the magnetic field seen by the AS5601 is below 8mT, the output is disconnected and permanent angle programming is not possible. The AB output will not show any change until the magnet is present again.

5.1 Electrical Setup

The Adapterboard can be used in 5V or in 3.3V mode in the configurations shown below. Short J1 to operate in 3.3V mode.

5.1.1 I^{2}C Mode

Using the I2C Interface, all functions of the AS5601 can be configured and permanently programmed. Additionally the output and a raw angle (unmodified value) can be read from the output registers.
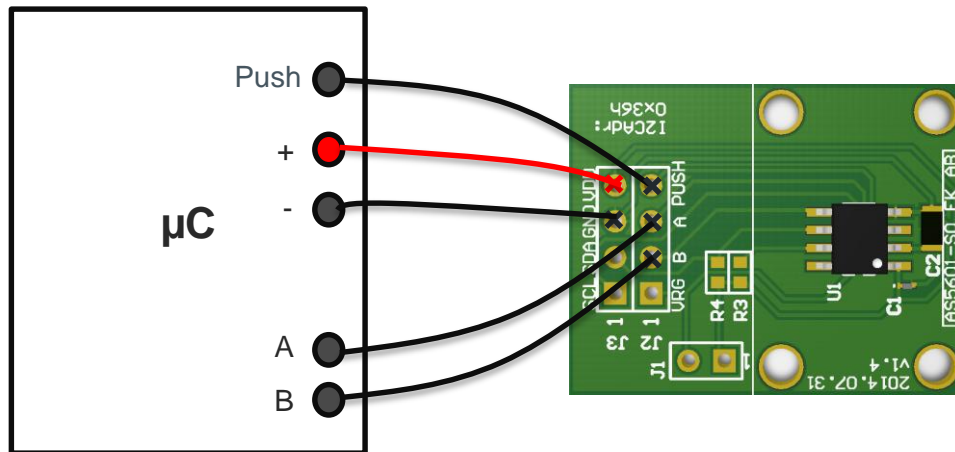
Figure 3:
Using the board in I2C mode
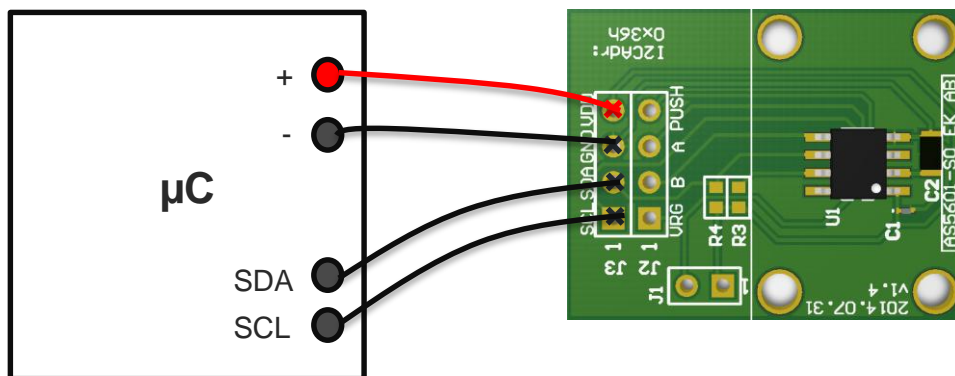
5.1.2 Incremental Mode

The incremental mode is used to set up a contactless encoder knob. In addition to the incremental output, a push button output is available to integrate a contactless push-button.

Figure 4:
Using the board in incremental mode

Note: The grid and grid offset must be configured.

Note: To use the push-button functionality

6   AS5601 Configuration

All options to configure the AS5601 are shown below. To use the AS5601 in incremental mode for a contactless rotary knob, the electrical signal must be aligned with the mechanical grid. As well the push-button threshold must be configured for the mechanical setup.

6.1   Configuring the grid offset

An ideal mechanical grid and the electrical output are shown below in Figure 5 for a 3-bit encoder. The transition of electrical signal should ideally be in the middle between two mechanical positions.

Figure 5:
Aligning electrical and mechanical grid
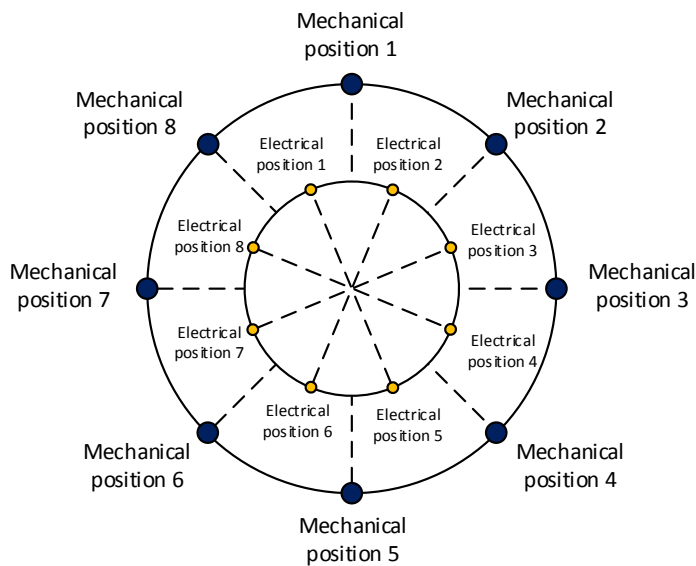
If the electrical are mechanical grid are not aligned due to production, it can easily be configured using a grid offset. The grid offset is calculated as shown below:

$$Grid\ Offset\ Segment = MOD\left(CurrentAngle;\ \frac{360°}{2n}\right) - \frac{360°}{2*2n}$$

$n \ldots Resolution\ [bit]$

$CurrentAngle \ldots Current\ Output\ Angle\ [°]$

Note: To configure the grid offset, the offset value in degrees must be converted and written into the ZPOS register.

6.2 Configuring the grid push button threshold

The push-button threshold must be configured for optimal output. Therefor the threshold must be determined and written into the PUSHTHR register.

The swing of the pushbutton function can be found by subtracting the AGC value of the pressed button from the AGC value of the released button. The threshold value for the contactless pushbutton should be half of the swing.

6.3 Permanently programming a configuration

A configuration is written using the I2C interface. The Burn_Setting command (Write 0x40 into register 0xFF) can be used to permanently program a configuration.

6.3.1 Low Power Mode

Three low power modes are available to reduce the power consumption down to 1,5mA max.

6.3.2 Hysteresis

A 1 to 3 LSB hysteresis of the 12-bit resolution can be enabled.

6.3.3 Slow Filter

The slow filter allows improving the output noise. The default setting for the Slow Filter is 16x and can be reduced for faster response.

6.3.4 Fast Filter

The fast filter is active by selecting a Fast Filter Threshold. If the output value remains below the threshold, the output noise is defined by the slow filter setting. When exceeding the threshold, the output noise is defined from the fast filter for fast output response. The output noise is again defined by the slow filter as soon as the output stays in the threshold again.

6.3.5 Watchdog

If the watchdog is active, the AS5601 automatically enters Low Power Mode 3 after one minute if the output value stays within a threshold of 4 LSB.

7   Board Schematics, Layout and BOM

The schematic, layout and BOM of the adapterboard are shown below for reference.

7.1   Schematics

The schematic of the board is shown below in Figure 6.

Figure 6:
Adapterboard Schematic
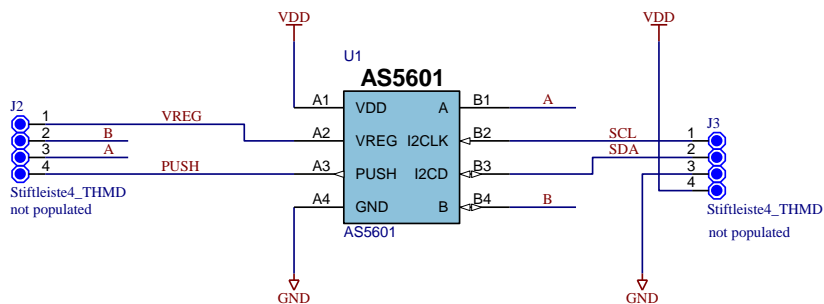
Note1: Supply
J1=OPEN: 5V
J1=CLOSED: 3.3V
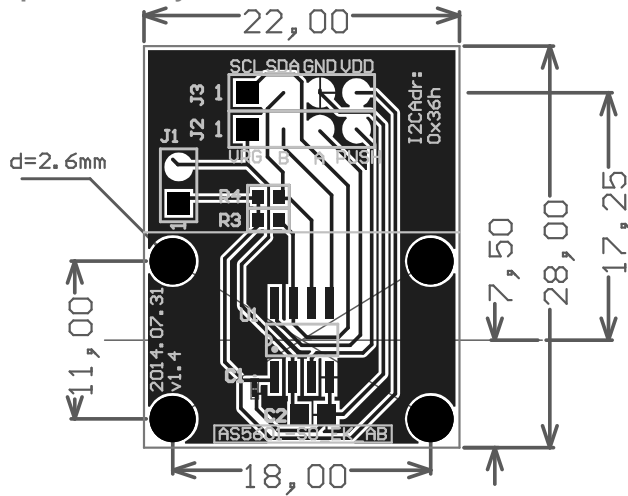
Note2: Optional pull-ups
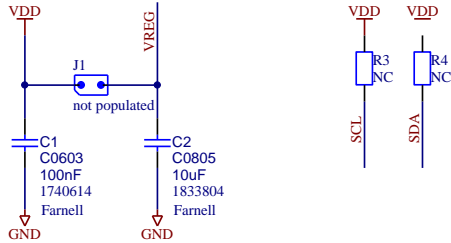
Note3:
Adapterboard can be used with AS5XXX-UCB-1.0
(Use 4pin I2C header in 3.3V mode)

Note4:
AS5601 I2C Address is 0x36h

7.2   Layout and Board Dimensions

The PCB layout is shown below in Figure 7.

Figure 7:
Adapterboard layout

7.3   Bill of Materials

The BOM of the pcb is below in Table 3.

Table 3:
Bill of Materials

Designator	Part	Footprint	Manufacturer	Comment
J1	Jumper / not populated			
J2	Header / not populated			
J3	Header / not populated			
C1	C0603	0603		

Designator	Part	Footprint	Manufacturer	Comment
C2	C0805	0805		
R3	Resistor / not populated	R0603		
R4	Resistor / not populated	R0603		
U1	AS5601	SOIC-8	amsAG	Smart Potentiometer IC
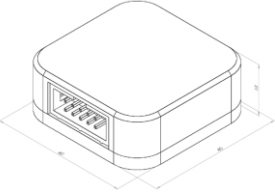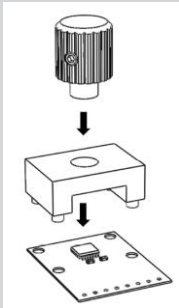
8 Evaluation tools

To configure the AS5601, no dedicated programmer is needed. For fast setup time the USB I&P Box can be used to configure the AS5601 over I^{2}C. The USB I&P Box can be ordered from the ams webpage.

Additionally a magnet holder kit is available with consist of a distance block and a Knob which holds the sensor magnet.

Please find the ordering information below in Table 4.

Table 4:
Ordering Information for Evaluation Tools

Ordering Code	Description	Image
USB I&P Box	To configure the AS5601	
RMH05-DK-XX-1.0	Rotary Magnet Holder for adapterboard	

9   Ordering & Contact Information

Ordering Code	Description
AS5601-SO_EK_AB	AS5601 Eval Kit Adapter Board

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11 Revision Information

Initial version 1-00

Changes from 0-01 (2014-Jun-26) to current revision 1-00 (2014-Jul-31)	Page
Initial revision	

Note: Page numbers for the previous version may differ from page numbers in the current revision.