

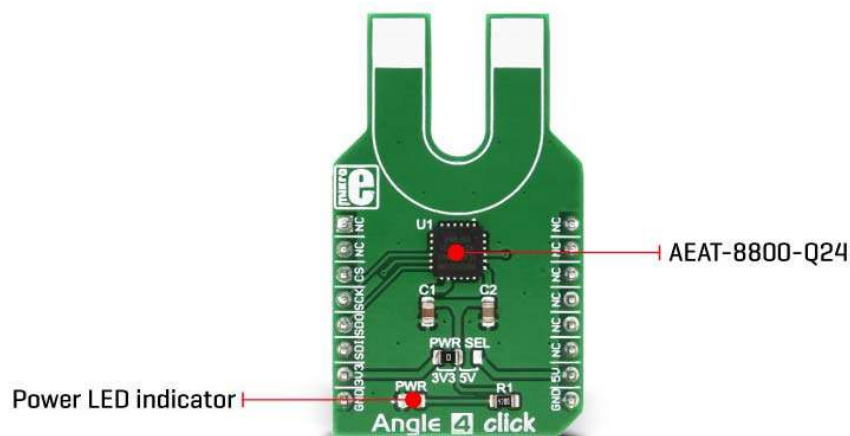
## Angle 4 click PID: MIKROE-3130 Weight: 24 g

**Angle 4 click** is an angular magnetic rotary sensor, which can be used as a rotary encoder. With the help of the AEAT-8800-Q24, an integrated 10 to 16-bit programmable angular magnetic encoder, the Angle 4 click can sense the magnetic field rotation aligned with the center of the sensor, over the whole range of 360°. The absolute angular position can be read from the SPI interface. The sensor IC itself offers a versatile contactless rotation sensing platform, with the ability to fine-tune several important working parameters, such as the resolution, zero position, direction, hysteresis, and more.

The AEAT-8800-Q24 IC utilizes integrated Hall sensor elements, accompanied by very sophisticated circuits for processing analog and digital signals, resulting in a very robust and precise rotary sensing interface. This makes Angle 4 click an ideal solution for a wide variety of contactless angle measurement applications, such as the acquisition of position and rotation for various BLDC or stepper motors, mechanical potentiometer replacement, for building various HMI platforms, in robotics, and similar applications.

# How does it work?

As already mentioned, Angle 4 click uses the AEAT-8800-Q24, an integrated 10 to 16-bit programmable angular magnetic encoder, by Broadcom. This sensor relies on integrated Hall elements and complex analog front end and digital signal processing, in order to provide absolute angular position over the industry standard SPI interface. The user has the ability to programmatically set the zero position, direction, hysteresis, and the resolution. This allows the Click board™ to be tailored according to needs for a range of different applications.



The possibility to sense the rotational angle of a diametrically magnetized object parallel with the Click board™ surface, gives an opportunity to develop both contactless rotational and positional measurement applications, as well as the human-machine interfaces (HMI), such as the rotary encoders, digital potentiometers, and similar. The calibration is simple, and the AEAT-8800-Q24 datasheet provides a detailed explanation how to calibrate the device by using a diametrically magnetized object (i.e. a magnetic disc), with its axis aligned to the center of the sensor. For the best results, the magnet properties should be according to specifications in the datasheet. Once calibrated, it can be permanently used, with no additional recalibrations.

The AEAT-8800-Q24 uses the non-volatile one-time programming memory during the operation. It contains registers with the calibration values, zero offsets, resolution and so on. All the OTP locations have their shadow locations, which allow writing, but only when the unlock command is issued (writing 0xAB to the location 0x10). However, the values will be lost after the power cycle and will be rewritten with the values contained in the OTP memory.

The library provided with Angle 4 click offers several simple and useful functions, among which is the **angle4\_calibration** function, which will automatically program the direction and the resolution parameters to the OTP memory, passed as arguments to this function. However, the OTP memory will not be permanently written, unless appropriate programming voltage is applied to the VDDP pin. Since the OTP memory can be programmed only once, a thorough understanding of the OTP programming process is required. More information about the OTP programming process can be found in the AEAT-8800-Q24 datasheet.

The Click board™ contains an SMD jumper, labeled as PWR SEL, which can be used to set the operating voltage of the click board to either 3.3V or to 5V. This allows a wide range of different MCUs to be interfaced with the Click board™, operating both at 3.3V and 5V.

## Specifications

Type	Magnetic
Applications	It is an ideal solution for a wide variety of contactless angle measurement applications, such as the acquisition of position and rotation for various BLDC or stepper motors, mechanical potentiometer replacement, for building various HMI platforms, in robotics, and similar applications
On-board modules	AEAT-800-Q24, an integrated 10 to 16-bit programmable angular magnetic encoder, by Broadcom
Key Features	Accurate sensing of the magnetic angle, providing absolute positional readings over the SPI, good linearity and low error margin over 360°, programmable working parameters, OTP memory for permanent working parameters storage
Interface	SPI
Input Voltage	3.3V or 5V
Click board size	M (42.9 x 25.4 mm)

## Pinout diagram

This table shows how the pinout on **Angle 4 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	<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	<b>5V</b>	Power supply
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
JP1	PWR SEL	Left	Power supply voltage selection: left position 3.3V, right position 5V

# Software support

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We provide a library for the Angle4 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

Library initializes and defines SPI bus driver and driver functions which offer a choice to write data in registers and to read data from registers. Library also offers a choice to sets absolute resolution read data and sets the direction. A user has an angle-reading function, a function for starting the measurement, and starting the chip calibration that is necessary for operation.

Key functions:

- `vuint8_t angle4_getNewAngle(uint16_t *dataOut)` - Functions for read Angle
- `void angle4_startMesurement()` - Functions for start measurement
- `void angle4_calibration(uint8_t dir, uint8_t data_resolution)` - Functions for calibration chip

## Example description

The application is composed of three sections:

- System Initialization - Initializes SPI module and set CS pin as OUTPUT
- Application Initialization - Driver initialization, standard configurations, and start measurement
- Application Task - (code snippet) - Reads Angle in degrees and logs data to USBUART every 200 ms.

```
void applicationTask()
{
    angle4_getNewAngle(&Angle);

    IntToStr(Angle, demoText);
    mikrobus_logWrite(" Angle : ", _LOG_TEXT);
    mikrobus_logWrite(demoText, _LOG_TEXT );
    mikrobus_logWrite(" deg", _LOG_LINE);
    Delay_ms( 200 );
}
```

The full application code, and ready to use projects can be found on our Libstock page.

Other MikroElektronika libraries used in the example:

- SPI
- Conversions

## Additional notes and information

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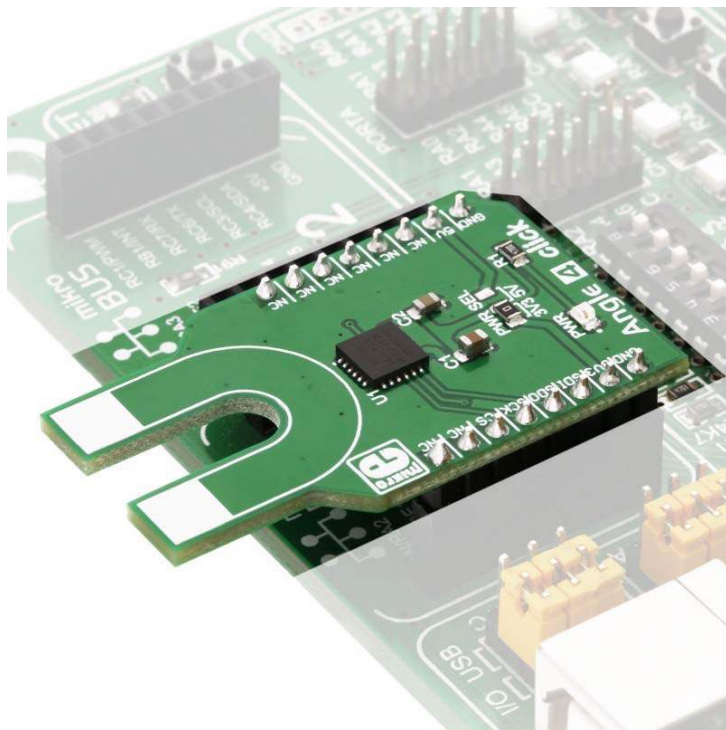
Depending on the development board you are using, you may need USB UART click, USB UART 2 click or RS232 click to connect to your PC, for development systems with no UART to USB interface available on the board. The terminal available in all MikroElektronika compilers, or any other terminal application of your choice, can be used to read the message.

## mikroSDK

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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.



<https://www.mikroe.com/angle-4-click> 9-19-18