

# CDT-A

(CO2, Temperature and Humidity controller / transmitter)

## User Manual

Rev 1.0

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## Product Overview

The **CDT-A** is a compact indoor air quality controller and transmitter designed for accurate monitoring and control of **CO<sub>2</sub> concentration, temperature, and relative humidity** in residential, commercial, and light-industrial environments.

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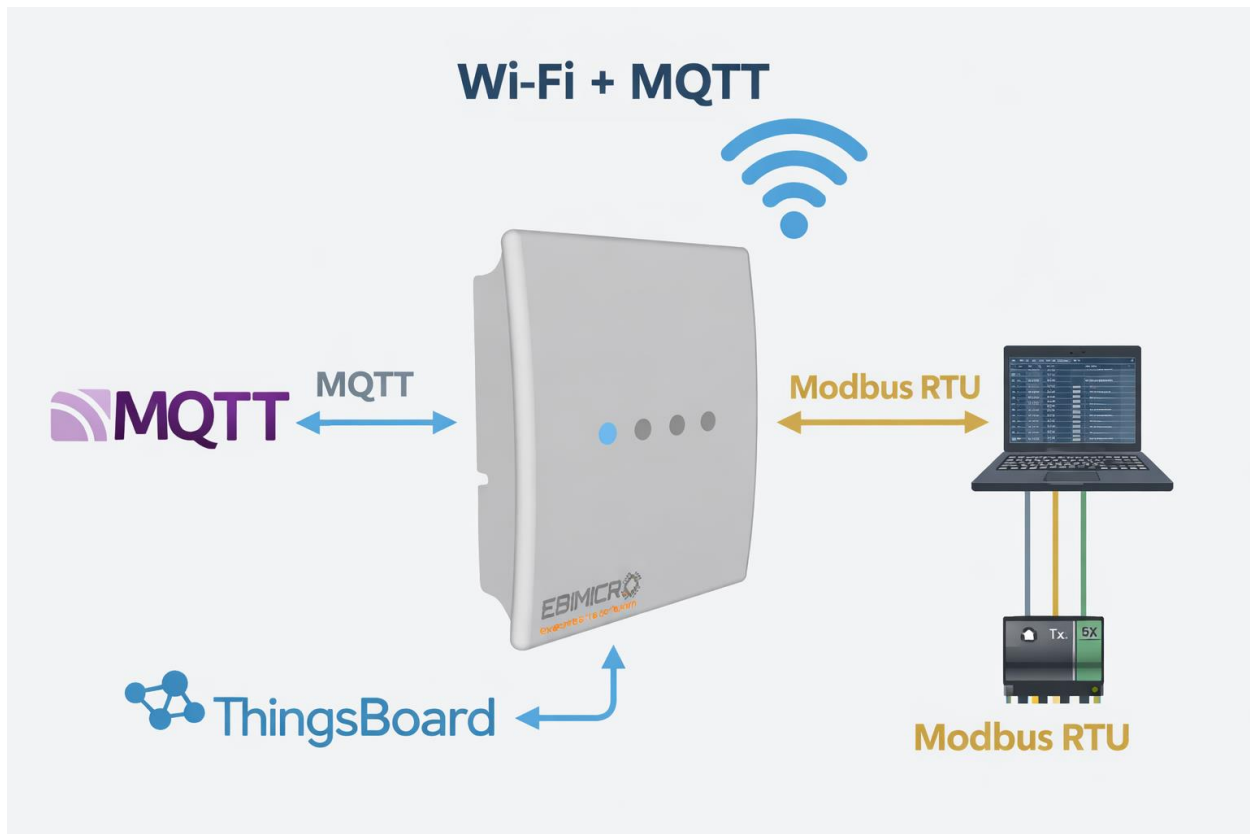
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The device provides reliable long-term performance with minimal maintenance and supports **relay control**, **analog outputs**, **Modbus RTU**, and **Wi-Fi connectivity** for seamless integration with building management systems and cloud-based IoT platforms.

Housed in a durable **ABS plastic enclosure** with **IP32 protection**, the CDT-A is ideal for indoor wall-mount installations.



## Key Features

- CO<sub>2</sub>, temperature, and humidity measurement

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- Relay output for ventilation, alarm, or control applications (tied to CO<sub>2</sub> level)
- Analog outputs (tied to CO<sub>2</sub> level):
  - 0–10 V
  - 0–20 mA (scalable to 4-20mA via Modbus register or Wi-Fi App/ MQTT)
- RS-485 Modbus RTU communication
- Wi-Fi communication
- AP & STA modes
- Cloud data publishing support
- Web-based configuration interface (Wi-Fi AP mode)
- Wide supply voltage range: **6–37 VDC**
- Low power consumption for continuous operation
- Maintenance-free CO<sub>2</sub> sensing technology
- ABS plastic enclosure, **IP32**

## Measured Parameters

Parameter	Measurement Range	Accuracy
CO <sub>2</sub>	400 – 10,000 ppm	±(30 ppm + 3% of reading)
Temperature	-10 °C to +60 °C	±0.3 °C
Relative Humidity	0 – 100 %RH	±2 %RH

## Technical Specifications

Power Supply	6–37 VDC
Power Consumption	< 0.5~0.8 W
Interfaces	Modbus RTU, MQTT
Wi-Fi Standard	802.11ax (Wi-Fi 6 – 2.4GHz)
MQTT QoS	0 (fast), 1 (reliable)
Enclosure	ABS-PC, IP32-rated
Firmware	Custom firmware options available
Updatability	OTA, USB, USB-Serial

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<b>Security</b>	Designed with CRA (Cyber Resilience Act) compliance in mind
<b>Operating Temperature</b>	-20 °C to +80 °C
<b>Dimensions</b>	25 × 85 × 100 mm
<b>Weight</b>	90 gr
<b>Certifications</b>	CE (FCC pending)

## Applications

- Indoor air quality monitoring
- Demand-controlled ventilation (DCV)
- Residential and commercial buildings
- Schools, classrooms, and offices
- Smart home systems
- Building automation systems (BAS / BMS)
- IoT-based environmental monitoring

## Wiring & Hardware Configuration

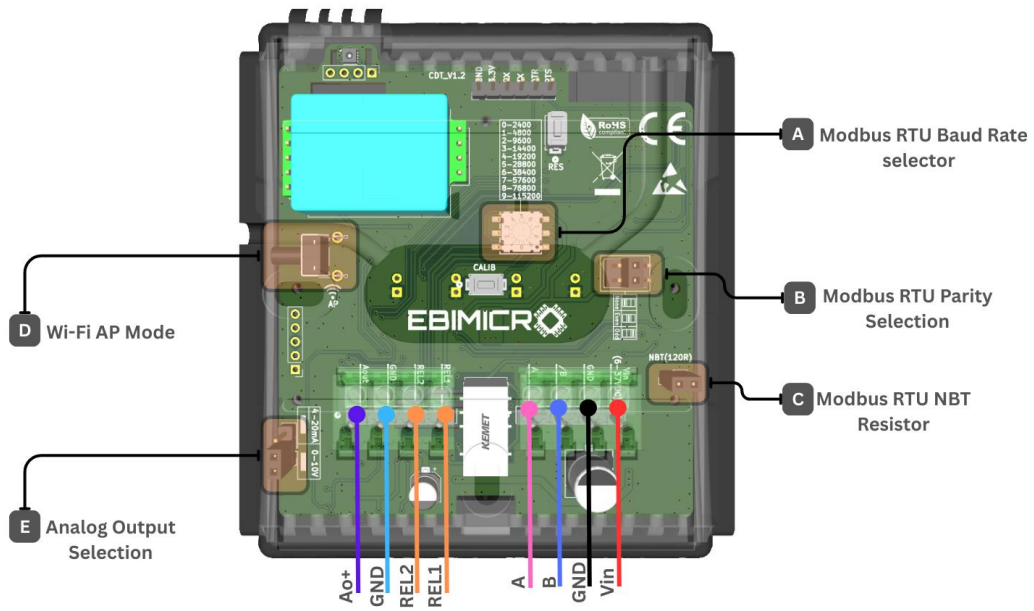
This section describes the electrical wiring of the CDT-A device. All connections are made using the screw terminals located at the bottom of the device enclosure.

**Note:** Ensure power is disconnected before wiring the device.

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## Terminal Overview

The CDT-A provides terminals for power supply, analog output, relay outputs, and Modbus RTU communication.

Terminal	Description
AO+	Analog output (0–10 V or 0–20 mA)
GND	Ground (analog output reference)
REL2	Relay output 2
REL1	Relay output 1
A	RS-485 Data A (Modbus RTU)
B	RS-485 Data B (Modbus RTU)
GND	Communication ground

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VIN	Power supply input (6–37 VDC)
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## Power Supply Wiring

The device is powered via the **VIN** and **GND** terminals.

- Supply voltage: **6–37 VDC**
- Typical wiring:
  - **VIN** → Positive supply (+)
  - **GND** → Supply ground (-)

**Warning:** Applying voltage outside the specified range may damage the device.

## Analog Output Wiring

The CDT-A provides a single configurable analog output tied to **CO<sub>2</sub> level only**.

- Output modes:
  - **0–10 V**
  - **0–20 mA** (scalable to 4–20 mA via firmware configuration)

### Wiring:

- **AO+** → Analog signal output
- **GND** → Analog ground reference

The output type is selected using the on-board **Analog Output Selection jumper**.

**Note:** Ensure the selected output mode matches the connected controller or input module.

## Relay Output Wiring

The device includes a **single latching relay output (REL1 and REL2)**, suitable for control or alarm signaling tied to **CO<sub>2</sub> level only**.

- Relay outputs are **potential-free contacts**
- Typical applications:
  - Ventilation control
  - Alarm signaling
  - External device switching

### Wiring:

- **REL1** → Relay contact 1
- **REL2** → Relay contact 2

Relay behavior and control logic can be configured via Modbus registers or MQTT (ThingsBoard Cloud platform).

## Modbus RTU (RS-485) Wiring

The CDT-A supports Modbus RTU communication over RS-485.

### Wiring:

- **A** → RS-485 Data A
- **B** → RS-485 Data B
- **GND** → Communication ground (recommended for long cable runs)

For multi-drop networks:

- Use twisted pair cabling
- Maintain consistent A/B polarity across all devices

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## RS-485 Termination Resistor

An internal **120  $\Omega$  termination resistor** can be enabled using the **NBT jumper**.

- **Enable termination** if the device is located at the end of the RS-485 bus
- **Disable termination** if the device is not at the bus end

**Note:** Incorrect termination may result in unstable Modbus communication.

## Typical Wiring Example

A typical installation may include:

- Power supply connected to **VIN / GND**
- Analog output connected to a PLC or controller input
- RS-485 A/B connected to a Modbus master (PLC, BMS, or gateway)
- Optional relay outputs connected to ventilation or alarm equipment

Refer to the wiring diagram provided in this manual for terminal positioning and connection reference.

## Communication Interfaces

The **CDT-A** supports both **wired and wireless communication**, allowing flexible integration into modern building automation and cloud-based monitoring systems. The device can publish measured data and parameters using three communication methods:

- MQTT over TCP
- ThingsBoard over MQTT
- MODBUS RTU (RS485)

Please note that the device can operate using all the above communication methods simultaneously, but it's **highly recommended** to use only one communication way at a time to prevent overlapping configurations.

### Wi-Fi (MQTT / ThingsBoard)

The CDT-A includes an integrated Wi-Fi interface for wireless connectivity.

When connected to a local Wi-Fi network, the device can publish measured values and device status to a cloud platform using **MQTT to ThingsBoard cloud platform** indirectly and directly to any MQTT broker of user's choice.

Publishing data to ThingsBoard cloud platform requires only setting an email to get registration and API link and publishing data to an MQTT broker directly requires filling the secure credentials of end users MQTT preferred broker. This instruction can be found in [Basic and Advance Configuration](#) in AP mode section.

- Compatible with **ThingsBoard Cloud**
- Periodic telemetry publishing
- Remote monitoring via web dashboard
- Configuration via local access point (AP mode)

### Wi-Fi Access Point (AP) Mode Push Button

The CDT-A includes a dedicated **AP Mode push button** on the internal PCB. This button is used to enable the device's Wi-Fi Access Point mode for local configuration.

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AP mode allows direct access to the device without requiring an existing network connection.

### ***Function Description***

When AP mode is enabled, the CDT-A creates its own Wi-Fi network. A user can connect to this network using a smartphone, tablet, or computer to access the built-in web configuration interface.

Typical use cases:

- Initial device configuration
- Wi-Fi network setup
- Recovery when Wi-Fi credentials are unknown or incorrect

### ***Activating AP Mode***

To enable the Wi-Fi Access Point (AP) mode on the CDT-A, follow the steps below:

1. **Ensure the device is powered on**  
Verify that the CDT-A is properly connected to the power supply and operational.
2. **Press and hold the AP button**  
Press and hold the **AP mode push button located on the left side of the device** for approximately **5–7 seconds**.
3. **Wait for AP mode indication**  
Release the button once the AP mode is activated.  
The device will indicate AP mode by **LEDs blinking sequentially (one after another)**.

AP Mode Behavior

- The CDT-A creates a temporary Wi-Fi network (Access Point)
- The device is ready for configuration via a smartphone or computer
- Default access IP address: **192.168.4.1**

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## Notes

- AP mode is intended for **initial setup and configuration**
- If no configuration is completed, the device will automatically exit AP mode after a timeout (≈10 minutes)
- During AP mode, normal operation (data transmission) is temporarily paused

## Important Note – AP Mode Credentials

The credentials required to access the device configuration in AP mode are printed on the wall mounting bracket and are also available as a QR code for easy installation.

A duplicate label is included in the package. It is strongly recommended to store this label in a safe place for future use (e.g., device reconfiguration or recovery).

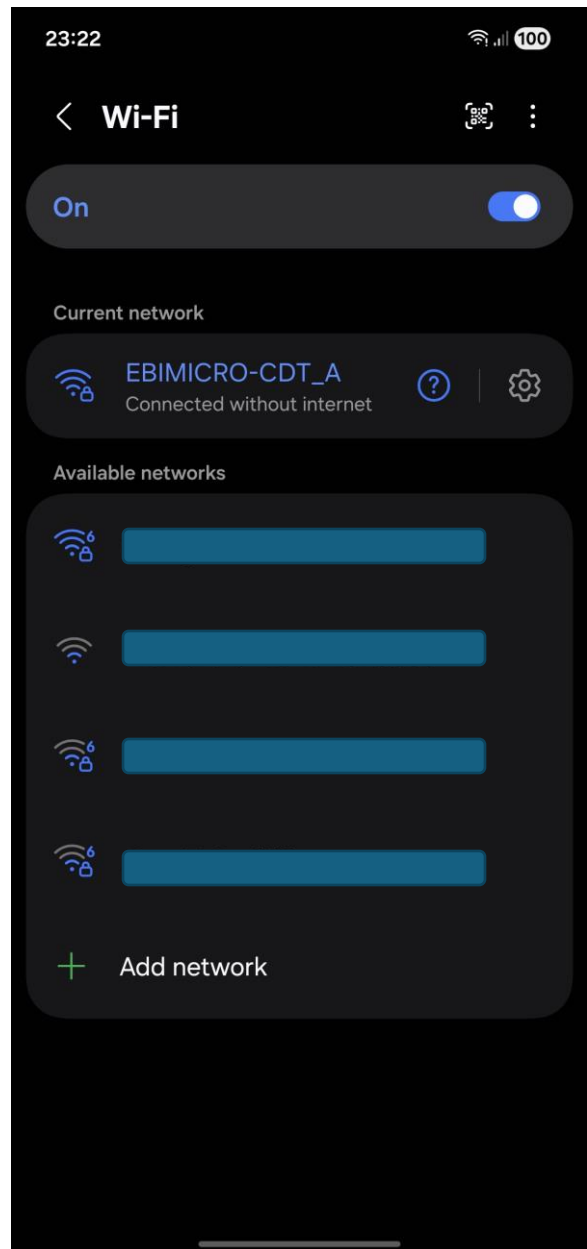
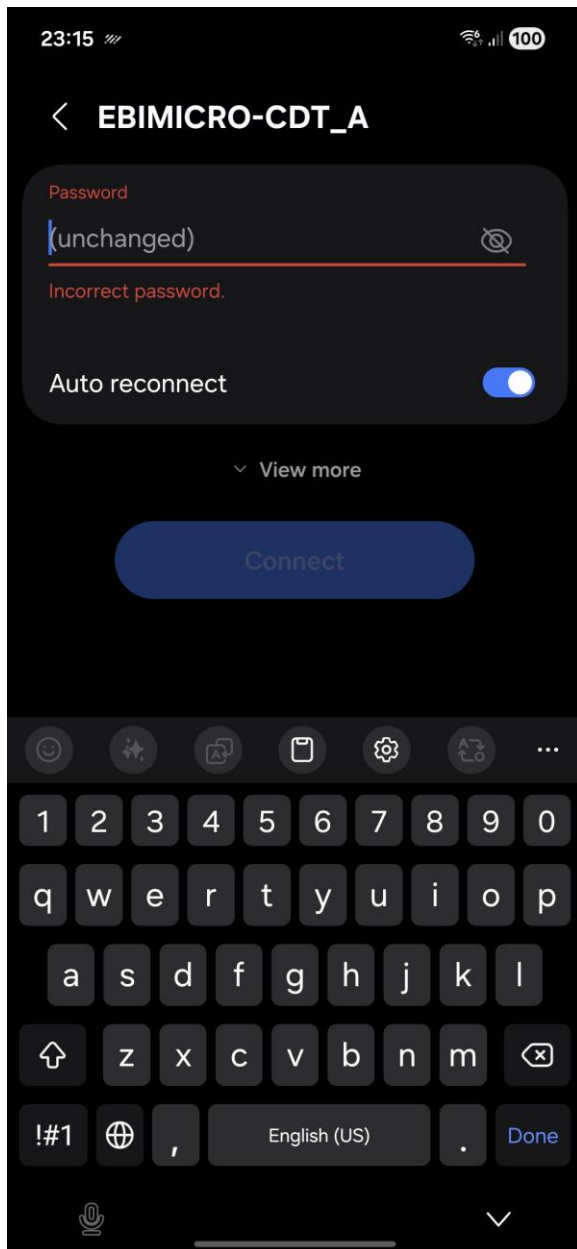
Each device is assigned a **unique password** that cannot be changed or recovered.

**Therefore, it is important to keep the label secure to prevent unauthorized access and avoid loss of access to the device.**

## *Connecting to the Device*

Once AP mode is active, follow these steps:

1. Open Wi-Fi settings on your smartphone or computer
2. Select the network: **EBIMICRO-CDT\_A**
3. Enter the password from the device label or QR code



**Note:**

It is normal to see a message such as “*Connected without internet*”. This is expected, as the CDT-A operates as a local access point during setup.

After connecting, ensure that your device is connected to the CDT-A network:

- The network **EBIMICRO-CDT\_A** should show as *connected*
- Other Wi-Fi networks should not be active

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**Important:**

Some devices may automatically switch to another Wi-Fi network with internet access. If this happens, reconnect manually to the CDT-A network before proceeding.

**Accessing the Web Interface**

Once connected to the CDT-A Wi-Fi network:

1. Open a web browser
2. Enter: <http://192.168.4.1>
3. The CDT-A setup page will appear

From this interface, you can configure:

- Wi-Fi credentials
- MQTT parameters
- ThingsBoard provisioning

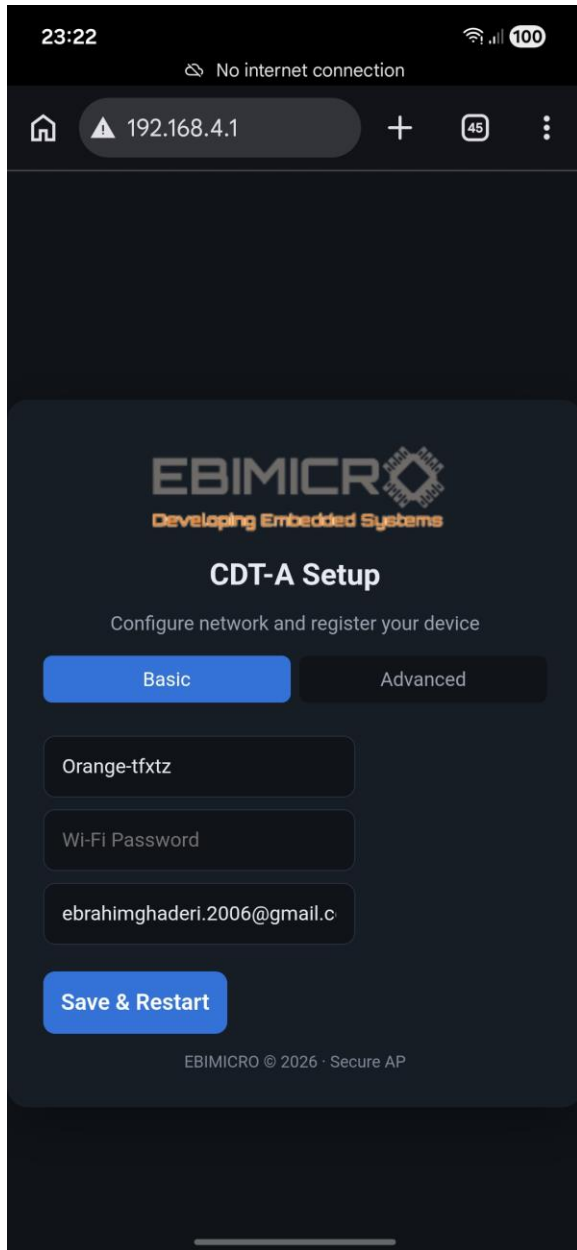
The configuration interface is divided into two tabs: **Basic** and **Advanced**, as shown below.

**Basic Configuration**

In the *Basic* tab:

- Enter your **Wi-Fi network name (SSID)**
- Enter your **Wi-Fi password**
- Enter your **email address** (for ThingsBoard provisioning)

Tap “**Save & Restart**” to apply the settings.



### Advanced Configuration (Optional)

In the *Advanced* tab, you can configure MQTT settings:

- **Broker address** (e.g., broker.emqx.io)
- **Port number** (default: 1883)

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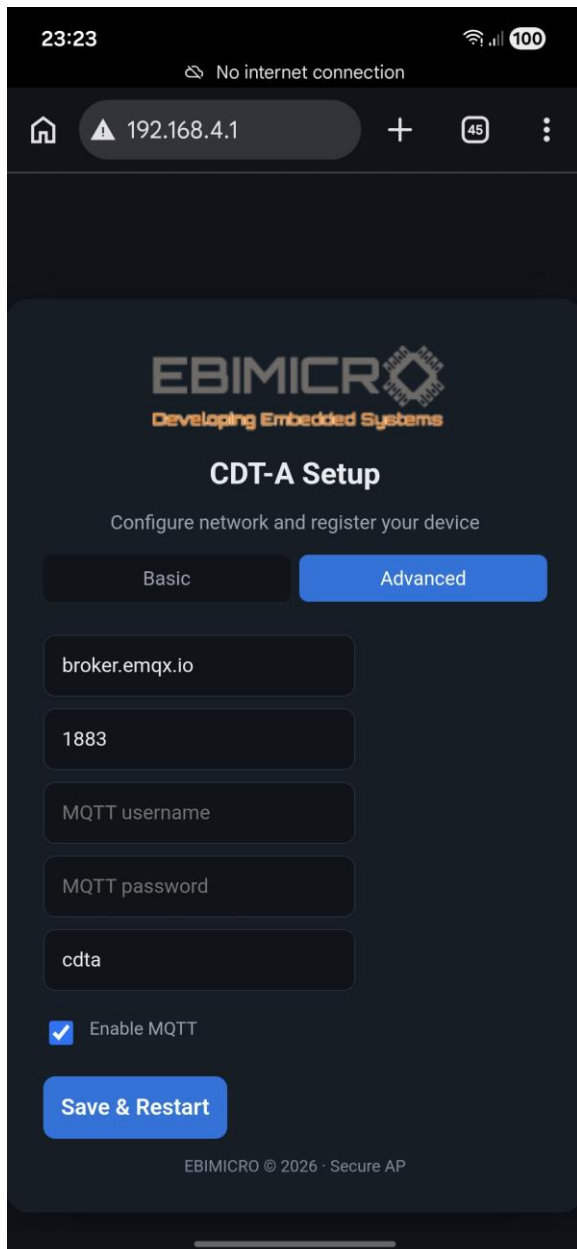
- **MQTT username and password**
- **Device topic / identifier**

Enable or disable MQTT using the checkbox.

Tap “**Save & Restart**” after making changes.

**Note:**

These settings are intended for advanced users or system integrators. Default settings are sufficient for most installations.



### ***Exiting AP Mode***

AP mode can be exited in the following ways:

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- **Automatic timeout:**  
The device exits AP mode after approximately 10 minutes if no configuration is completed.
- **After successful configuration:**  
When valid Wi-Fi credentials are saved, the device restarts and connects to the configured network (STA mode).
- **Manual restart:**  
Power cycling the device will also terminate AP mode.

After exiting AP mode, the CDT-A resumes normal operation, including measurement and communication.

**Note:**

During AP mode, data transmission is temporarily paused. Normal operation resumes automatically after exiting AP mode.

**Notes and Recommendations**

**Note:** AP mode is intended for configuration and maintenance. For normal operation, the device should be connected to a Wi-Fi network in STA mode or used via Modbus RTU.

**For security reasons, CDT-A will return to STA mode after a maximum of 10 minutes in any case.**

## Example MQTT Topics

Out-of-the-box CDT-A publishes the following topics:

### (Continues)Read Only Topics:

```
/cdta/CDT-A-XXXXXXXXXXXX/CO1  
/cdta/CDT-A-XXXXXXXXXXXX/Temp1  
/cdta/CDT-A-XXXXXXXXXXXX/Hum1  
/cdta/CDT-A-XXXXXXXXXXXX/Relay1  
/cdta/CDT-A-XXXXXXXXXXXX/Analog1  
/cdta/CDT-A-XXXXXXXXXXXX/fw_version  
/cdta/CDT-A-XXXXXXXXXXXX/wifi_rssi  
/cdta/CDT-A-XXXXXXXXXXXX/wifi_quality_text
```

### Writable Topics:

```
/cdta/CDT-A-XXXXXXXXXXXX/set/co2_setpoint  
/cdta/CDT-A-XXXXXXXXXXXX/set/co2_hysteresis  
/cdta/CDT-A-XXXXXXXXXXXX/set/co2_min  
/cdta/CDT-A-XXXXXXXXXXXX/set/co2_max  
/cdta/CDT-A-XXXXXXXXXXXX/set/4-20mA
```

- *Users may configure custom topics via the device's web service (AP mode).*
- *XXXXXXXXXXXX is the Wi-Fi MAC address.*

## Example ThingsBoard Dashboard

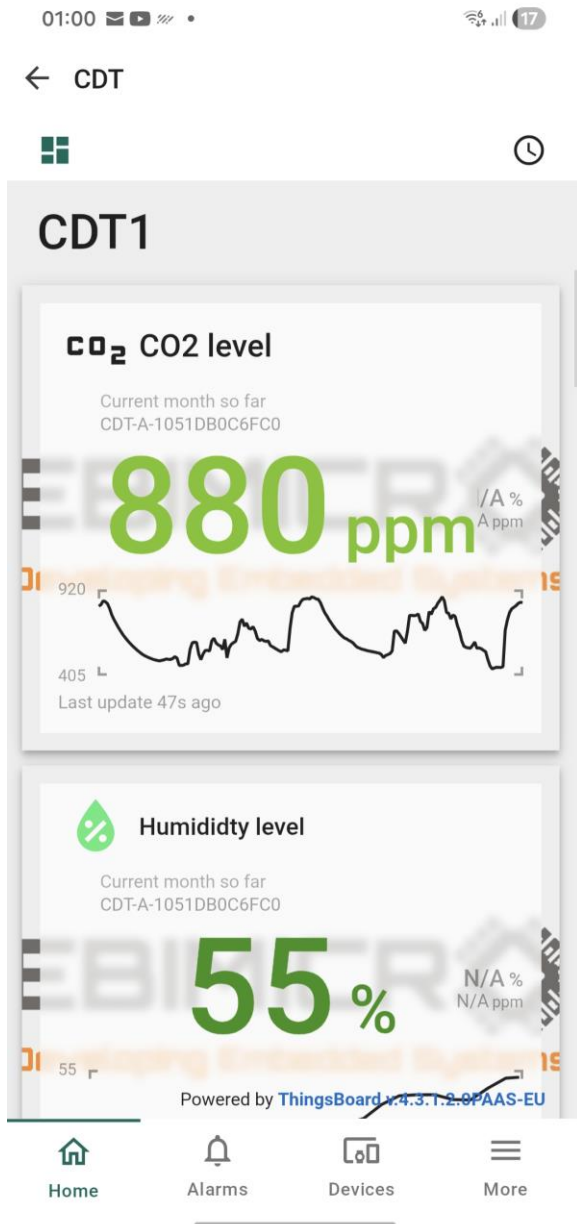
To get access to the ThingsBoard dashboard, it's required to set the email in Basic configuration tab in AP mode. The user will get a link to download the mobile version app and after will be asked to set its own password to access the dashboard.

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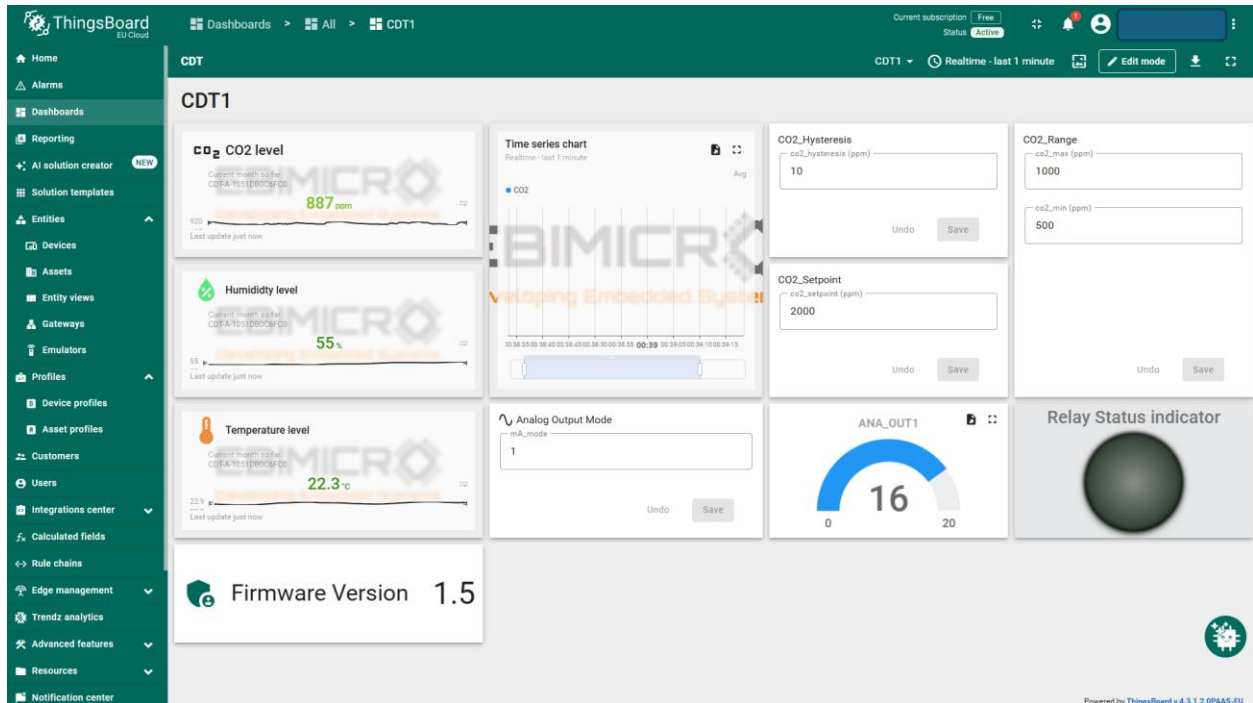
ThingsBoard mobile App view:



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ThingsBoard PC/ Tablet view:



## Modbus RTU (RS-485)

For industrial and building automation systems, the CDT-A provides a **Modbus RTU interface over RS-485**.

- Standard Modbus RTU slave
- Input registers for measured values
- Holding registers for configuration and control
- Multi-drop network support
- Suitable for PLCs, BMS, and SCADA systems

This interface enables reliable wired communication in environments where Wi-Fi is not available or not preferred.

**EBICON Software (Optional)**

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EBIMICRO provides a free software tool called **EBICON**, which allows users to monitor measured values and control device outputs such as relays and analog outputs. All holding registers can be configured through a user-friendly interface.

The software can be downloaded from the official EBIMICRO website:

<https://ebimicro.com/ebicon/>

EBICON is developed for Windows and automatically scans the Modbus RTU network to detect all connected EBIMICRO devices, simplifying commissioning and diagnostics.

To use EBICON, a **USB to Modbus RTU (RS-485) converter** is required. This can be purchased from EBIMICRO or sourced from any standard (preferably industrial-grade) supplier.

For detailed instructions on installation, wiring, and usage of the EBICON software, please refer to the documentation available on the download page.

**Note:**

Users may also use third-party Modbus software. In this case, refer to the register map and communication examples provided in the following section.

***Modbus RTU Register Map***

*Input Registers*

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Register address	Description	Data type	range	Default Value
30017	Temperature Level	Signed int	-200 to 1000	-
30018	Relative Humidity level	Unsigned int	0-1000	-
30019	CO2 level	Unsigned int	400 to 10000	-
30020	Analog Output (CO2)	Unsigned int	0-100	-
30021	Relay Output (CO2)	Unsigned int	0-1	-

#### *Holding Registers*

Register address	Description	Data type	range	Default Value
40001	Device Address	Unsigned int	1-247	1
40002	Modbus Baud Rate	Unsigned int	1-4	2
40003	Modbus Parity	Unsigned int	0-2	1
40004	Device Type	Unsigned int	-	20020 (CDT-A)
40005	Hardware Ver	Unsigned int	0-1000	-
40006	Firmware Ver	Unsigned int	-	-
40007	CO2 Hysteresis	Unsigned int	10-100	50 ppm
40011	Min Output Val	Unsigned int	0-100	0
40012	Max Output Val	Unsigned int	0-100	100
40013	Overwrite Mode	Unsigned int	0-1	0 (not overwriting)
40014	Overwrite Value	Unsigned int	0-100	0
40018	Start Output Value	Unsigned int	0-100	0
40025	CO2 Setpoint	Unsigned int	400 to 10000	1200 ppm

#### ***Modbus RTU Hardware Configuration***

The CDT-A provides hardware selectors on the internal PCB for configuring Modbus RTU communication parameters. These settings allow reliable integration with PLCs, BMS, and SCADA systems.

### ***Modbus RTU Baud Rate Selection***

The Modbus RTU baud rate is selected using the **rotary switch** on the PCB.

The rotary switch position corresponds to the baud rate as shown below:

<b>Switch Position</b>	<b>Baud Rate</b>
0	2400
1	4800
2	9600
3	14400
4	19200
5	28800
6	38400
7	57600
8	76800
9	115200

The selected baud rate must match the configuration of the Modbus master device.

**Note:** The factory default baud rate is **19200 bps**.

### ***Modbus RTU Parity Selection***

Modbus RTU parity is selected using the **parity jumper** on the PCB.

Available parity modes:

- **None**
- **Even**
- **Odd**

The jumper position determines the active parity mode. Ensure that the selected parity matches the Modbus master configuration.

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**Note:** Mismatched parity settings will prevent successful Modbus communication.

### ***Modbus RTU NBT (120 Ω) Termination Resistor***

The CDT-A includes an internal **120 Ω RS-485 termination resistor**, controlled by the **NBT pin header**.

#### **Purpose of termination:**

- Improves signal integrity
- Reduces reflections on long RS-485 cables

#### **Configuration guidelines:**

- **Enable NBT** if the CDT-A is installed at the **end of the RS-485 bus**
- **Disable NBT** if the CDT-A is located in the **middle of the bus**

Only the **two devices** at the physical ends of the RS-485 network should have termination enabled.

**Warning:** Incorrect termination may cause unstable or unreliable Modbus communication.

### ***Summary of Modbus Hardware Settings***

<b>Setting</b>	<b>Configuration Method</b>
Baud rate	Rotary switch
Parity	Jumper selection
RS-485 termination	NBT pin header

**Note:** All Modbus hardware settings are retained after power cycling.

## Modbus Input Register Reading Examples

This section provides practical Modbus RTU examples showing how to read **temperature, relative humidity, and CO<sub>2</sub> concentration** from the CDT-A using **Function Code 04 (Read Input Registers)**.

### 1. Read Measured Temperature (Input Register 30017)

#### Modbus Request (Master → CDT-A)

0x01 0x04 0x00 0x11 0x00 0x01 0x61 0xCF

Byte(s)	Description
0x01	Slave Address (CDT-A device ID)
0x04	Function Code – Read Input Registers
0x00 0x11	Starting Register Address (30017)
0x00 0x01	Number of Registers
0x61 0xCF	CRC16 (Low byte first)

#### Modbus Response (CDT-A → Master)

0x01 0x04 0x02 0x09 0x42 0x3F 0x51

Byte(s)	Description
0x01	Slave Address
0x04	Function Code
0x02	Byte Count
0x09 0x42	Temperature Data
0x3F 0x51	CRC16

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**Conversion:**

$$0x0942 = 2370$$

$$2370 \div 10 = 23.7 \text{ } ^\circ\text{C}$$

**2. Read Measured Relative Humidity (Input Register 30018)**

**Modbus Request**

0x01 0x04 0x00 0x12 0x00 0x01 0x91 0xCF

Byte(s)	Description
0x00	Starting Register Address (30018)
0x12	

**Modbus Response Example**

0x01 0x04 0x02 0x0C 0x1C 0xBD 0xF9

Byte(s)	Description
0x0C	Humidity Data
0x1C	
0xBD	CRC16
0xF9	

**Conversion:**

$$0x0C1C = 3100$$

$$700 \div 100 = 31.0 \text{ } \%RH$$

**Measured humidity = 31.0 %RH**

**3. Read Measured CO<sub>2</sub> Concentration (Input Register 30019)**

**Modbus Request**

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0x01 0x04 0x00 0x13 0x00 0x01 0xC0 0x0F

Byte(s)	Description
0x00 0x13	Starting Register Address (30019)

### Modbus Response Example

0x01 0x04 0x02 0x03 0x3B 0xF8 0x13

Byte(s)	Description
0x03 0x3B	CO <sub>2</sub> Data
0xF8 0x13	CRC16

### Conversion:

0x033B = 827 ppm

**Measured CO<sub>2</sub> concentration = 827 ppm**

### *CRC16 Byte Order (Important)*

The CDT-A uses **standard Modbus RTU CRC16**, where:

- **CRC is transmitted Low Byte first, then High Byte**
- Example:
  - Calculated CRC = 0xCF61
  - Transmitted as: 0x61 0xCF

### ⚠ Important:

Some Modbus tools, PLCs, or software libraries display CRC values in **MSB–LSB order**. If communication fails, ensure your Modbus master **swaps the CRC bytes correctly**.

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## General Notes

- Input registers are **read-only**
- Function Code **04** must be used
- Temperature is scaled by **0.1** and humidity values is scaled by **0.01**
- CO<sub>2</sub> values are provided directly in **ppm**
- Register addressing may differ depending on the Modbus master (zero-based vs 300xx notation)

## LED INDICATION AND ANALOG OUTPUT

The CDT-A provides visual indication of CO<sub>2</sub> levels and relay status using front LEDs and generates a configurable analog output proportional to the measured CO<sub>2</sub> concentration.

### 1. CO<sub>2</sub> LEVEL LED INDICATION

The CDT-A uses three front LEDs to indicate the measured CO<sub>2</sub> concentration range. Thresholds are configurable via:

- Modbus registers
- MQTT
- ThingsBoard

#### *LED Functions*

##### **Blue LED (1st LED from the left)**

Indicates the LOW CO<sub>2</sub> concentration range.

##### **Green LED (2nd LED from the left)**

Indicates the MEDIUM CO<sub>2</sub> concentration range.

##### **Red LED (3rd LED from the left)**

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Indicates the HIGH CO<sub>2</sub> concentration range.

The configurable CO<sub>2</sub> range between the minimum and maximum values is automatically divided into three equal regions.

### Example Configuration

Parameter	Value
Minimum CO <sub>2</sub> Level	500 ppm
Maximum CO <sub>2</sub> Level	1200 ppm

The configured range is divided into three equal sections:

CO <sub>2</sub> Level	Active LED
≤ 733 ppm	Blue
734 – 966 ppm	Green
> 966 ppm	Red

### Front LED Layout

LED Position	Function
LED 1 (Blue)	Low CO <sub>2</sub> indication
LED 2 (Green)	Medium CO <sub>2</sub> indication
LED 3 (Red)	High CO <sub>2</sub> indication
LED 4 (Red)	Relay status indication

### LED Indication Notes

- LED thresholds can be configured via Modbus registers, MQTT, or ThingsBoard.
- Only one CO<sub>2</sub> status LED is active at a time.
- The relay status LED operates independently from the CO<sub>2</sub> level LEDs.

## 2. RELAY STATUS LED INDICATION

The fourth LED (rightmost Red LED) indicates the relay output status.

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Relay activation is controlled by:

- CO<sub>2</sub> setpoint
- Hysteresis value

Both parameters can be configured via:

- Modbus registers
- MQTT
- ThingsBoard

### *Relay LED Behavior*

Relay LED State	Description
ON	Relay active (closed)
OFF	Relay inactive (open)

### *Relay Hysteresis Example*

Parameter	Value
Relay Setpoint	1000 ppm
Hysteresis	100 ppm

### *Relay Operation*

CO <sub>2</sub> Level	Relay State
≥ 1100 ppm	Relay ON
≤ 900 ppm	Relay OFF
901 – 1099 ppm	Previous state maintained

The hysteresis function prevents rapid relay switching near the configured setpoint.

## 3. ANALOG OUTPUT

The CDT-A provides a configurable analog output proportional to the measured CO<sub>2</sub> concentration.

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The analog output scaling is based on the configured:

- Minimum CO<sub>2</sub> value
- Maximum CO<sub>2</sub> value

These parameters can be configured via:

- Modbus registers
- MQTT
- ThingsBoard

### ***Supported Output Modes***

The analog output supports:

- 0–10 V
- 0–20 mA
- 4–20 mA

### ***Output Configuration***

#### **Hardware Selection**

Voltage or current mode is selected using the hardware jumper located on the PCB.

#### **Software Selection**

The current output mode (0–20 mA or 4–20 mA) is configured via:

- Modbus registers
- MQTT
- ThingsBoard

### ***Analog Output Scaling***

The analog output increases linearly between the configured minimum and maximum CO<sub>2</sub> levels.

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### Example Configuration

Parameter	Value
Minimum CO <sub>2</sub> Level	500 ppm
Maximum CO <sub>2</sub> Level	1200 ppm

### Output Percentage Scaling

CO <sub>2</sub> Level	Output Percentage
≤ 500 ppm	0%
850 ppm	50%
≥ 1200 ppm	100%

### Voltage Output Example (0–10 V)

CO <sub>2</sub> Level	Output Voltage
500 ppm	0.0 V
850 ppm	5.0 V
1200 ppm	10.0 V

### Current Output Example (0–20 mA)

CO <sub>2</sub> Level	Output Current
500 ppm	0.0 mA
850 ppm	10.0 mA
1200 ppm	20.0 mA

### Current Output Example (4–20 mA)

CO <sub>2</sub> Level	Output Current
500 ppm	4.0 mA
850 ppm	12.0 mA
1200 ppm	20.0 mA

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## Analog Output Notes

- The output scaling is linear between the configured minimum and maximum values.
- Values below the minimum threshold generate the minimum output value.
- Values above the maximum threshold generate the maximum output value.
- Analog output configuration can be modified using Modbus registers, MQTT, or ThingsBoard.

# LED INDICATION AND ANALOG OUTPUT

The CDT-A provides visual indication of CO<sub>2</sub> levels and relay status using front LEDs and generates a configurable analog output proportional to the measured CO<sub>2</sub> concentration.



## 1. CO<sub>2</sub> LEVEL LED INDICATION

The CDT-A uses three front LEDs to indicate the measured CO<sub>2</sub> concentration range. Thresholds are configurable via Modbus registers, MQTT or ThingsBoard.

- ① **Blue LED (Low)**  
Indicates the LOW CO<sub>2</sub> concentration range.
- ② **Green LED (Mid)**  
Indicates the MEDIUM CO<sub>2</sub> concentration range.
- ③ **Red LED (High)**  
Indicates the HIGH CO<sub>2</sub> concentration range.

The configurable CO<sub>2</sub> range between the minimum and maximum values is automatically divided into three equal regions.



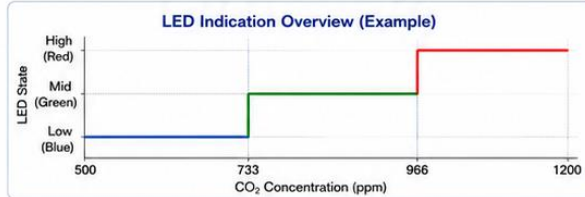
### Example Configuration

Minimum CO <sub>2</sub> Level (Low)	500 ppm
Maximum CO <sub>2</sub> Level (High)	1200 ppm



### LED Indication Summary

CO <sub>2</sub> Level (ppm)	Active LED	Description
≤ 733 ppm	Blue (Low)	CO <sub>2</sub> level is in the low range.
734 – 966 ppm	Green (Mid)	CO <sub>2</sub> level is in the mid range.
> 966 ppm	Red (High)	CO <sub>2</sub> level is in the high range.



## 2. RELAY STATUS LED INDICATION

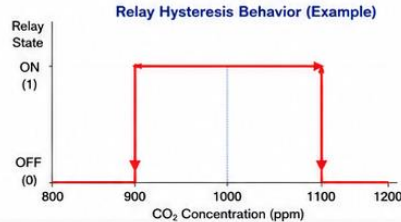
The fourth (rightmost) red LED indicates the relay output status. Relay activation is controlled by the CO<sub>2</sub> setpoint and hysteresis value, configurable via Modbus registers, MQTT or ThingsBoard.

### Relay LED (Red)

ON = Relay Active (Closed)  
OFF = Relay Inactive (Open)

### Example

Setpoint = 1000 ppm  
Hysteresis = 100 ppm



Relay turns ON when CO<sub>2</sub> ≥ 1100 ppm (Setpoint + Hysteresis)

Relay turns OFF when CO<sub>2</sub> ≤ 900 ppm (Setpoint - Hysteresis)

Between 900–1100 ppm, the relay maintains its previous state.

## 3. ANALOG OUTPUT

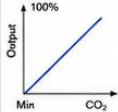
The analog output is proportional to CO<sub>2</sub> concentration between the configured minimum and maximum values. Output type (0–10 V, 0–20 mA or 4–20 mA) is selected via software. Voltage or current mode is selected using the hardware jumper on the PCB.



### Output Mode Selection

- Use the jumper on the PCB to select Voltage (V) or Current (I) output.
- Current range (0–20 mA or 4–20 mA) is configured via software.

### Output Behavior



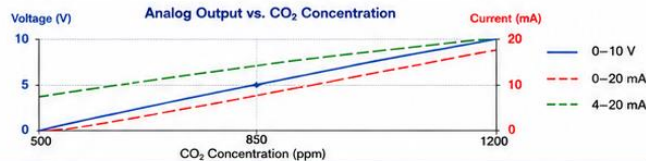
- ≤ Min value → 0% output (0 V / 0 or 4 mA)
- ≥ Max value → 100% output (10 V / 20 mA)
- Between Min and Max → Linear scaling

### Scaling Principle

Min (Low) = 500 ppm → 0% output  
Max (High) = 1200 ppm → 100% output  
Output increases linearly between Min and Max.

### Analog Output Examples (Min = 500 ppm, Max = 1200 ppm)

CO <sub>2</sub> Level (ppm)	Output Percentage	0–10 V Output	0–20 mA Output	4–20 mA Output
≤ 500	0%	0.0 V	0.0 mA	4.0 mA
850 (Mid)	50%	5.0 V	10.0 mA	12.0 mA
≥ 1200	100%	10.0 V	20.0 mA	20.0 mA



All thresholds (Low/High), setpoint, hysteresis and analog output parameters can be configured via Modbus registers, MQTT or ThingsBoard.

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## Updatability and Security

The CDT-A supports automatic firmware updates via **OTA (Over-the-Air)**, requiring no user interaction.

When the device is connected to a Wi-Fi network with internet access, it will automatically check for and install firmware updates.

The currently running firmware version can be accessed via:

- Modbus registers
- MQTT / ThingsBoard dashboard

### OTA Update Behavior

Firmware updates are designed to occur without interrupting normal device operation. Measurement and control functions continue during the update process.

Once the new firmware is fully downloaded, the device seamlessly switches to the updated version with minimal interruption.

### Security Features

The CDT-A is designed with security in mind and includes:

- **Secure boot**
- **Wi-Fi 6 connectivity**
- **Automatic OTA updates**
- **Unique, device-specific AP mode credentials**

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These features ensure a high level of reliability and help align the device with **Cyber Resilience Act (CRA)** requirements.

## Ordering Information

Model	Communication	Outputs
CDT-A-MB	Modbus RTU	Relay + Analog
CDT-A-WF	Wi-Fi	Relay + Analog
CDT-A-MBWF	Modbus RTU + Wi-Fi	Relay + Analog

**Included in Package:** Device unit, user manual

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