

Air Quality 13 Click



PID: MIKROE-7008

Air Quality 13 Click is a compact add-on board for real-time particulate matter monitoring in embedded systems. It is based on the [BMV080](#), an ultra-mini optoelectronic sensor that measures PM1, PM2.5, and PM10 mass concentrations using fanless laser-based free-space sensing, from [Bosch Sensortec](#). The Click supports I2C and SPI communication, continuous and duty-cycling modes, selectable processing algorithms, configurable I2C addresses, and interrupt-driven operation for air quality measurement. With protocol and address selection jumpers, ClickID, Click Snap, a PWR indicator, and a detachable sensing section, it suits air quality monitors, smart thermostats, air purifiers, HVAC systems, portable instruments, and IoT applications.

For more information about **Air Quality 13 Click** visit the official [product page](#).

How does it work?

Air Quality 13 Click is a compact add-on board for real-time particulate matter monitoring, based on the BMV080 ultra-mini optoelectronic particulate matter sensor from Bosch Sensortec. The BMV080 provides mass concentration measurements for airborne particles with diameters of up to 1µm, 2.5µm, and 10µm, reported as PM1, PM2.5, and PM10 values. Unlike conventional particulate matter sensors that require a fan, air inlet, or internal flow channel, the BMV080 uses a fanless free-space measurement principle based on naturally moving ambient air. Its laser system focuses light approximately 5mm above the sensor lens, where particles carried by the surrounding airflow pass through the sensitive region. Light scattered back from these particles is detected by the integrated photodetectors, while the Doppler shift generated by particles crossing the focal point is used to determine their relative velocity. Bosch Sensortec algorithms then process the particle count and velocity information to

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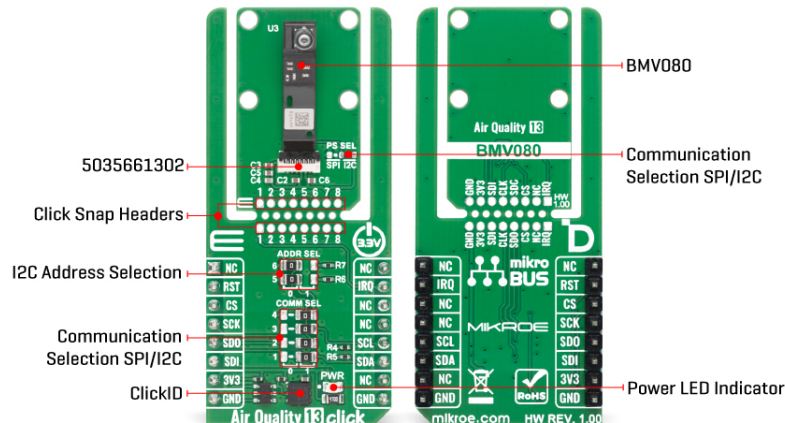


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calculate the corresponding particulate matter concentrations. This operating principle enables silent and maintenance-free operation without moving parts while minimizing the mechanical impact on the host system.



The BMV080 offers a PM2.5 measurement range from 0 to 1000 $\mu\text{g}/\text{m}^3$ with a 1 $\mu\text{g}/\text{m}^3$ output resolution and can detect particles as small as 0.5 μm under the specified test conditions. It supports relative particle velocities from 0.02 to 1.5m/s and provides a typical precision of $\pm 10\mu\text{g}/\text{m}^3$ across the 0 to 100 $\mu\text{g}/\text{m}^3$ range and $\pm 10\%$ from 101 to 1000 $\mu\text{g}/\text{m}^3$. The sensor can operate in continuous or duty-cycling measurement mode, allowing the application to balance measurement frequency and power consumption. Continuous mode provides readings at a maximum output data rate of 0.97Hz, while duty-cycling mode periodically activates the sensor according to a configured measurement interval. Three processing algorithms are available: High Precision, Balanced, and Fast Response, with the High Precision and Balanced algorithms intended for continuous operation and the Fast Response algorithm also available for duty-cycled measurements. The sensor typically starts within 1.9 seconds when software polling is used or 2.9 seconds when hardware interrupt triggering is selected. It consumes less than 68mA during active measurement and less than 30 μA in sleep mode, supports an operating temperature range from 15°C to 65°C, and is specified as a Class 1 laser product with an operating lifetime of up to ten years under defined integration and operating conditions.

Air Quality 13 Click can communicate with the host controller through either an I2C or a four-wire SPI interface. The desired interface is selected through the COMM SEL jumpers, which route the shared sensor communication signals to the corresponding mikroBUS™ pins, while the PS SEL jumper configures the BMV080 protocol-select input. The PS SEL and COMM SEL settings must correspond to one another before the board is powered because the sensor samples and latches the protocol-selection state during power-up. In I2C mode, the board uses the SCL and SDA lines of the mikroBUS™ socket and supports Standard-mode at 100kHz, Fast-mode at 400kHz, and Fast-mode Plus at up to 1MHz. The BMV080 uses seven-bit addressing without clock stretching, and the ADDR SEL jumpers configure its address as 0x54, 0x55, 0x56, or 0x57. In SPI mode, the board uses the SCK, COPI, CIPO, and CS pins and supports a four-wire interface operating from 1MHz to 10MHz in SPI mode 0 or mode 3. The sensor's active-low interrupt output is routed to the IRQ pin on the mikroBUS™ INT line, allowing measurement handling through hardware interrupts instead of continuous polling. The mikroBUS™ RST pin is used by the onboard ClickID selection circuit rather than as a hardware reset input for the BMV080.

The BMV080 sensor assembly is attached to the board through a dedicated 5035661302

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connector, keeping the ultra-mini optical sensor and its flexible interconnection mechanically separated from the main interface circuitry. The board includes a green PWR LED that provides a visual indication when the 3.3V supply is present. The PS SEL jumper selects the sensor protocol, four COMM SEL jumpers configure the routing between the I2C and SPI signal sets, and two ADDR SEL jumpers set the I2C address bits. Air Quality 13 Click also includes ClickID circuitry based on the DS28E36BQ and a 74LVC1G3157 analog switch, enabling automatic board identification when used with a compatible host platform. It is designed in the Click Snap form factor, with break-off lines and duplicated signal pads that allow the sensing section to be separated from the standard mikroBUS™ section. This provides additional flexibility when the sensor must be positioned away from the host board, installed near an enclosure opening, or integrated into a space-constrained custom design while retaining access to its communication, interrupt, power, and ground signals.

Air Quality 13 Click operates exclusively from the 3.3V power rail, which supplies the sensor's laser, analog, digital, and interface power domains and provides the required 3.3V logic level for communication with the host controller. Appropriate decoupling capacitors are placed close to the sensor connector to stabilize the individual supply domains and reduce the influence of supply noise on the optical and analog measurement circuitry. The 5V rail of the mikroBUS™ socket is not used. Air Quality 13 Click comes with a library containing easy-to-use functions and a ready-to-use code example that can be used as a reference for initializing the board, configuring the selected communication interface, starting particulate matter measurements, and retrieving PM1, PM2.5, and PM10 data.

Click Snap

Click Snap is an innovative feature of our standardized Click add-on boards, designed to bring greater flexibility and optimize your prototypes. By simply snapping the PCB along predefined lines, you can easily detach the main sensor/IC/module area, reducing the overall size, weight, and power consumption - ideal for the final phase of prototyping. For more details about Click Snap, visit the [official page](#) dedicated to this feature.

Specifications

Type	Environmental
Applications	Ideal for applications such as indoor air quality monitors, smart thermostats, air purifiers, HVAC systems, portable environmental instruments, and IoT devices
On-board modules	BMV080 - Ultra-mini optoelectronic particulate matter sensor with fanless laser-based free-space sensing from Bosch Sensortec
Key Features	Fanless laser-based free-space sensing, PM1, PM2.5, and PM10 measurements, up to 1000µg/m³ range, continuous and duty-cycling modes, selectable High Precision, Balanced, and Fast Response algorithms, I2C and SPI interfaces, configurable addressing, interrupt support, ClickID, Click Snap, and more
Interface	GPIO, I2C, SPI
Feature	Click Snap, ClickID

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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 Air Quality 13 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	
RESET	RST	2	RST	INT	15	IRQ	Interrupt
SPI CS, ClickID	CS	3	CS	RX	14	NC	
Clock	SCK	4	SCK	TX	13	NC	
Controller In, Peripheral Out	CIPO	5	MISO	SCL	12	SCL	I2C Clock
Controller Out, Peripheral In	COPI	6	MOSI	SDA	11	SDA	I2C Data
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	PS SEL	Left	Communication select SPI/I2C
JP2	COMM SEL	Left	Communication select SPI/I2C
JP3	COMM SEL	Left	Communication select SPI/I2C
JP4	COMM SEL	Left	Communication select SPI/I2C
JP5	ADDR SEL	Left	I2C address select
JP6	COMM SEL	Left	Communication select SPI/I2C
JP7	ADDR SEL	Left	I2C address select

Air Quality 13 Click electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.2	3.3	3.4	V
Operating Temperature	16	-	65	°C

Software Support

[Air Quality 13 Click](#) demo application is developed using the [NECTO Studio](#), ensuring compatibility with [mikroSDK](#)'s open-source libraries and tools. Designed for plug-and-play implementation and testing, the demo is fully compatible with all development, starter, and mikromedia boards featuring a [mikroBUS™](#) socket.

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Example Description

This example demonstrates the use of Air Quality 13 Click board by reading PM1.0, PM2.5 and PM10 mass concentration measurements from the Bosch BMV080 ultra-miniature particulate matter sensor and displaying the results on the USB UART.

Key Functions

- `airquality13_cfg_setup` This function initializes Click configuration structure to initial values.
- `airquality13_init` This function initializes all necessary pins and peripherals used for this Click board.
- `airquality13_default_cfg` This function executes a default configuration of Air Quality 13 Click board.
- `airquality13_start_measurement` This function starts continuous particulate matter measurement via `bmV080_start_continuous_measurement`.
- `airquality13_serve_interrupt` This function processes pending data from the BMV080 FIFO by calling `bmV080_serve_interrupt`.
- `airquality13_set_meas_alg` This function sets the PM concentration calculation algorithm via `bmV080_set_parameter`.

Application Init

Initializes the driver and performs the Click default configuration.

Application Task

Calls `airquality13_serve_interrupt` every 100 ms to process the sensor FIFO. When a new measurement is ready (approximately once per second), logs the PM1.0, PM2.5 and PM10 mass concentrations to the USB UART. If the optical path is obstructed, a warning is printed instead.

Application Output

This Click board can be interfaced and monitored in two ways:

- Application Output - Use the "Application Output" window in Debug mode for real-time data monitoring. Set it up properly by following [this tutorial](#).
- UART Terminal - Monitor data via the UART Terminal using a [USB to UART converter](#). For detailed instructions, check out [this tutorial](#).

Additional Notes and Information

The complete application code and a ready-to-use project are available through the NECTO Studio Package Manager for direct installation in the [NECTO Studio](#). The application code can also be found on the MIKROE [GitHub](#) account.

Resources

[mikroBUS™](#)

[mikroSDK](#)

[Click board™ Catalog](#)

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[Click boards™](#)

[ClickID](#)

Downloads

[Air Quality 13 Click example package](#)

[Air Quality 13 Click 2D and 3D files v100](#)

[Air Quality 13 Click schematic v100](#)

[BMV080 datasheet](#)

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