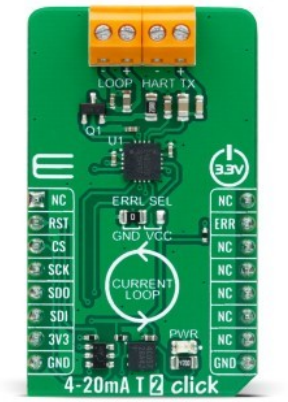
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4-20mA T 2 Click





PID: MIKROE-5540

4-20mA T 2 Click is a compact add-on board for transmitting an analog output current over an industry-standard 4-20mA current loop. This board features DAC161S997, a low-power 16-bit ΣΔ digital-to-analog converter (DAC) from Texas Instruments. It has a programmable Power-Up condition and loop-error detection/reporting accessible via simple 4-wire SPI for data transfer and configuration of the DAC functions. In addition, it is characterized by low power consumption and the possibility of simple Highway Addressable Remote Transducer (HART) modulator interfacing, allowing the injection of FSK-modulated digital data into the 4-20mA current loop. This Click board™ is suitable for 2-wire 4-20mA current loop transmitters, industrial process control, low-power transmitters, and many more.

4-20mA T 2 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.

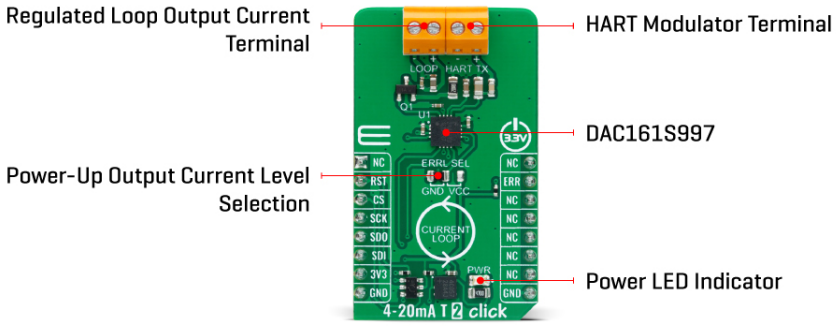
How does it work?

4-20mA T 2 Click is based on the DAC161S997, a low-power 16-bit ΣΔ digital-to-analog converter (DAC) from Texas Instruments, realized as a ΣΔ modulator. Next to ΣΔ DAC, the DAC161S997 also contains an internal ultra-low power voltage reference and an internal oscillator to reduce power and component count in compact loop-powered applications. This architecture, where DAC's output current represents a multiplied copy of the filtered modulator output, ensures an excellent linearity performance while minimizing the device's power consumption. In addition to an industry-standard 4-20 mA current loop over the LOOP terminal, the DAC161S997 also has the possibility of a simple Highway Addressable Remote Transducer (HART) modulator interfacing through an onboard HART TX terminal. It allows the injection of

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FSK-modulated digital data into the 4-20mA current loop.



This Click board™ communicates with MCU using a 4-wire SPI serial interface with a maximum frequency of 10MHz, for data transfer and configuration of the DAC functions. The DAC161S997 supports both Mode 0 and Mode 3 of the SPI protocol. 4-20mA T 2 Click comes with an additional feature, as an interrupt, available on the ERR pin of the mikroBUS™ socket, the loop-error detection/reporting feature. By default, the DAC161S997 detects and reports several types of errors, such as loop error, SPI timeout error (channel error), frame error, and alarm current.

In the case of a fault condition or during the initial Power-Up sequence, the DAC161S997 will output current in either the upper or lower error current band. The band's choice is user-selectable via the appropriate position of an onboard jumper ERRL SEL, while the current error value is programmable through the SPI interface.

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	Current
Applications	Can be used for 2-wire 4-20mA current loop transmitters, industrial process control, low-power transmitters, and more
On-board modules	DAC161S997 - 16-bit DAC for 4-20mA loops from Texas Instruments
Key Features	High resolution, industry-standard current loop, SPI-programmable, low power consumption, Power-Up programmable output current, loop-error detection and reporting, HART modulator interfacing, and more
Interface	SPI
ClickID	Yes

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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 4-20mA T 2 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
	NC	1	AN	PWM	16	NC	
	NC	2	RST	INT	15	**ERR**	Loop-Error Interrupt
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
JP1	ERRL SEL	Left	Power-Up Output Current Level Selection GND/VCC: Left position GND, Right position VCC

4-20mA T 2 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	-	3.3	-	V
Output Current	4	-	20	mA

Software Support

We provide a library for the 4-20mA T 2 Click as well as a demo application (example), developed using Mikroe compilers. The demo can run on all the main Mikroe development boards.

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

Library Description

This library contains API for 4-20mA T 2 Click driver.

Key functions

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- c420mat2_set_output_current 4-20mA T 2 set output current function.
- c420mat2_get_status 4-20mA T 2 set status function.
- c420mat2_set_lower_limit 4-20mA T 2 set lower limit function.

Example Description

This example demonstrates the use of 4-20mA T 2 Click board™. This driver provides functions to configure analog output current transfer over an industry standard 4-20mA current loop.

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

Other Mikroe Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.c420mAT2

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 Mikroe compilers.

mikroSDK

This Click board™ is supported with mikroSDK - Mikroe 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™

ClickID

Downloads

4-20mA T 2 click example on Libstock

4-20mA T 2 click 2D and 3D files

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DAC161S997 datasheet

4-20mA T 2 click schematic

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