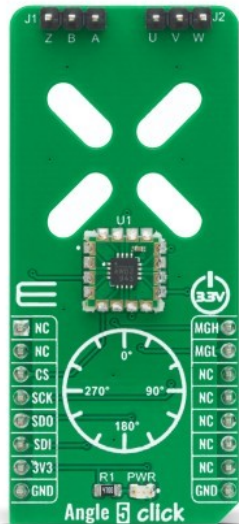


## Angle 5 Click



PID: MIKROE-4270

Angle 5 Click is a compact add-on board that detects the absolute angular position of a permanent magnet, typically a diametrically magnetized cylinder on a rotating shaft. This board features the MA302, a 12-bit digital contactless angle sensor with ABZ and UVW incremental outputs from Monolithic Power Systems. The MA302 features an ABZ encoder, UVW pole pair emulation, fast data acquisition, and processing which provides accurate angle measurement at speeds from 0 to 60,000 rpm, and a magnetic field strength detection with programmable thresholds. This Click board™ is suitable for various applications such as detecting the absolute rotor position of a brushless motor in real-time, even without a target magnet, by measuring the fringe field of the rotor.

Angle 5 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.

**NOTE:** DC Motor doesn't come with this Click board™, if you are interested you can find [2207V-2500KV BLDC Motor](#) in our shop. Or you can buy the full package [here](#).

### How does it work?

Angle 5 Click is based on the MA302, a 12-bit digital contactless angle sensor with ABZ and UVW incremental outputs from Monolithic Power Systems. This Click board™ can detect the absolute rotor position of a Brushless motor in real-time, even without a target magnet, by measuring the fringe field of the rotor. The sensor must be positioned at the correct place (in this case below the rotor) to get the maximum value of the rotor magnetic field without being disturbed by other fields. The rotor magnetic field is then measured, and an adequate position

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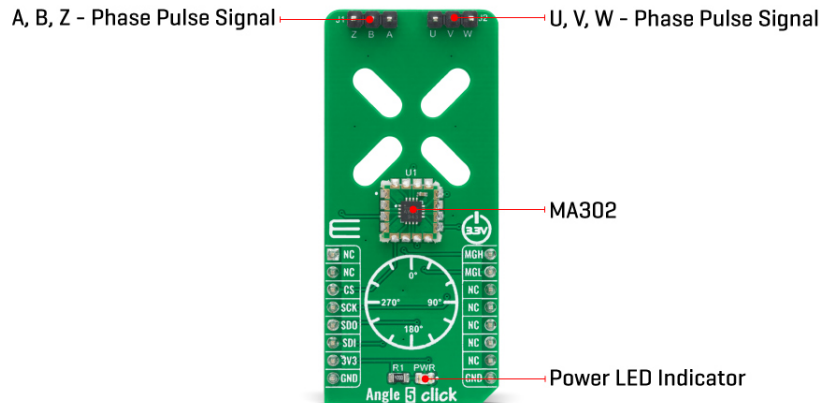


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was determined from that information. It uses the SPI serial interface for digital angle readout and configuration, alongside with programmable magnetic field strength detection function for diagnostic checks.



The magnetic field is detected with integrated Hall devices located in the center of the package. The angle is measured using the Spinaxis™ method, based on phase detection and generates a sinusoidal signal with a phase that represents the angle of the magnetic field. The angle is then obtained by a time-to-digital converter, which measures the time between the zero-crossing of the sinusoidal signal and the edge of a constant waveform. The time-to-digital represents an output from the front-end to the digital conditioning block. This output delivers a digital number proportional to the angle of the magnetic field at the rate of 1MHz in a straightforward and open-loop manner.

The Angle 5 Click communicates with MCU using the standard SPI serial interface for angle reading and register programming, which supports SPI Mode 0 and 3 and operates at clock rates up to 25 MHz. It also has the magnetic flags used for indication when the magnetic field at the sensor position is out of range, defined by the lower and upper magnetic field thresholds, routed on the PWM and INT pin of the mikroBUS™ socket labeled as MGH and MGL.

This Click board™ possesses an incremental encoder and block commutation function that uses three output pins each: ABZ and UVW. The ABZ output emulates a 10-bit incremental encoder (such as an optical encoder) providing logic pulses in quadrature, while the UVW output emulates the three Hall switches usually used for the block commutation of a three-phase electric motor. The ABZ and UVW pins of the MA302 are routed on two standard 2.54 mm (0.1 inches) pitch 1x3 header, mounted on the Angle 5 Click, so it can be easily accessed by an external application.

This Click board™ is designed to be operated only with a 3.3V logic voltage level. A proper logic voltage level conversion should be performed before the Click board™ is used with MCUs with different logic levels. However, the Click board™ comes equipped with a library that contains easy to use functions and an example code that can be used as a reference for further development.

## Specifications

Type	Magnetic
Applications	Can be used for various applications such as

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	detecting the absolute rotor position of a brushless motor in real-time, even without a target magnet, by measuring the fringe field of the rotor.
On-board modules	Angle 5 Click is based on the MA302, a 12-bit digital contactless angle sensor with ABZ and UVW incremental outputs from Monolithic Power Systems.
Key Features	Fast data acquisition, magnetic field strength detection, contactless sensing for long life, supported both end-of-shaft and off-axis, and many more.
Interface	SPI
ClickID	No
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V

## Pinout diagram

This table shows how the pinout on Angle 5 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	<b>MGH</b>	Magnetic Field Strength Detection (HIGH)
	NC	2	RST	INT	15	<b>MGL</b>	Magnetic Field Strength Detection (LOW)
SPI Chip Select	<b>CS</b>	3	CS	RX	14	NC	
SPI Clock	<b>SCK</b>	4	SCK	TX	13	NC	
SPI Data OUT	<b>SDO</b>	5	MISO	SCL	12	NC	
SPI Data IN	<b>SDI</b>	6	MOSI	SDA	11	NC	
Power Supply	<b>3.3V</b>	7	3.3V	5V	10	NC	
Ground	<b>GND</b>	8	GND	GND	9	<b>GND</b>	Ground

## Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
J1	M1x3	-	A, B, Z incremental encoder outputs
J2	M1x3	-	U, V, W block commutation outputs

## Angle 5 Click electrical specifications

Description	Min	Typ	Max	Unit
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Supply Voltage	-0.5	3.3	+4.6	V
Applied Magnetic Filed	30	60	-	mT
Magnetic Field Detection Accuracy	-	5	-	mT
Effective resolution	11	11.8	12.8	bit
Operating Temperature Range	-40	-	+125	°C

## Software Support

We provide a library for the Angle 5 Click on our [LibStock](#) page, as well as a demo application (example), developed using MikroElektronika [compilers](#). The demo can run on all the main MikroElektronika [development boards](#).

## Library Description

The library contains a basic functions for using Angle 5 click.

Key functions:

- uint16\_t angle5\_read\_raw\_angle ( void ) - Reads Raw Angle data
- float angle5\_read\_angle\_deg ( void ) - Reads Angle data in deg

## Examples description

The application is composed of three sections :

- System Initialization - Initializes the SPI module and all necessary GPIO pins.
- Application Initialization - Initializes dvicer init
- Application Task - Reads the angle position of the magnet and log data to USB UART

The full application code, and ready to use projects can be found on our [LibStock](#) page.

Other mikroE Libraries used in the example:

- SPI Library
- UART Library
- Conversions Library

## 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. The terminal available in all MikroElektronika [compilers](#), or any other terminal application of your choice, can be used to read the message.

## 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](#).

## Resources

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[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

[Click Boards™](#)

## Downloads

[Angle 5 click 2D and 3D files](#)

[MA302 datasheet](#)

[Angle 5 Click schematic](#)

[Angle 5 click example on Libstock](#)

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