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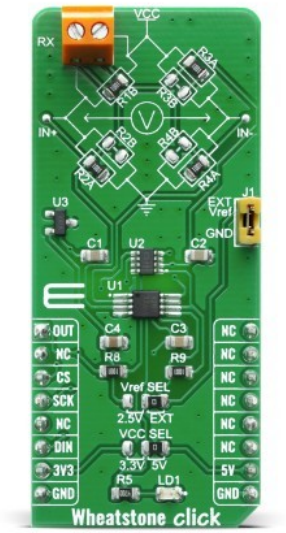
Wheatstone Click



PID: MIKROE-4124

Wheatstone Click is a measurement Click board™ which utilizes a Wheatstone bridge circuit onboard, in order to precisely measure the resistance of an external element. Besides the wheatstone bridge circuit, this Click board™ also utilizes MAX4208 – an ultra-low offset/drift, precision instrumentation amplifier, from Analog Devices. Having features such as Spread-Spectrum, Auto-Zero, Low Offset Voltage Drift and more makes the mentioned IC ideal for accurate detection of very small voltage changes and conversion into a digital form. Having these features in mind, Wheatstone click is ideal for using in various applications which may include sensor readings and precise resistance measurements.

Wheatstone 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?

A Wheatstone bridge is an electrical circuit used to measure an unknown electrical resistance by balancing two branches of a bridge circuit, one branch of which includes the unknown component. The primary benefit of the circuit is its ability to provide extremely accurate measurements, in contrast with a simple voltage divider.

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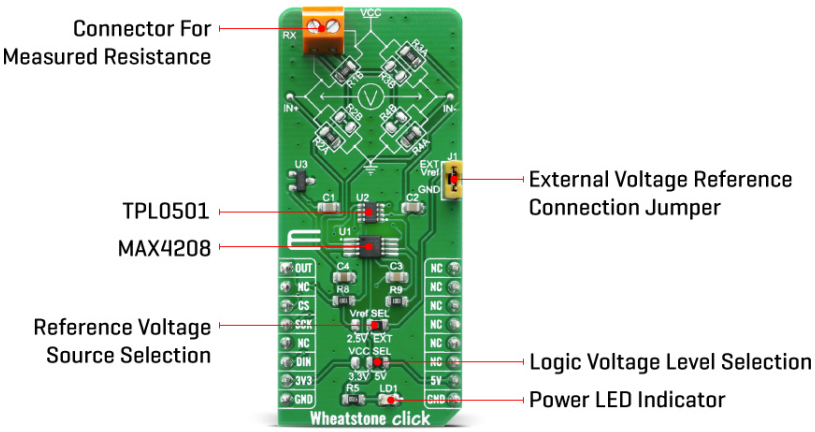

The R2, R3, and R4 are resistors of known resistance (1k ohm), while the resistance R1 is brought to the terminal block and therefore it is changeable. With no resistance connected to the terminal block, the bridge on this Click board™ is in balance. At this point, the voltage between the two midpoints (IN- and IN+) will be zero. Therefore the ratio of the two resistances in the known branch (R1 and R3) is equal to the ratio of the two resistances in the unknown leg (R2 and R4). If the external resistance is connected to the terminal block, bridge is unbalanced, and the voltage on the midpoints is proportional to the external resistor value.

Wheatstone click is based around the MAX4208 IC, which is connected to an onboard Wheatstone bridge circuit, in order to precisely measure the resistance of an external element. The mentioned IC uses a spreadspectrum, autozeroing technique that constantly measures and corrects the input offset, eliminating drift over time and temperature and the effect of 1/f noise. This technique achieves less than 20µV offset voltage, allows ground-sensing capability, provides ultra-low CMOS input bias current and increased common-mode rejection performance. It also provides high-impedance inputs, optimized for small-signal differential voltages (±100mV), which makes it ideal for an application such as wheatstone bridge disbalance measurement.

This Click board™ also has TPL0501 onboard - 256-Taps, Single-Channel, Digital Potentiometer With SPI Interface, from texas instruments. It is connected to the MAX4208 in a way that it serves an gain adjust instead of with two external resistors

The power supply voltage selection for the logic section is done by moving the SMD jumper labeled as VCC SEL to a desired position: left position to select 3.3V, right position to select 5V. This will allow both 3.3V and 5V MCUs to be interfaced with the Click board™ directly.

Specifications

Type	Measurements
Applications	Wheatstone click is ideal for using in various applications which may include sensor readings and precise resistance measurements.
On-board modules	MAX4208 – an ultra-low offset/drift, precision instrumentation amplifier, from Maxim Integrated TPL0501 onboard - 256-Taps,

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	Single-Channel, Digital Potentiometer With SPI Interface, from texas instruments
Key Features	ultra-low offset/drift, Spread-Spectrum, Auto-Zero, Low Offset Voltage Drift and more
Interface	Analog,SPI
Feature	No ClickID
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V or 5V

Pinout diagram

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

Notes	Pin	mikroBUS				Pin	Notes
Analog	**OUT**	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	
	NC	5	MISO	SCL	12	NC	
	NC	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
PWR	PWR	-	Power LED Indicator
VCC SEL	JP1	Left	Logic voltage level selection: left position 3.3V, right position 5V
VREF SEL	JP2	Left	Reference voltage selection: left position 2.5V, right position EXT
EXT VREF	JP1	-	External reference voltage connection jumper
RX	-	-	Load cell excitation voltage connector

Software Support

We provide a library for the Wheatstone 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.

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Library Description

The library contains basic functions for working with Wheatstone click.

Key functions:

- float wheatstone_get_voltage (uint16_t adc_value) - Get Voltage
- void wheatstone_set_adc_vref (float vref) - Set ADC VREF
- void wheatstone_set_adc_resolution (float res) - Set ADC resolution

Examples description

The application is composed of three sections :

- System Initialization - Initializes the SPI driver init all necessary GPIO pins
- Application Initialization - Initializes driver init and ADC module init - sets the ADC resolution, vref and potentiometer
- Application Task - Reads the ADC value and converts to voltage on the AN pin
- Note: Set the ADC resolution and vref before programming

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
- ADC 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

mikroBUS™

mikroSDK

Click board™ Catalog

Click Boards™

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Downloads

Wheatstone click 2D and 3D files

TPL0501 datasheet

MAX4208 datasheet

Wheatstone click example on Libstock

Wheatstone click schematic

Wheatstone click schematic