

FCCA8-DM | FREE COOLING CONTROLLER

Mounting and operating instructions



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1. SAFETY AND PRECAUTIONS



Read all the information in this manual, in the datasheet and in the Modbus Register Map before working with the product. For personal and equipment safety and for optimum product performance, make sure you fully understand the content before installing, using or servicing this product.



For safety and licensing (CE) reasons, unauthorised conversions and / or modifications of the product are inadmissible.



The product should not be exposed to abnormal conditions, such as extreme temperatures, direct sunlight or vibrations. Long-term exposure to chemical vapours in high concentrations can affect the product performance. Make sure the work environment is as dry as possible and avoid condensation.



All installations must comply with local health and safety regulations and local electrical standards and approved codes. This product should only be installed by an engineer or a technician with expert knowledge of the product and safety precautions.



Avoid contact with energised electrical parts. Always disconnect the power supply before connecting, servicing or repairing the product.



Always check that you are connecting the correct power supply to the product and use wires with the correct characteristics and cross-section. Make sure all screws and nuts are properly tightened and fuses (if any) are in place.



Consideration should be given to recycling the equipment and packaging. These should be disposed of in accordance with local and national laws and regulations.



If there are questions that are not answered, contact your technical support or consult a professional.

2. PRODUCT DESCRIPTION

FCCA8-DM is a fan speed controller intended for free cooling applications. In free cooling, colder outside air is used to cool indoor spaces without the use of air conditioning systems. The free cooling controller features two PT500 temperature probe inputs for indoor and outdoor temperature monitoring. Fan speed is regulated via a single analogue output. The controller also has a relay output, which can be connected to a damper or other auxiliary equipment.

The free cooling controller supports two fan speed control modes that can be selected via Holding Register 84 through Modbus communication:

- **Variable fan speed control** — Select this control mode by setting HR84 to 0 % (default setting).
- **Fixed fan speed control** — Select this control mode by setting HR84 to a value greater than 0 %.

Both Variable and Fixed fan speed control modes support the **Boost function** activated by pressing the button on the device front panel. During Boost operation, the fan runs at a predefined speed set in Holding Register 14. The fan operates at this speed until the Boost timeout (HR85) expires or the button is pressed again.

To control fan speed manually, the free cooling controller provides an **Override control** function, which can be selected via Holding Register 15. When Override control is activated, all automatic control functions are suspended.

3. ARTICLE CODES

Article code	Analogue output	Relay output
FCCA8-DM	1	1

4. INTENDED AREA OF USE

- Suitable for ventilation systems where cool outdoor air can be used to reduce the need for mechanical cooling

5. TECHNICAL DATA

- Supply voltage: 85—264 VAC, 50—60 Hz
- Power supply for an external device: 24 VDC, 500 mA
- Modbus RTU communication
- Two temperature probe inputs for connecting PT500 temperature sensors:
 - Measurement range: -55—155 °C
 - Temperature reporting resolution: 0,1 °C
 - Calibration points: 5—35 °C
- Analogue output types
 - 0—10 VDC (load resistance $\geq 1\text{ k}\Omega$)
 - 2—10 VDC (load resistance $\geq 1\text{ k}\Omega$)
 - 0—5 VDC (load resistance $\geq 1\text{ k}\Omega$)
 - 0—20 mA (load resistance $\leq 500\ \Omega$)
 - 4—20 mA (load resistance $\leq 500\ \Omega$)

- PWM Push-Pull (frequency = 1 kHz, load resistance $\geq 1\text{ k}\Omega$, output voltage level = 12 VDC)
- PWM Open Collector (frequency = 1 kHz, pull-up resistance $\geq 1\text{ k}\Omega$, pull-up voltage level $\leq 12\text{ VDC}$)
- Relay output
 - Maximum switching voltage: 220 VDC / 250 VAC
 - Rated current: 2 A (resistive load)
- Storage conditions
 - Temperature: 0—20 °C
 - Relative humidity: 15—80 % rH
- Operating conditions
 - Temperature: -10—60 °C
 - Relative humidity: 15—90 % rH, non-condensing
- Enclosure
 - Ingress protection: IP54
 - Material: Acrylonitrile Butadiene Styrene (ABS) plastic
 - Colour: Grey (RAL 7035)

6. STANDARDS

- Low Voltage Directive 2014/35/EU
- Electromagnetic Compatibility (EMC) Directive 2014/30/EU
- Commission Delegated Directive (EU) 2015/863 (RoHS 3) of 31 March 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances
- WEEE Directive 2012/19/EU



7. WARNINGS AND ATTENTION POINTS

- Turn off the power supply before servicing and maintenance.
- Avoid mounting the device in locations affected by direct sunlight.
- Do not short-circuit the terminals or the input and output wiring.
- During operation, the unit must be closed.
- If the unit does not work according to the instructions, the wiring connections, supply voltage and settings need to be checked.

8. MOUNTING INSTRUCTIONS IN STEPS

Before you start mounting the unit, read carefully “**Safety and Precautions**”.

Follow these steps:

1. Unscrew and remove the cover of the device enclosure.
2. Fix the enclosure onto the surface by means of suitable fasteners (included) while adhering to the mounting dimensions — **Fig. 1** and the correct mounting position — **Fig. 2**.
3. Switch OFF the power supply before connecting any power cables.
4. Insert the cables through the cable glands and do the wiring according to the wiring diagram — see **Fig. 3**.
5. Close the cover of the device enclosure and fasten it with the screws.
6. Switch ON the power supply.
7. Check the state of the device.

Fig. 1 Mounting dimensions

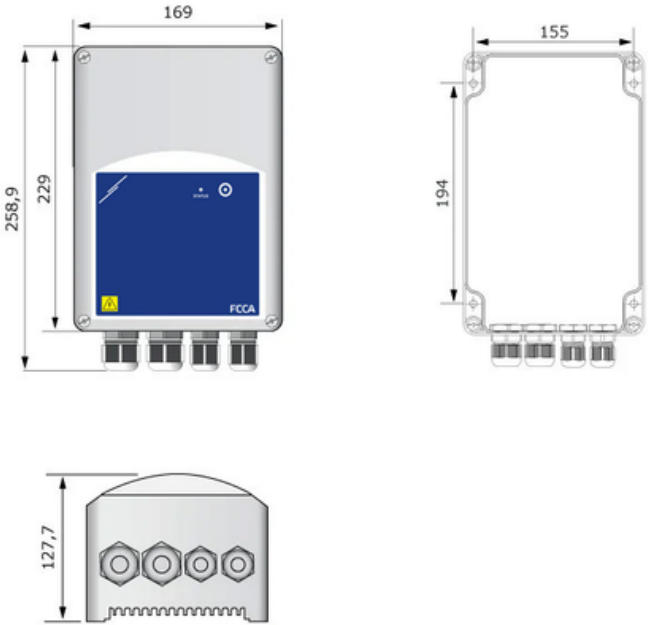
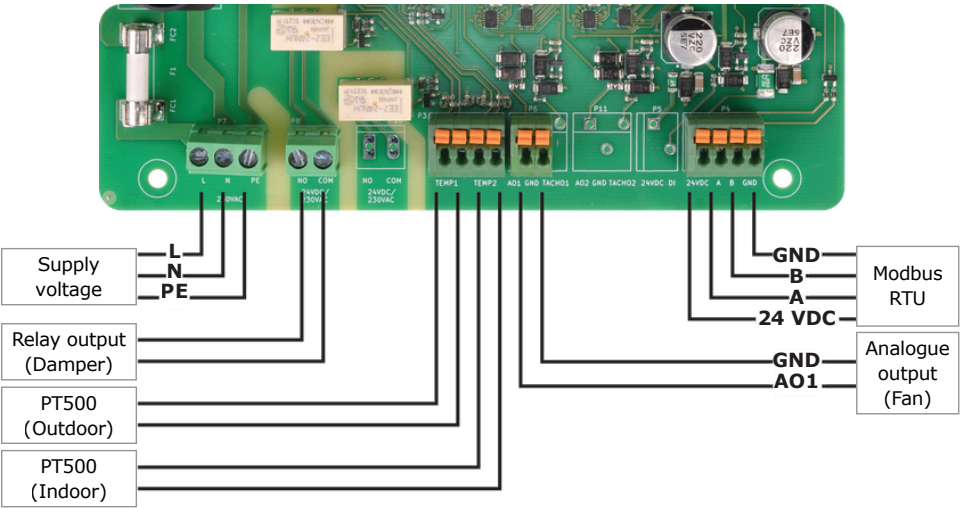


Fig. 2 Mounting position



9. WIRING AND CONNECTIONS

Fig. 3 Wiring diagram



Screw terminal blocks

Supply voltage

L, N, PE	85–264 VAC, 50 / 60 Hz
	<i>Connect the supply voltage to L, N and PE.</i>

Relay output

NO, COM	250 VAC / 24 VDC
	<i>If applicable, connect a damper to the relay output. The damper protects the fan inlet when the fan is not operating.</i>

Cable characteristics	cross section $\geq 1,5 \text{ mm}^2$
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Spring clamp terminal blocks

Temperature probe inputs

TEMP1	Outdoor temperature sensor PT500
TEMP2	Indoor temperature sensor PT500
Cable characteristics	cross section $\leq 1,5 \text{ mm}^2$
	<i>To minimise EMC disturbances, avoid creating loops in the PT500 sensor cables and keep the cable length as short as possible.</i>

Analogue output

AO1, GND	12 VDC
	<i>Connect the fan(s) to the analogue output AO1 and GND.</i>
Cable characteristics	cross section $\geq 0,5 \text{ mm}^2$

Power supply output

24 VDC, GND	Power supply for an external device
Cable characteristics	Cat5 / EIB cable

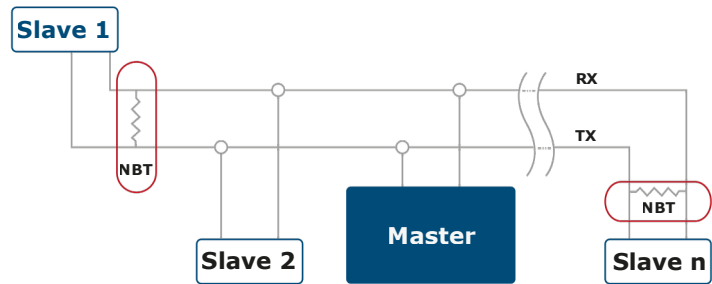
Modbus RTU

A, /B	Modbus RTU (RS485)
Cable characteristics	Cat5 / EIB cable

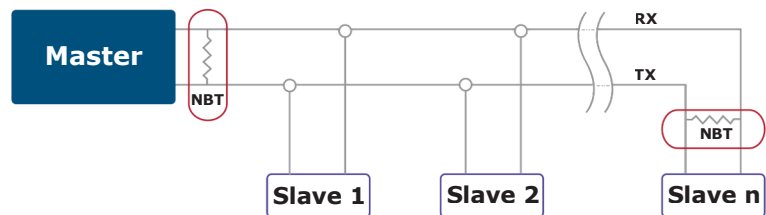
Optional settings

The Network Bus Termination (NBT) Resistor is controlled via Modbus RTU and is disconnected by default. For correct communication, the NBT needs to be activated only in the two end devices on the Modbus RTU network. If necessary, enable the NBT resistor through SenteraWeb via Holding Register 9.

Example 1



Example 2



NOTE

On a Modbus RTU network, two bus terminators (NBTs) need to be activated.

10. OPERATING INSTRUCTIONS

The free cooling controller can regulate fan speed in two different control modes selected via Holding Register 84:

- **Variable fan speed control** — Selected by setting HR84 to 0 %.
- **Fixed fan speed control** — Selected by setting HR84 to a value greater than 0 %.

A **Boost function** is available in both variable and fixed fan speed controls and can be activated by pressing of the button on the device front cover.

Fan speed can also be regulated manually by enabling the Override control function via Holding Register 15. When enabled, the Override control function overrides all operating modes and alarm states. If a damper is connected to the free cooling controller, it should be taken into account that **Override control** does not manage the opening and closing of the damper. In this case, appropriate precautions must be taken before enabling Override control.

In both variable and fixed fan speed controls, the fan starts running only when the following conditions are met:

- The indoor temperature is more than 1 °C (not configurable) above the setpoint (HR61).
- The indoor temperature is higher than outdoor temperature by more than the configured difference (HR62).
- The outdoor temperature is greater than 5 °C (not configurable).

The fan stops running when either of the following conditions is met:

- The indoor temperature falls more than 1 °C below the setpoint (HR61).
- The difference between indoor and outdoor temperature falls below 1 °C.
- The outdoor temperature falls below 4 °C.

Note: Fan speed can be fixed or variable. By default, the fans run at variable speed, depending on the temperature difference. To run the fans at fixed speed when free cooling conditions are met, enter a value in HR84.

Boost Function

The Boost function is available in both Variable and Fixed speed control modes. When the Boost function is activated by pressing of the button on the device front cover, the free cooling conditions are bypassed and the controller executes the following actions:

1. Open the damper.
2. Wait for the configured Damper opening time (HR83) to elapse.
3. Start the fan at the configured Boost fan speed (HR14).

The fan operates at the configured boost speed until the Boost timeout (HR85) expires or the button on the device front cover is pressed again.

After the boost period ends, the controller returns to the previously selected fan control mode (Variable fan speed control or Fixed fan speed control) and resumes normal operation according to the free cooling conditions.

The standard shutdown sequence, including the Fan coast-down time and the damper closing sequence, is maintained during Boost operation.

Override Control

Override Control allows fan speed to be regulated manually by setting the analogue output to a predefined value, overriding the automatic control logic.

- Override control is activated when the user selects Override as the analogue output source in Holding Register 15.
- In this state, the fan operates at an Override speed selected in Holding Register 14.
- All automatic control functions are suspended while Override control is active.
- Override control bypasses alarm-related output shutdowns. During Override control, the analogue output remains active and the fan continues to operate at the configured speed even if an alarm condition is present.
- To exit Override control, the user must change the analogue output source from Override to any other available control source.

Override control is intended for manual operation when direct fan speed control is required.

Alarm States

The free cooling controller continuously monitors the connected sensors and the overall system status. If an abnormal condition is detected, the controller switches to predefined alarm states to maintain safe and reliable operation.

When a fault condition is detected, the controller first enters a **pre-alarm state**.

The purpose of this state is to place the free cooling system in a safe condition before activating the alarm. If the damper is open, the controller performs the shutdown sequence to ensure that the fan is completely stopped before the damper is closed. The shutdown sequence is as follows:

1. Stop the fan.
2. Wait for the configured Fan coast-down time (HR81) to allow the fan to come to a complete stop.
3. Close the damper.

If the fan is already stopped and the damper is closed, the controller immediately transitions to an **alarm state**. During an active alarm state, the analogue output is forced to 0 % and the relay output is deactivated, except when Override control is active. The Override control overrules all alarm states, preventing them from interfering with the activity of the analogue output.

After the alarm condition is cleared, the controller enters a **post-alarm state**. During this state, a timeout of 20 seconds is applied before the controller returns to normal operation. This delay ensures that the fault has been fully resolved and prevents rapid switching between alarm and normal operating states.

If the system enters an alarm state more than 10 times after recovery (primarily due to recurring hardware faults), the controller automatically switches to a **locked alarm state**. The locked alarm state protects the system against recurrent fault conditions. In this state, normal operation is inhibited and outputs remain disabled. Recovery from the locked alarm state is only possible by power cycling the device.

Variable Fan Speed Control

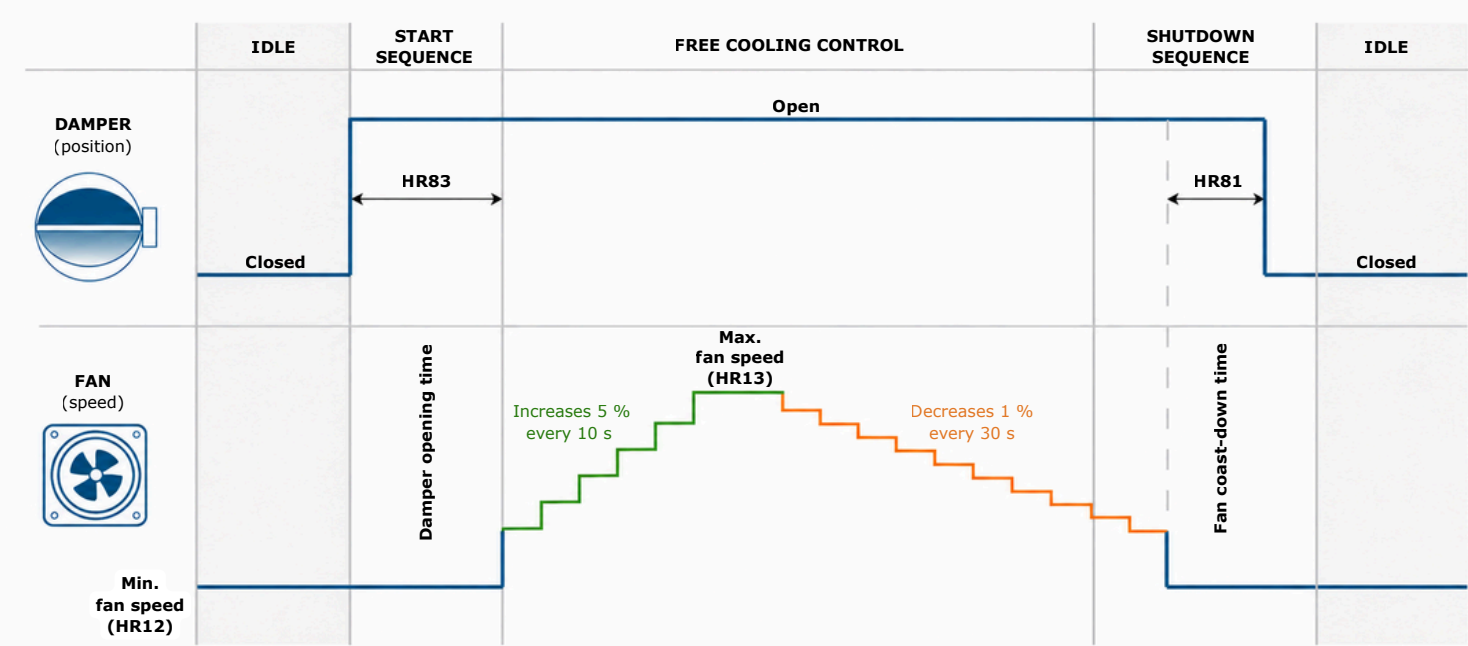
State	Description	Damper	Fan
Standby	Idle state. Waiting for all free cooling start conditions to be met.	Closed	OFF
Damper start up	The damper is being opened and the controller is waiting for the configured Damper open time (HR83) to elapse.	Opening / open	OFF
Always ON	The damper is fully open and the fan starts at the configured Minimum fan speed (HR12). This state is maintained until ramp-up conditions are evaluated.	Open	Minimum speed
Ramp up	Fan speed is increased by 5 % every 10 seconds, up to the configured Maximum fan speed (HR13), as long as the indoor temperature stays above the setpoint.	Open	Increasing
Ramp down	Fan speed is reduced by 1 % every 30 seconds, down to the configured Minimum fan speed (HR12), once the indoor temperature falls to or below the setpoint.	Open	Decreasing
Shutting down	Once shutdown conditions are detected, fan speed steps down quickly — 5 % every second — until it reaches the Minimum fan speed (HR12). It then remains at that minimum speed until the configured Minimum fan runtime (HR82) elapses.	Open	Minimum speed
Fan coast down	The fan is stopped and the controller waits for the configured Fan coast-down time (HR81) before closing the damper.	Open	OFF
Boost	Optional operating state for boost ventilation.	Open	Boost speed

Fixed Fan Speed Control

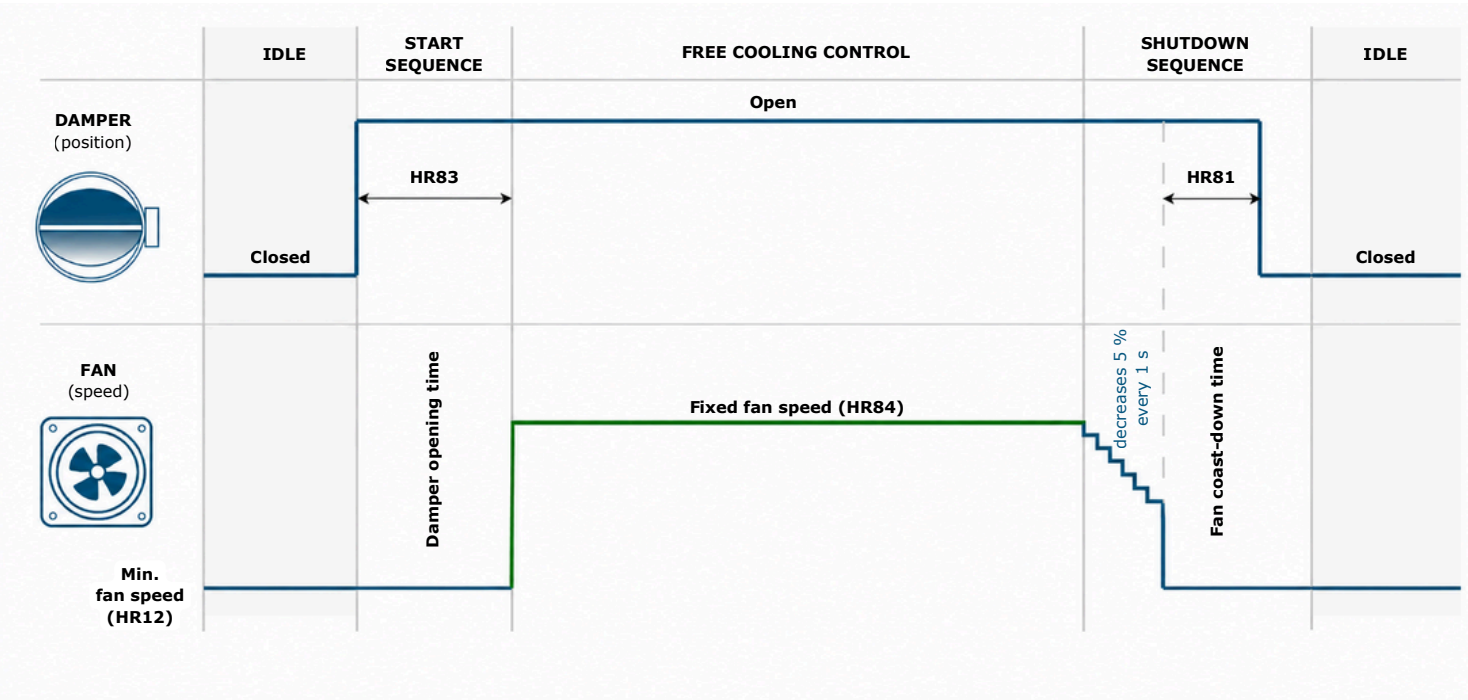
State	Description	Damper	Fan
Standby	Idle state. Waiting for all free cooling start conditions to be met.	Closed	OFF
Damper start up	The damper is being opened and the controller is waiting for the configured Damper open time (HR83) to elapse.	Opening / open	OFF
Always ON	Applicable only when the Analogue output always ON function (HR16) is enabled. The fan operates at the configured Minimum fan speed (HR12) until the controller transitions to Run state.	Open	Minimum speed
Run state	Normal free cooling operation. The fan operates at the configured Application fixed fan speed (HR84) while the start conditions remain fulfilled.	Open	Fixed speed
Shutting down	Once shutdown conditions are detected, fan speed steps down quickly — 5 % every second — until it reaches the Minimum fan speed (HR12). It then remains at that minimum speed until the configured Minimum fan runtime (HR82) elapses.	Open	Minimum speed
Fan coast down	The fan is stopped and the controller waits for the configured Fan coast-down time (HR81) before closing the damper.	Open	OFF
Boost	Optional operating state for boost ventilation.	Open	Boost speed

11. OPERATIONAL DIAGRAMS

Variable Fan Speed Control



Fixed Fan Speed Control



12. VERIFICATION OF INSTALLATION

If your unit does not function as expected, please check the connections or refer to the **"Troubleshooting"** section.

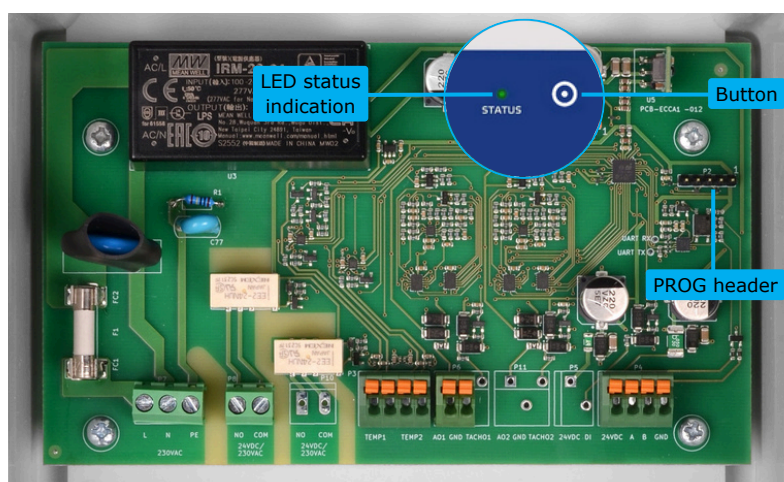
13. TROUBLESHOOTING



NOTE

The troubleshooting steps are described in an easy-to-follow order, beginning with the simplest solutions to the more detailed ones. This approach is created to help users resolve any issues they may encounter when working with our product. Please refer to **Fig. 4** when using the troubleshooting steps.

Fig. 4 Settings and indications



PROG header, P2		Put a jumper onto pins 1 and 2 and wait for at least 5 seconds to reset the Modbus communication parameters.
Button - Boost function		A button to activate Boost function.
LED status indication		
Red ON		Critical hardware fault detected (see Input Register 44). Sensor error or another hardware defect.
Red blinking		Locked alarm detected (see Input Register 41). Alarm recurred over 10 times after recovery. All outputs are disabled.
Yellow ON		Hardware warning (see Input Register 45). The internal supply voltage is out of range.
Green ON		The system is operating normally.
Blue blinking		A firmware is being uploaded.
White ON		The button on the device front cover is pressed. The Boost function is active.
The RGB LED brightness is regulated by setting the value of Holding Register 91. The LED can be turned OFF (no indication) by setting the value to "0".		

No visible sign of functioning

- **How to recognise this issue?**
 - The RGB LED is not lit.
- **How to solve this issue?**
Verify that:
 - The power supply is enabled.
 - The cable is properly connected to the device.
 - The cable is properly connected to the power supply.
 - The cable pinout is correct.

No Modbus communication

- **How to recognise this issue?**
 - The device is not detected on the Modbus network by the Modbus master.
- **How to solve this issue?**
Verify that:
 - The Modbus communication settings (baudrate, parity) match the network configuration.
 - The slave ID of FCCA8-DM matches the ID expected by the Modbus master.
 - The slave ID of FCCA8-DM does not match the ID of any other device connected to the same Modbus network.
 - FCCA8-DM responds to the broadcast read command (slave ID = 0; read the first 4 Holding Registers).
 - The RS-485 communication line is wired correctly on both sides (A to A, B to B).
 - The cable length does not exceed 1000 meters.
 - The device is connected to an isolated Modbus network without other slave devices. Then check the communication.

Problems with the temperature probes

- **How to recognise this issue?**
 - The RGB LED is blinking red.
 - Input Register 31 (Outdoor temperature sensor state) contains the value "Short circuit failure" or "Not connected".
 - Input Register 33 (Indoor temperature sensor state) contains the value "Short circuit failure" or "Not connected".
- **How to solve this issue?**
 - Disconnect the device from the power supply for at least 15 seconds. Then connect it again.
 - Carefully disconnect the temperature probe that is giving the error. Then reconnect it.
 - Try connecting another temperature probe of the same type.

Other problems

- **How to recognise this issue?**
 - Input Register 1 (Device status – errors) contains the value "Supply voltage fault".
 - Input Register 2 (Device status – warnings) contains the value "Supply voltage warning".
- **How to solve this issue?**
 - Disconnect the device from the power supply for at least 15 seconds. Then connect it again.

14. FREQUENTLY ASKED QUESTIONS (FAQs)

When is the relay output activated?

The relay output is activated to open the damper when the free cooling start conditions are met. The controller waits for the configured damper opening time (HR83) to elapse before starting the fan. During shutdown, the fan is stopped first, and the controller waits for the configured fan coast-down time (HR81) before closing the damper. During Boost operation, the damper is also opened regardless of the normal free cooling conditions. The relay output is deactivated during an active alarm, except when Override control is enabled.

What type of fans can be regulated with FCCA8-DM?

FCCA8-DM is a free cooling controller that features a single analogue output. The device can control EC fans via the analogue signal directly or it can be connected to a [Sentera variable fan speed controller](#) with an analogue input to regulate AC fans indirectly. The analogue output of **FCCA8-DM** provides different types of analogue signal that can be selected via Modbus communication.

Can FCCA8-DM withstand dust and water ingress?

FCCA8-DM is intended for indoor applications in buildings where free cooling can be used. The controller enclosure has an IP54 rating, which protects the internal components against dust ingress and water splashes from any direction.

15. TRANSPORT AND STORAGE

Avoid shocks and extreme conditions; stock in original packaging.

16. WARRANTY AND RESTRICTIONS

Two years from the delivery date against defects in manufacturing. Any modifications or alterations to the product after the production date relieve the manufacturer of any responsibilities. The manufacturer bears no responsibility for any misprints or mistakes in this data.

17. MAINTENANCE

In normal conditions, this product is maintenance-free. If soiled, clean with a dry or damp cloth. In case of heavy pollution, clean with a non-aggressive product. In these circumstances, the unit should be disconnected from the supply. Pay attention that no fluids enter the unit. Only reconnect it to the supply when it is completely dry.

