

Magnetic Rotary 3 Click



PID: MIKROE-5203

Magnetic Rotary 3 Click is a compact add-on board for accurate magnet-position sensing. This board features the [AS5147](#), an SPI-configurable high-resolution rotary position sensor for fast absolute angle measurement over a full 360-degree range from [ams AG](#). The AS5147 position sensor suppresses the influence of any homogenous external stray magnetic field, equipped with a revolutionary integrated dynamic angle error compensation (DAEC™) with almost zero latency. It also comes with onboard headers reserved for incremental and commutation signals of their respective A/B/I and U/V/W signals alongside embedded self-diagnostics, including magnetic field strength too high, magnetic field strength too low or lost magnet, and other related diagnostic features. This Click board™ has been designed to support BLDC motor commutation for the most challenging automotive applications.

Magnetic Rotary 3 Click is supported by a [mikroSDK](#) compliant library, which includes functions that simplify software development. This [Click board™](#) comes as a fully tested product, ready to be used on a system equipped with the [mikroBUS™](#) socket.

How does it work?

Magnetic Rotary 3 Click as its foundation uses the AS5147U, a high-resolution rotary position sensor for fast absolute angle measurement over a full 360-degree range from ams AG. The AS5147U continuously generates the angle information, which the different interfaces can request from the device. The internal 14-bit resolution is available by readout register via the SPI interface, while the resolution on the ABI output can be programmed for 10 or 14 bits. It is also equipped with a Dynamic Angle Error Compensation block that corrects the calculated angle regarding latency by using a linear prediction calculation algorithm.

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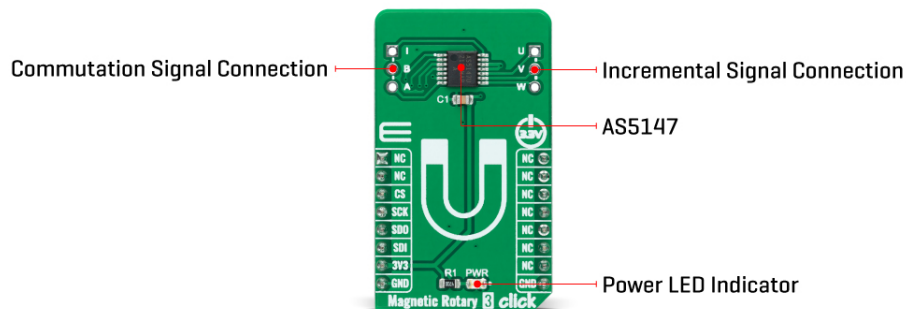
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The core of the AS5147U represents a CMOS technology Hall-effect magnetic sensor that converts the magnetic field component perpendicular to the surface of the chip into a voltage. The signals coming from internal Hall sensors are amplified and filtered before their conversion by the ADC and then processed by the CORDIC block to compute the angle and magnitude of the magnetic field vector. The intensity of the magnetic field is used by the automatic gain control (AGC) to adjust the amplification level to compensate for temperature and magnetic field variations.

Magnetic Rotary 3 Click communicates with MCU through a standard SPI interface supporting the common SPI mode, SPI Mode 1, allowing a host MCU to read 14-bit absolute angle position data from the AS5147U. This Click board™ also comes with onboard headers reserved for incremental and commutation signals of their respective A/B/I and U/V/W signals alongside embedded self-diagnostics, including magnetic field strength too high, magnetic field strength too low or lost magnet, and other related diagnostic features. Incremental movements are indicated on ABI signals with a maximum resolution of 16384 steps / 4096 pulses per revolution.

Besides, brushless DC (BLDC) motors are also controllable through a standard UVW commutation interface with a programmable number of pole pairs from 1 to 7. At constant rotation speed, the latency time is internally compensated by the AS5147U, reducing the dynamic angle error at the SPI, ABI, and UVW outputs, while at higher speeds, the interpolator fills in the missing ABI pulses and generates the UVW signals with no loss of resolution. The AS5147U allows selection between a UVW output interface and a PWM-encoded interface on the W pin, which can be seen as an absolute angle position.

This Click board™ can be operated only with a 3.3V logic voltage level. The board must perform appropriate logic voltage level conversion before using MCUs with different logic levels. However, the Click board™ comes equipped with a library containing functions and an example code that can be used, as a reference, for further development.

Specifications

Type	Magnetic
Applications	Can be used to support BLDC motor commutation for the most challenging automotive applications

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On-board modules	AS5147U - rotary position sensor for fast absolute angle measurement over a full 360-degree range from ams AG
Key Features	Good resolution for motor and position control, independent output interfaces, self-diagnostics, immune to external stray field, low power consumption, and more
Interface	SPI
Feature	No ClickID
Compatibility	mikroBUS™
Click board size	M (42.9 x 25.4 mm)
Input Voltage	3.3V

Pinout diagram

This table shows how the pinout on Magnetic Rotary 3 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin							Pin	Notes
	NC	1	AN	PWM	16	NC			
	NC	2	RST	INT	15	NC			
SPI Chip Select	CS	3	CS	RX	14	NC			
SPI Clock	SCK	4	SCK	TX	13	NC			
SPI Data OUT	SDO	5	MISO	SCL	12	NC			
SPI Data IN	SDI	6	MOSI	SDA	11	NC			
Power Supply	3.3V	7	3.3V	5V	10	NC			
Ground	GND	8	GND	GND	9	GND	Ground		

Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
J1	ABI	Unpopulated	Commutation Signal Connection Header
J2	UVW	Unpopulated	Incremental Signal Connection Header

Magnetic Rotary 3 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	-	3.3	-	V
Rotation Angle Range	0	-	360	deg
Core Resolution	-	14	-	bit
Maximum Speed	-	-	14500	RPM
Operating Temperature Range	-40	+25	+120	°C

Software Support

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We provide a library for the Magnetic Rotary 3 Click as well as a demo application (example), developed using MikroElektronika [compilers](#). The demo can run on all the main MikroElektronika [development boards](#).

Package can be downloaded/installed directly from NECTO Studio Package Manager(recommended way), downloaded from our [LibStock™](#) or found on [Mikroe github account](#).

Library Description

This library contains API for Magnetic Rotary 3 Click driver.

Key functions

- `magneticrotary3_write_register` This function writes a desired data to the selected register by using SPI serial interface.
- `magneticrotary3_read_register` This function reads data from the selected register by using SPI serial interface.
- `magneticrotary3_get_angle` This function reads the absolute position raw data and converts it to degrees (Angle).

Example Description

This example demonstrates the use of Magnetic Rotary 3 Click board™ by reading and displaying the magnet's angular position in degrees.

The full application code, and ready to use projects can be installed directly from NECTO Studio Package Manager(recommended way), downloaded from our [LibStock™](#) or found on [Mikroe github account](#).

Other Mikroe Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.MagneticRotary3

Additional notes and informations

Depending on the development board you are using, you may need [USB UART click](#), [USB UART 2 Click](#) or [RS232 Click](#) to connect to your PC, for development systems with no UART to USB interface available on the board. UART terminal is available in all MikroElektronika [compilers](#).

mikroSDK

This Click board™ is supported with [mikroSDK](#) - MikroElektronika Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the [LibStock](#) and installed for the compiler you are using.

For more information about mikroSDK, visit the [official page](#).

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Resources

[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

[Click boards™](#)

Downloads

[Magnetic Rotary 3 click example on Libstock](#)

[Magnetic Rotary 3 click 2D and 3D files](#)

[AS5147U datasheet](#)

[Magnetic Rotary 3 click schematic](#)

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