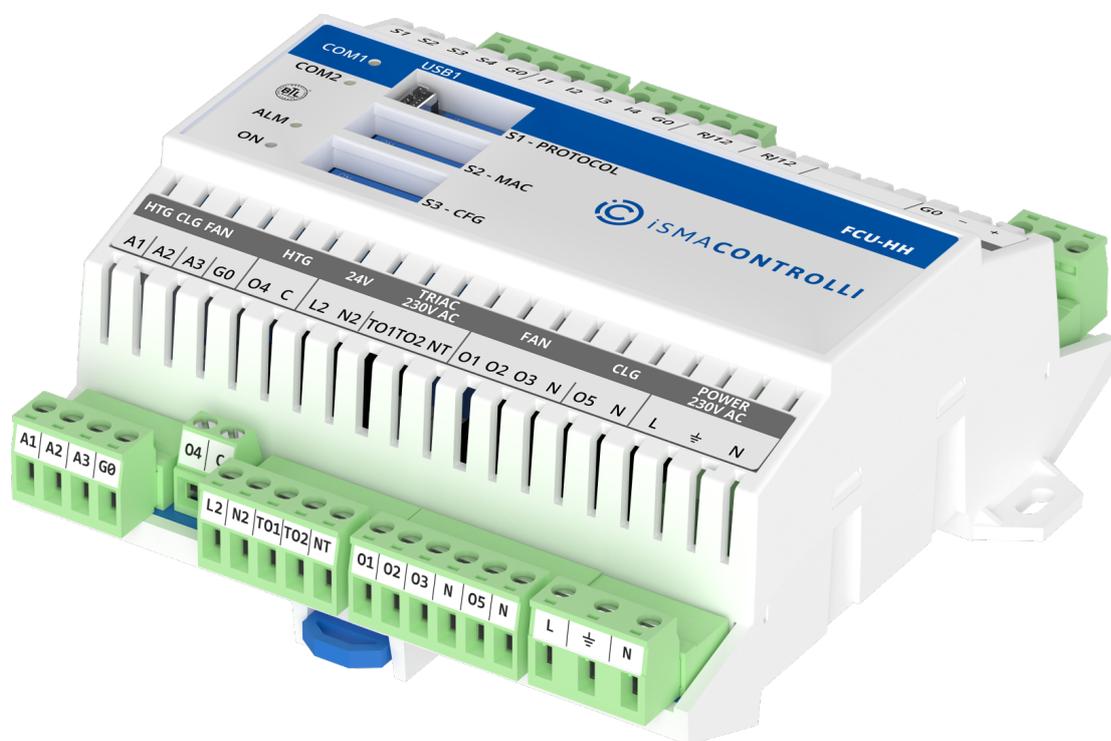


# iSMA-B-FCU

User Manual

## Hardware



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# 1 Introduction

The iSMA-B-FCU is a fully programmable controller, built with the aim of controlling the FCU. The controller is factory-equipped with the two most popular open communication protocols Modbus ASCII/RTU and BACnet MS/TP, which are selected using DIP switches.

To minimize time and simplify the commissioning process the controller is delivered with universal application, which supports the most popular types of FCU. Dedicated DIP switch allows adjusting parameters of the application. Additionally, in the BACnet protocol, the application has the built-in function, which allows automatically to bind master and slave controllers in groups.

In cases if the standard application does not meet the project requirements, it can be modified or created from scratch. Changing of the application is possible in real-time by USB port. There are three hardware versions which have different types of triac outputs and power supply (iSMA-B-FCU-HH, iSMA-B-FCU-HL, iSMA-B-FCU-LL).

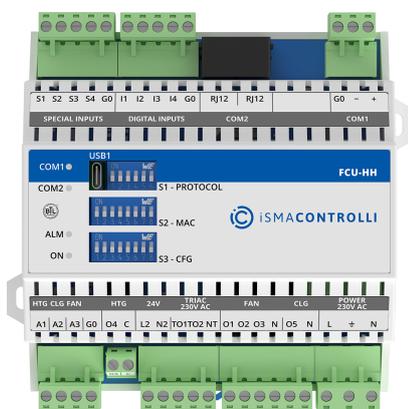


Figure 1. FCU-HH

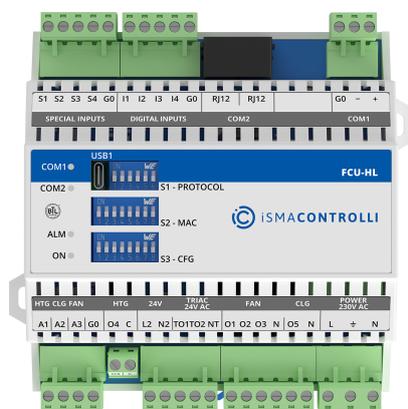


Figure 2. FCU-HL

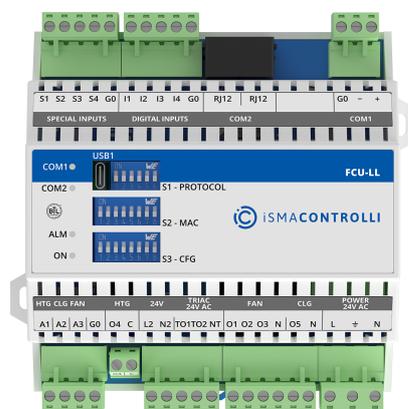


Figure 3. FCU-LL

## 1.1 Revision History

Date	Rev.	Description
17 Mar 2026	1.7	Exchanged USB connector (USB-C)
30 Jan 2025	1.6	Updated RJ12 Socket for External Connections section
19 Jul 2024	1.5	<ul style="list-style-type: none"> <li>Corrected FCU-HL diagram</li> <li>Updated information about the default settings (I/O configuration cleared while restoring to default settings)</li> <li>Updated information about setting the BACnet device ID</li> <li>Updated SI temperature input type information</li> </ul>
21 Feb 2023	1.4	<ul style="list-style-type: none"> <li>Updated RJ12 Socket for External Connections section</li> <li>Editorial corrections</li> </ul>
28 Feb 2022	1.3	Rebranded
-	1.2	Company data update
-	1.1	iSMA-B-FCU-LL hardware description added

Date	Rev.	Description
-	1.0	First edition

*Table 1. Revision history*

## 2 Safety Rules

- Improper wiring of the product can damage it and lead to other hazards. Make sure that the product has been correctly wired before turning the power on.
- Before wiring or removing/mounting the product, make sure to turn the power off. Failure to do so might cause an electric shock.
- Do not touch electrically charged parts such as power terminals. Doing so might cause an electric shock.
- Do not disassemble the product. Doing so might cause an electric shock or faulty operation.
- Use the product only within the operating ranges recommended in the specification (temperature, humidity, voltage, shock, mounting direction, atmosphere, etc.). Failure to do so might cause a fire or faulty operation.
- Firmly tighten the wires to the terminal. Failure to do so might cause a fire.
- Avoid installing the product in close proximity to high-power electrical devices and cables, inductive loads, and switching devices. Proximity of such objects may cause an uncontrolled interference, resulting in an instable operation of the product.
- Proper arrangement of the power and signal cabling affects the operation of the entire control system. Avoid laying the power and signal wiring in parallel cable trays. It can cause interferences in monitored and control signals.
- It is recommended to power controllers/modules with AC/DC power suppliers. They provide better and more stable insulation for devices compared to AC/AC transformer systems, which transmit disturbances and transient phenomena like surges and bursts to devices. They also isolate products from inductive phenomena from other transformers and loads.
- Power supply systems for the product should be protected by external devices limiting overvoltage and effects of lightning discharges.
- Avoid powering the product and its controlled/monitored devices, especially high power and inductive loads, from a single power source. Powering devices from a single power source causes a risk of introducing disturbances from the loads to the control devices.
- If an AC/AC transformer is used to supply control devices, it is strongly recommended to use a maximum 100 VA Class 2 transformer to avoid unwanted inductive effects, which are dangerous for devices.
- Long monitoring and control lines may cause loops in connection with the shared power supply, causing disturbances in the operation of devices, including external communication. It is recommended to use galvanic separators.
- To protect signal and communication lines against external electromagnetic interferences, use properly grounded shielded cables and ferrite beads.
- Switching the digital output relays of large (exceeding specification) inductive loads can cause interference pulses to the electronics installed inside the product. Therefore, it is recommended to use external relays/contactors, etc. to switch such loads. The use of controllers with triac outputs also limits similar overvoltage phenomena.
- Many cases of disturbances and overvoltage in control systems are generated by switched, inductive loads supplied by alternating mains voltage (AC 120/230 V). If they do not have appropriate built-in noise reduction circuits, it is recommended to use external circuits such as snubbers, varistors, or protection diodes to limit these effects.

### 3 Technical Specification

		iSMA-B-FCU-HH	iSMA-B-FCU-HL	iSMA-B-FCU-LL
Power Supply	Voltage	230 V AC $\pm$ 10%		24 V AC $\pm$ 10%
	Power consumption	Max. 12 VA (including 7 VA for triac outputs)		
Special Inputs	Temperature input	Measurement with attached RTDS (Real Time Digital Simulator) Resolution $\pm$ 0.1°C Accuracy $\pm$ 0.2°C at 25°C		
	Voltage input	Voltage measurement from 0 to 10 V DC (input impedance 120 k $\Omega$ ) Resolution $\pm$ 6 mV Accuracy $\pm$ 50 mV		
	Resistance input	Resistance measurement from 0 to 700 k $\Omega$ Measurement resolution $\pm$ 20 $\Omega$ for 20 k $\Omega$ load		
	Dry contact input	Output current $\sim$ 0.2 mA		
	Measurement resolution	12 bits		
Digital Inputs	Type	Dry contact		
	Max. input frequency	100 Hz		
Analog Outputs	Voltage range	0 to 10 V DC		
	Max. load current	5 mA		
	Resolution	12 bits		
	Accuracy	$\pm$ 1%		
Digital Outputs (Relays)	Resistive load (FAN, CLG)	6 A at 230 V AC or 6 A at 30 V AC		
	Inductive load AC3 (FAN, CLG)	75 VA at 230 V AC or 10 W at 30 V AC		
	Resistive load (HTG)	10 A at 230 V AC or 10 A at 30 V AC		
	Inductive load AC3 (HTG)	750 VA at 230 V AC		
Triac Outputs	Load	Min.: 1 mA Max.: 0.5 A at 230 V AC	Min.: 1 mA Max.: 0.3 A at 24 V AC $I_{\max} = 0.3 \text{ A} = I_{T01} + I_{T02} + I_{24VOut}$	Min.: 1 mA Max.: 0.5 A at 24 V AC
	Peak load per channel	1.5 A (30 s)		

	Gate control	Zero crossing turn ON	
	Frequency range	47 to 63 Hz	
	Snubber	Snubberless triac	
Power Supply Output	Power supply output	24 V AC $\pm$ 20%, 7 VA	24 V AC $\pm$ 20%, 7 VA** In HL this power supply is also used for triac outputs
COM1	RS485 interface	Up to 128 devices Fail-safe receiver (bus open, bus shorted, bus idle)	
	Communication protocols	Modbus RTU, Modbus ASCII or BACnet MS/TP set by switch	
	Ports	Screw connector	
	Baud rate	From 2400 to 115200 set by switch	
	Address	0 to 255 set by DIP switch	
COM2	RS485 interface	Switch mode, up to 128 devices	
	Communication protocol	Modbus RTU	
	Ports	2 RJ12 ports	
	Baud rate	From 2400 to 115200	
	Power supply for external device	34 V DC $\pm$ 15%, 2.5 W	
USB1	USB	USB type C	
Ingress Protection	IP	IP40 for indoor installation	
Temperature	Storage	-40°C to +85°C (-40°F to +185°F)	
	Operating	-10°C to +50°C (14°F to 122°F)	
Humidity	Relative	5 to 95%	
Connectors	Inputs/outputs, power supply, and communication	Removable	
	HTG relay	Constant	
	Maximum cable size	2.5 mm <sup>2</sup>	
Dimensions	Width	123.30 mm/4.85 in	
	Length	136.60 mm/5.38 in	

	Height	54.50 mm/2.15 in
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*Table 2. Technical specification*

## 4 Hardware Specification

### 4.1 Dimensions

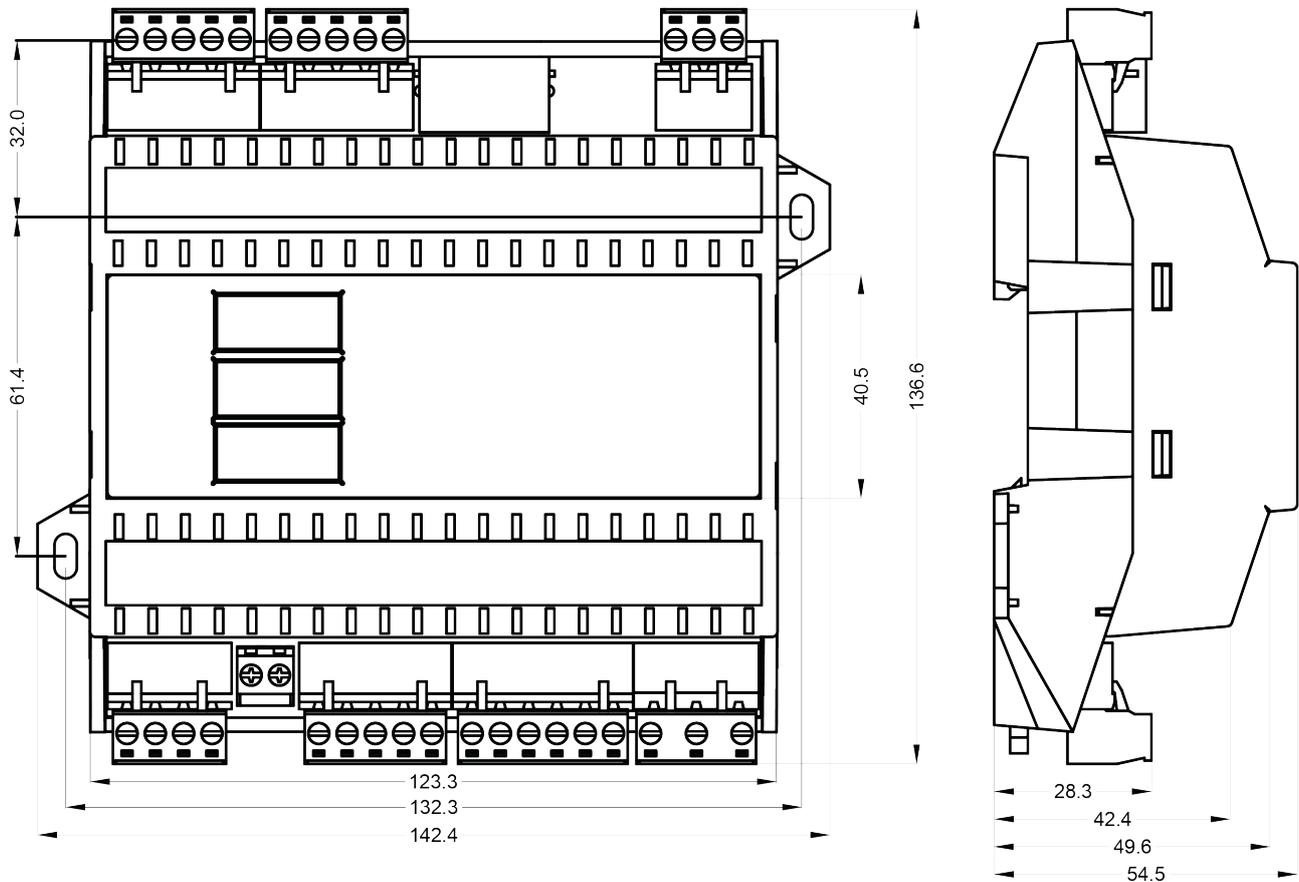


Figure 4. Dimensions

### 4.2 Power Supply

The iSMA-B-FCU-HH and iSMA-B-FCU-HL versions are designed to work with the 230 V AC power supply. Each iSMA-B-FCU device is equipped with a built-in 6 A fuse protecting the controller and the connected 230 V AC equipment.

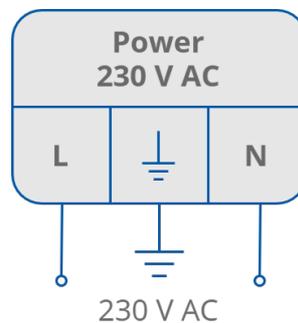


Figure 5. 230 V AC power supply

The iSMA-B-FCU-LL version is designed to work with the 24 V AC power supply. The device is equipped with a built-in 6 A fuse protecting the controller and the connected 24 V AC equipment.

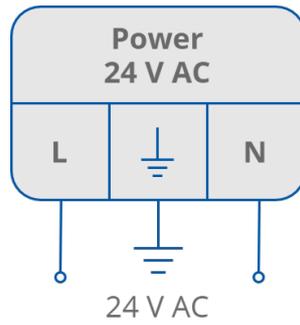


Figure 6. 24 V AC power supply

**Note:** Total current for digital relay outputs O1-O4 cannot exceed 6 A.

**Warning!**

It is forbidden to use a fuse with current exceeding 6 A! Higher current may permanently damage the device and cause danger to the user and to the equipment!

### 4.2.1 24 V AC Power Supply for External Equipment

The iSMA-B-FCU-HH is equipped with a 24 V AC, 7 VA power supply output to supply an external equipment like sensors and actuators. This power supply uses a separate coil in the transformer. The 24 V AC power supply terminal connection is labeled L2, N2.

The iSMA-B-FCU-HL is equipped with a 24 V AC power supply output for thermal valves controlled by triac outputs and external devices like sensors and actuators. This power supply uses a separate coil in the transformer. The 24 V AC power supply terminal connection is labeled L2, N2. The total power consumption with thermal valves and external devices cannot exceed 7 VA (~0.3 A).

The iSMA-B-FCU-LL is equipped with a 24 V AC, 7 VA power supply output to supply the external equipment like sensors and actuators. This power supply uses a separate 24 V AC transformer. The external separate power supply terminal connection is labeled L2, N2.

### 4.3 Default Settings

Out of the box device as well as after restoring default values procedure, has got the following default settings:

Name	Default Value
User baud rate	76800
Stop bits	1
Data bits	8
Parity bits	0
Response delay	0
I1-I4 digital input counters	0

Name	Default Value
Non-volatile values stored in the EEPROM memory	Cleared
I/O configuration	Cleared

Table 3. Default values

### 4.3.1 Restoring Default Settings

To restore the default iSMA-B-FCU device settings, follow the steps below:

**Step 1:** Turn the power supply off.

**Step 2:** Set the 6<sup>th</sup> switch of the Protocol DIP switch to ON.

**Step 3:** Turn on the power supply, wait until the power LED blinks.

**Step 4:** Set the 6<sup>th</sup> switch of the Protocol DIP switch to OFF to restore the default settings. To cancel the reset, turn off the power supply, and set the 6<sup>th</sup> switch of the Protocol DIP switch to the OFF position.

## 4.4 Front Panel and DIP Switches

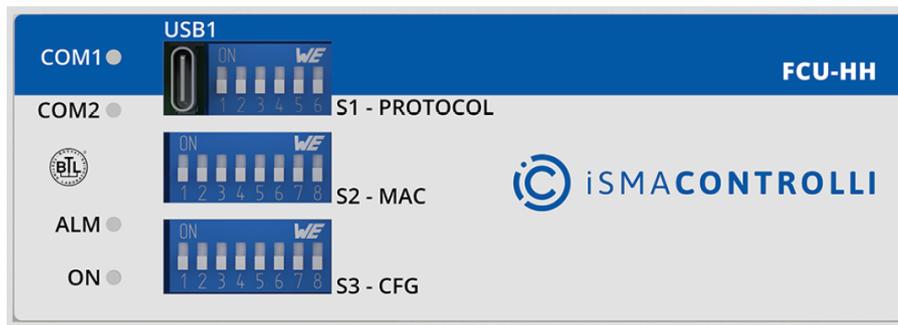


Figure 7. FCU front panel

### 4.4.1 USB1 Port

The iSMA-B-FCU device has a built-in mini USB1 port designed to manage controller firmware and application, as well as for diagnostics.

This USB1 port also provides controller power supply for commissioning processes and for application diagnostics. If the controller is powered up by a USB, all inputs and outputs are operational (except for triac outputs, which require external power supply).

### 4.4.2 LED

The iSMA-B-FCU device is equipped with 4 LED diodes for quick status check and diagnostics:

- The power LED (ON) lights up (green) after turning the power on.
- The communication LED (COM1):
  - in the Modbus protocol: lights up (orange) for 20 ms after sending each package through the main RS485 port. As long as module receives/sends packages, the communication LED blinks continuously;

- in the BACnet protocol: lights up (orange) while receiving a data package.
- The extension communication LED (COM2) lights up (orange) for 20 ms after sending each package through the extension ports. As long as the module receives/sends packages, the extension communication LED blinks continuously.
- The ALM LED is off by default, the function is programmable through the LED\_ALARM component; it blinks very softly if there is a fault during the start-up of Sedona Virtual Machine.
- During the device's reset, when the 6<sup>th</sup> switch in the S1 - PROTOCOL DIP switch is on (default settings restoration mode), the power LED (ON) blinks in 300 ms time intervals. After the switch 6 is switched off, the power LED is lit permanently, and the default settings are restored.
- If the device remains in the bootloader status, the power LED (ON) and the communication LED (COM1) blink alternatively. The communication LED keeps its functionality and blinks also after sending/receiving data packages.

### 4.4.3 DIP Switch

The iSMA-B-FCU controller is equipped with 3 DIP switches:

- 6-position S1 - PROTOCOL DIP switch;
- 8-position S2 - MAC DIP switch;
- 8-position S3 - CFG DIP switch.

#### S1 PROTOCOL DIP Switch: Baud Rate Selection

Transmission baud rate is determined by S1 switch (sections 1, 2, and 3 of the PROTOCOL DIP switch) in accordance with the following table.

1	2	3	Baud Rate
Off (0)	Off (0)	Off (0)	Defined by the user
Off (0)	Off (0)	On (1)	76800
Off (0)	On (1)	Off (0)	4800
Off (0)	On (1)	On (1)	9600
On (1)	Off (0)	Off (0)	19200
On (1)	Off (0)	On (1)	38400
On (1)	On (1)	Off (0)	57600
On (1)	On (1)	On (1)	115200

#### S1 PROTOCOL DIP Switch: Protocol Selection

Protocol selection is made with sections 4 and 5 of the PROTOCOL DIP switch according to the table.

4	5	Protocol
Off (0)	Off (0)	Modbus RTU
Off (0)	On (1)	Modbus ASCII
On (1)	Off (0)	BACnet client
On (1)	On (1)	BACnet server

**Warning!**

In BACnet mode, switch number 4 must be in ON(1) position, and switch number 5 decides if BACnet works in client or server mode (please see the above table). In order to activate the BACnet server mode after setting the 5th DIP switch to on, it is required to set the MAC address on the S2 MAC DIP switch to one from a BACnet server range (128-254).

**S2 MAC DIP Switch: Setting Controller Address**

The controller address is set with the MAC DIP switch. The procedure of setting the address is presented in the figure and table below. The addressing table is available in the separate section.

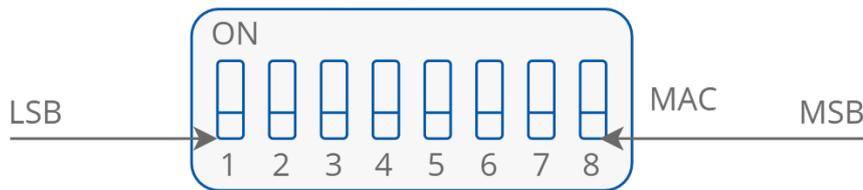


Figure 8. MAC DIP switch

Section of MAC DIP switch	Position	Function
1	On	Add 1 to MAC address
	Off	Add 0 to MAC address
2	On	Add 2 to MAC address
	Off	Add 0 to MAC address
3	On	Add 4 to MAC address
	Off	Add 0 to MAC address
4	On	Add 8 to MAC address
	Off	Add 0 to MAC address
5	On	Add 16 to MAC address
	Off	Add 0 to MAC address

Section of MAC DIP switch	Position	Function
6	On	Add 32 to MAC address
	Off	Add 0 to MAC address
7	On	Add 64 to MAC address
	Off	Add 0 to MAC address
8	On	Add 128 to MAC address
	Off	Add 0 to MAC address

**Example:** Configuration setting of the iSMA-B-FCU device address 83.

Address 83 contains following multiplicity of number 2:  $83 = 1 + 2 + 16 + 64$ . Address DIP switch settings are presented in the table below. All addresses of DIP switch configuration are presented in the separate section.

Address	S1	S2	S3	S4	S5	S6	S7	S8
83	On	On	Off	Off	On	Off	On	Off

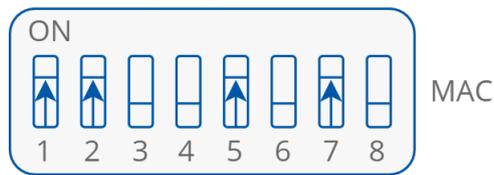


Figure 9. MAC DIP switch settings

**Warning!**

In BACnet network setting, the address above 128 automatically switches BACnet to slave mode. In this mode, the device cannot be discovered in device searching process.

**Warning!**

Do not set address 255 (all switches in ON position). This address setting is reserved for system operation.

**Setting Device ID in the BACnet Protocol**

Formula for the Device ID:

Device ID = Vendor ID \* 1000 + MAC + 128 (only in BACnet slave) where iSMA CONTROLLI Poland Vendor ID = 826.

For example, if the MAC address is set to 41, and the protocol is set to BACnet master, then the Device ID = 826041, or if the protocol is set to BACnet slave, then the Device ID = 826169.

### S3 CFG DIP Switch

The iSMA-B-FCU device has the 8-position DIP switch, which can be used in client application. Each of 8 positions can have true or false state. This DIP switch is dedicated for setting configuration in client application.

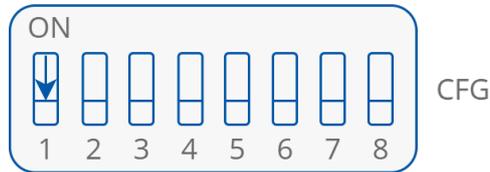


Figure 10. CFG DIP switch

## 4.5 Terminals and Internal Connections

There are 3 types of hardware available:

- iSMA-B-FCU-HH with 230 V AC power supply and triac outputs;
- iSMA-B-FCU-HL with 230 V AC power supply and 24 V AC triac outputs;
- iSMA-B-FCU-LL with 24 V AC power supply and triac outputs.

### 4.5.1 iSMA-B-FCU-HH

The iSMA-B-FCU-HH hardware version has a high voltage power supply (230 V AC) and high voltage triac outputs (230 V AC). The triac outputs are connected directly to the main controller power supply, as presented in the diagram below. The maximum current for each triac output is 0.5 A. The maximum power consumed by the external equipment connected to 24 V terminals (L2, N2) cannot exceed 7 VA in total.

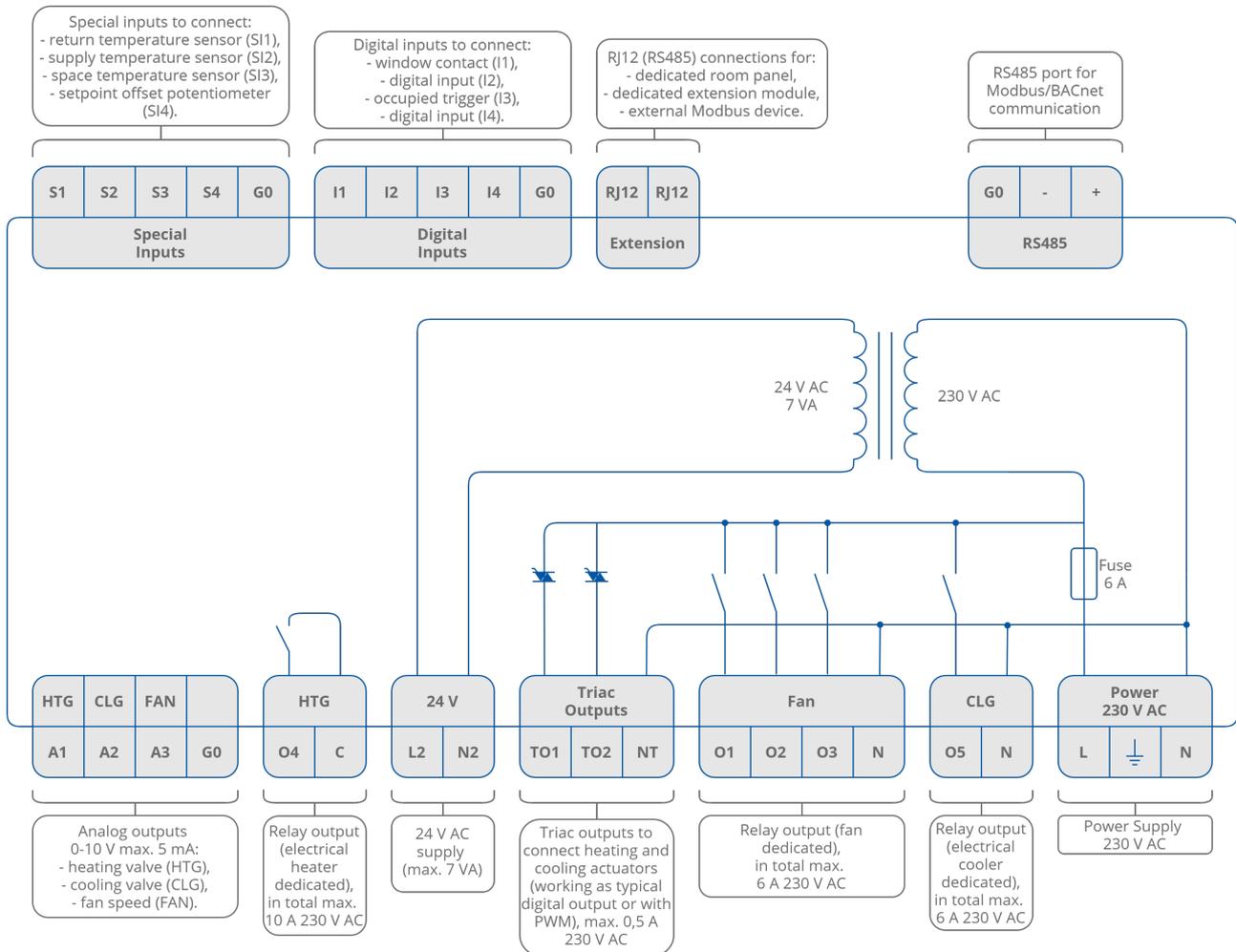


Figure 11. iSMA-B-FCU-HH diagram of terminals and internal connections

### 4.5.2 iSMA-B-FCU-HL

The iSMA-B-FCU-HL hardware version has a high voltage power supply (230 V AC) and low voltage triac outputs (24 V AC). The triac outputs are connected to a built-in 24 V AC transformer, as shown in the diagram below. The maximum power consumed by the external equipment connected to the triac outputs and to 24 V terminals (L2, N2) cannot exceed 7 VA in total.

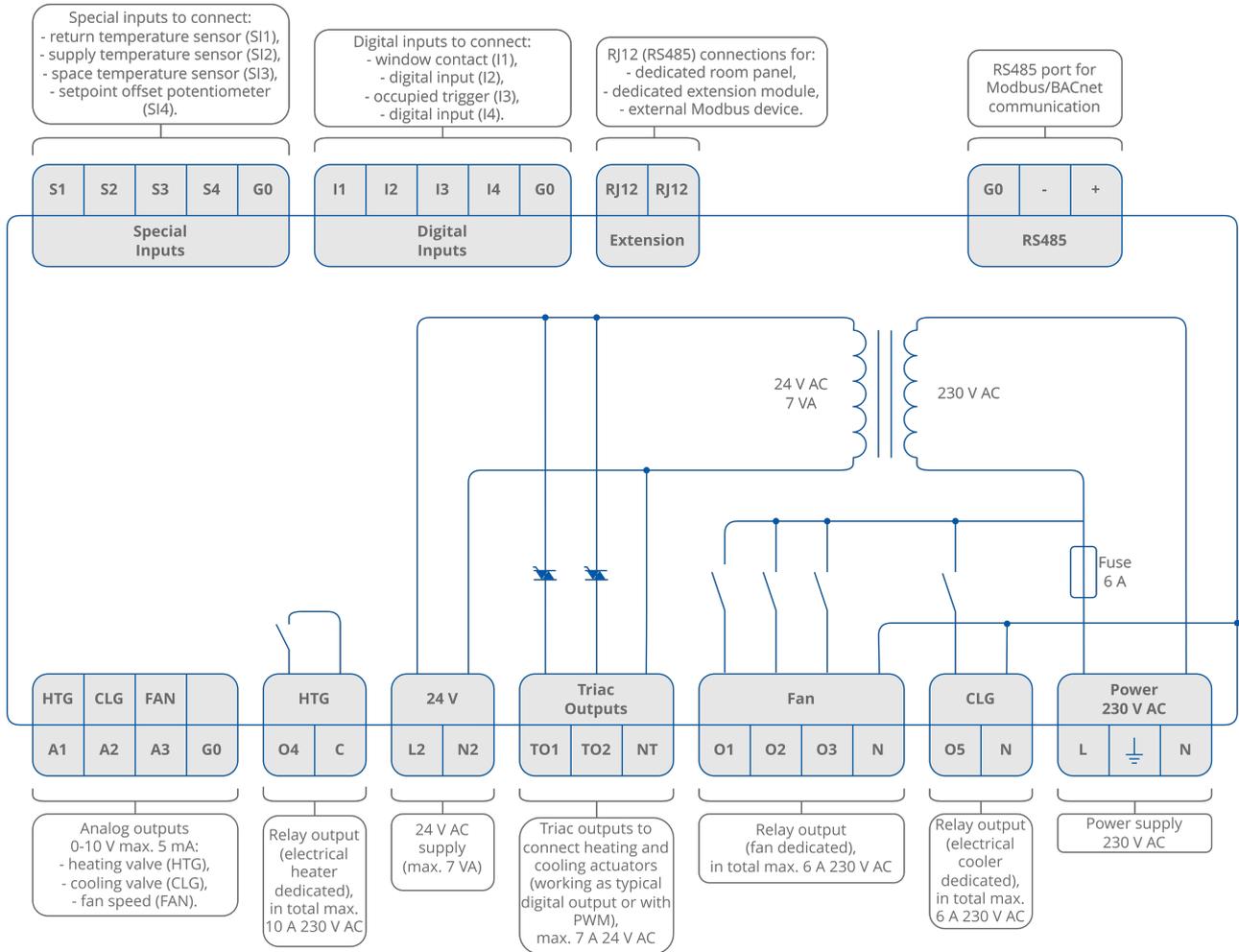


Figure 12. iSMA-B-FCU-HL diagram of terminals and internal connections

### 4.5.3 iSMA-B-FCU-LL

The iSMA-B-FCU-LL hardware version has a low voltage power supply and triac outputs (24 V AC). The triac outputs are connected to power supply terminals. The maximum current for each of the triac outputs is 0.5 A. The maximum power used by the external equipment connected to the 24 V terminals (L2, N2) cannot exceed 7 VA in total.

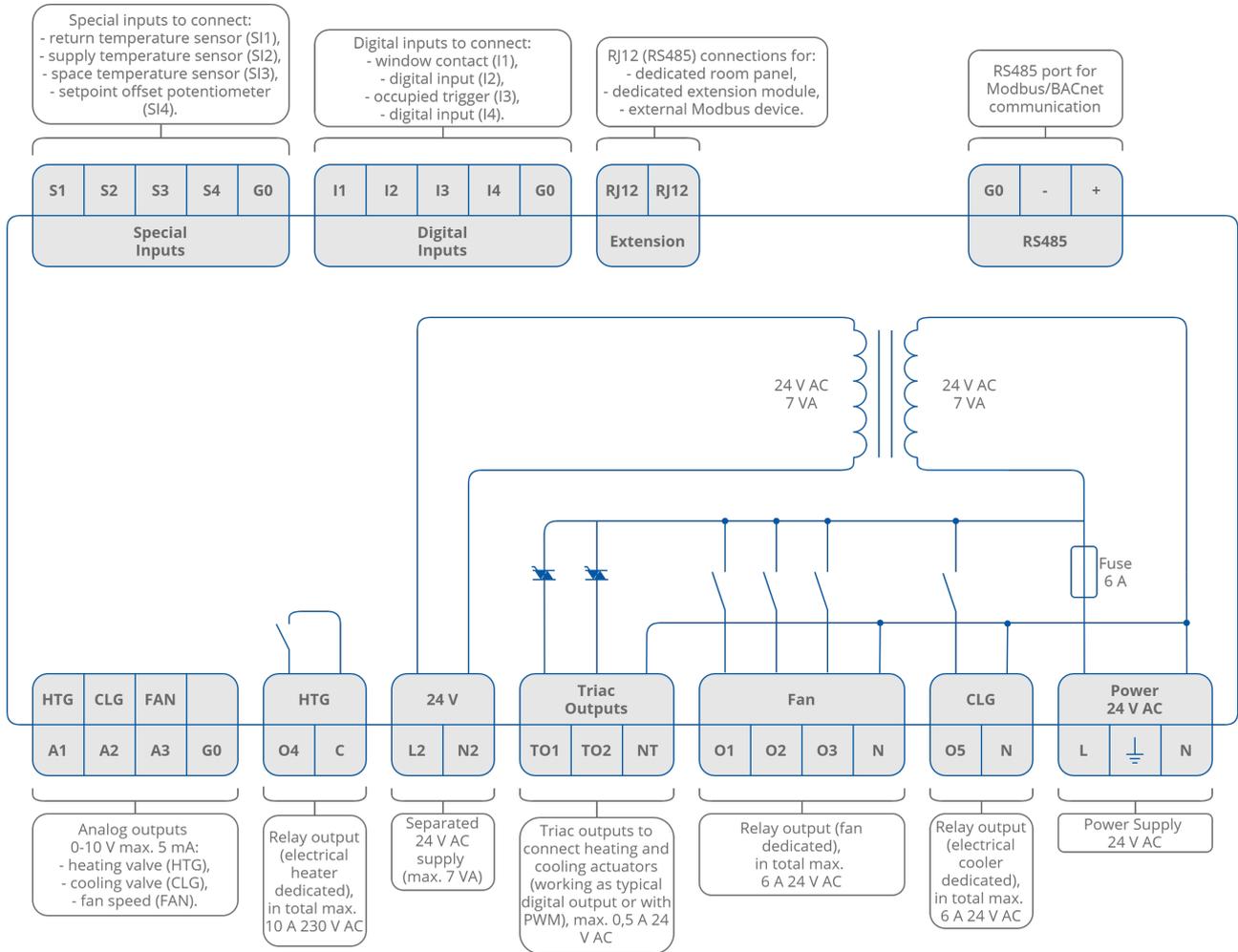


Figure 13. iSMA-B-FCU-LL diagram of terminals and internal connections

## 4.6 RS485 Communication

### 4.6.1 Connecting RS485 Communication Bus

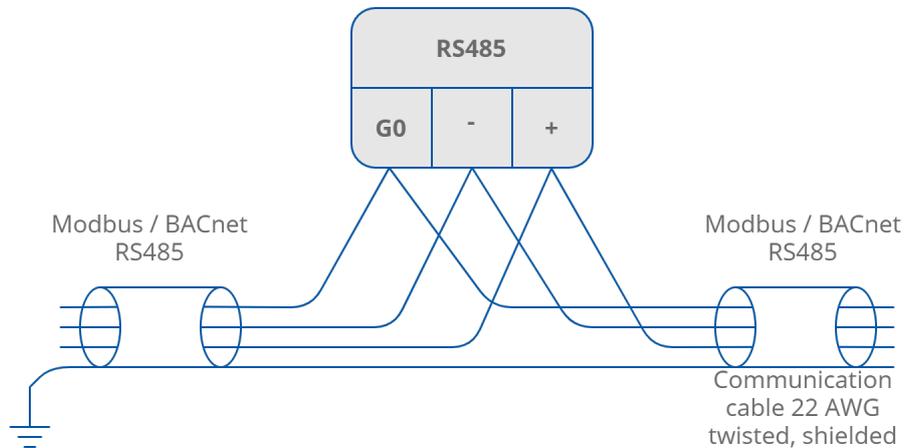


Figure 14. RS485 connection

### 4.6.2 RS485 Grounding and Shielding

In most cases controllers are installed in enclosures along with other devices, which generate electromagnetic radiation (for example, relays, contactors, transformers, motor invertors, etc.). Such electromagnetic radiation can induce electrical noise into both power and signal lines, as well as direct radiation into the controller, causing negative effects on the system. For this reason, an appropriate grounding, shielding, and other protective steps should be taken at the installation stage to prevent negative electromagnetic radiation effects, for example:

- control cabinet grounding;
- cable shield grounding;
- using protective elements for electromagnetic switching devices;
- proper wiring;
- consideration of cable types and their cross sections;
- and other.

### 4.6.3 RS485 Network Termination

Transmission line effects often present problems for data communication networks. These problems include reflections and signal attenuation.

To eliminate the presence of reflections of signal from the end of the cable, the cable must be terminated at both ends with a resistor across the line adequate to its characteristic impedance. Both ends must be terminated since the propagation is bidirectional. In case of an RS485 twisted pair cable this termination is typically 120 Ω.

## 4.7 RJ12 Socket for External Connections

The RJ12 socket is designed for connecting external modules, Modbus devices, and room/wall panels. The FCU device has two parallel RJ12 sockets (RS485 interface in a switch mode) with the same pin configuration. These sockets provide communication in the Modbus RTU protocol.

The RJ12 socket provides a power supply dedicated for external room panels with maximum load up to 2.5 W per both sockets. Before connecting devices powered from RJ12, please calculate the power supply load. For example, the power consumption of the LP/Touch Point/Control Point panels with a temperature sensor, on average, is 0.5 W, so the maximum number of such panels on the bus is 5, while the average power consumption of the FP panels is 0.2 W, so the maximum number of such panels on the bus is 10. It is recommended to connect maximum 5 LP/Touch Point/Control Point panels working at the same time or 10 FP panels.

**Note**

Connected panels can be freely combined (5 Control Point panels, or 5 Touch Point panels, or 2 Control Point panels and 3 Touch Point panels, or 3 Touch Point panels and 5 FP panels, etc.). It is important not to exceed a maximum load of 2.5 W for both RJ12 sockets together.

For short distance, up to 100 m, it is recommended to use for connection a standard category 3-, 4-, or 6-wire telephone straight cable without crossing (for example, YTLYP 6x0.12). For longer distance, it is recommended to use a standard twisted shielded Modbus cable.

RJ12 pins in the FCU controller are shown in the figure below.

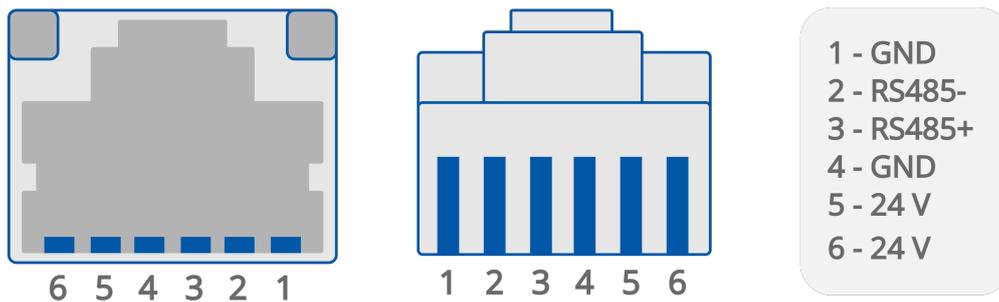


Figure 15. RJ12 pins

To connect the LP, Touch Point, or FP panel, use the following types of cables:

- LP: RJ12-RJ12 cable;

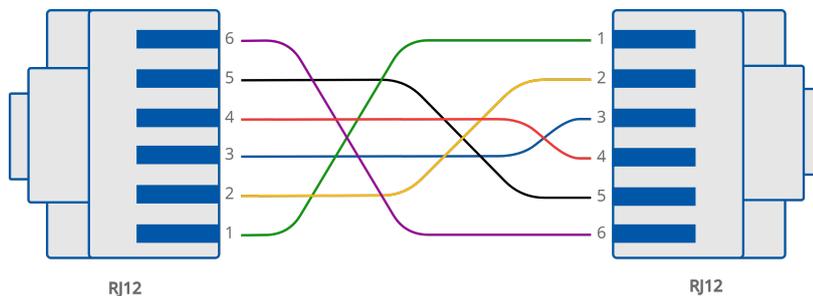


Figure 16. RJ12-RJ12 connection of the LP panel

- Touch Point and Control Point: RJ12-RJ45 cable (the Touch Point and Control Point panels are equipped with RJ45 sockets):

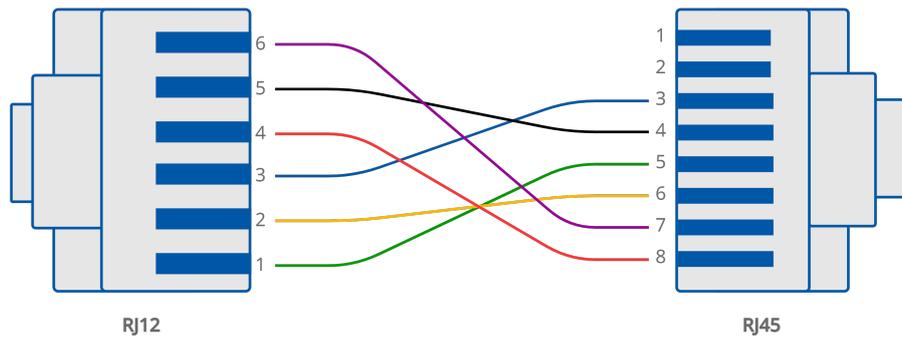


Figure 17. RJ12-RJ45 connection of the Touch Point and Control Point panels

- FP: RJ12-screw connector cable (the FP panel is equipped with a 4-pin screw terminal):

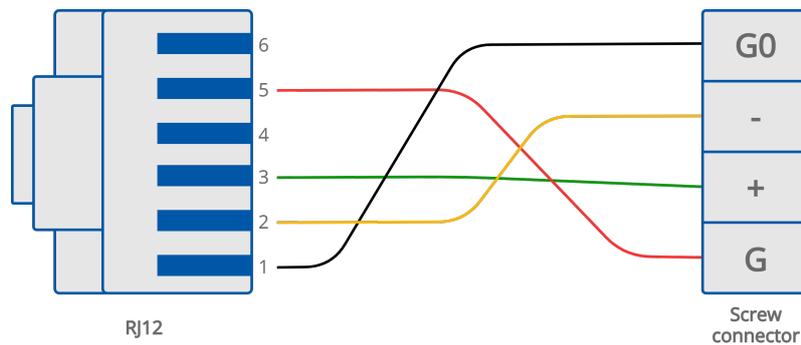


Figure 18. RJ12-screw connector connection of the FP panel

## 5 Inputs and Outputs

### 5.1 Inputs

The iSMA-B-FCU device is equipped with two types of inputs: 4 digital inputs (for Boolean values) and 4 special inputs (for resistance and voltage measurement).

#### 5.1.1 Special Inputs

The iSMA-B-FCU device has 4 built-in special inputs, which can work in the following modes:

- digital (dry contact);
- analog (0-10 V DC);
- resistance (0-1000 k $\Omega$  (1 M $\Omega$ ));
- temperature (working with NTC sensors).

#### Special Input in Digital Mode

In this mode, the special input works as a digital input dry contact and reactive Boolean value, false for open circuit and true for close circuit. The circuit status is measured with 1 mA current.

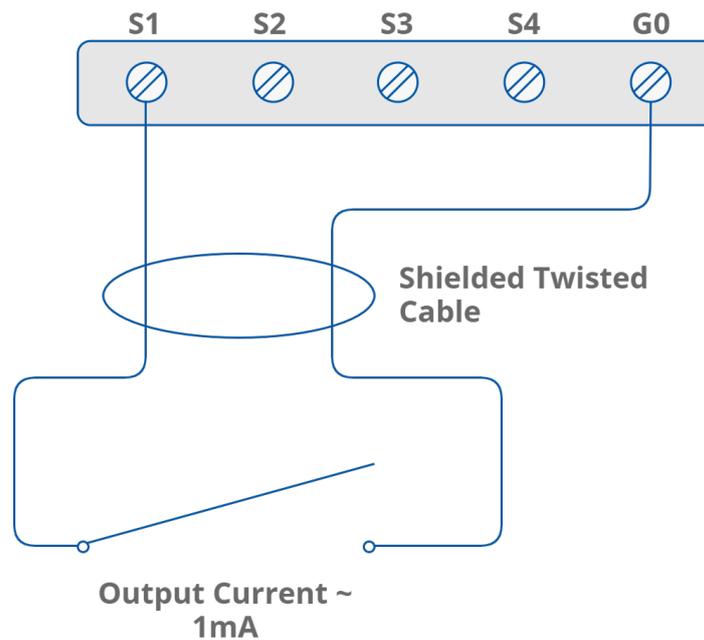


Figure 19. Special inputs in digital mode connection

#### Special Input in Analog Mode

In this mode, the special input measures voltage in the range from 0 to 10 V DC (10 000 mV) with 6 mV resolution.

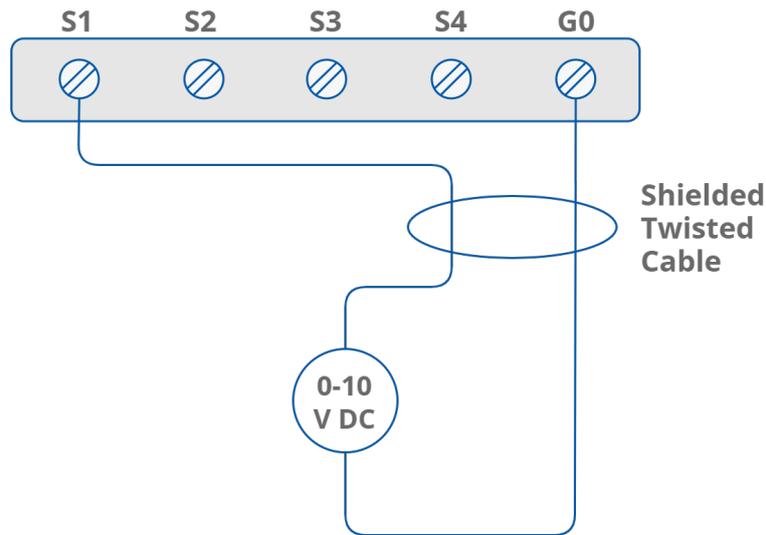


Figure 20. Special inputs in analog mode connection

## Special Input in Resistance Mode

In this mode, the special input measures resistance value with the voltage driver. The input works in range from 0 to 1000 k $\Omega$  (1 M $\Omega$ ), with resolution  $\pm 20 \Omega$  for 20 k $\Omega$  load.

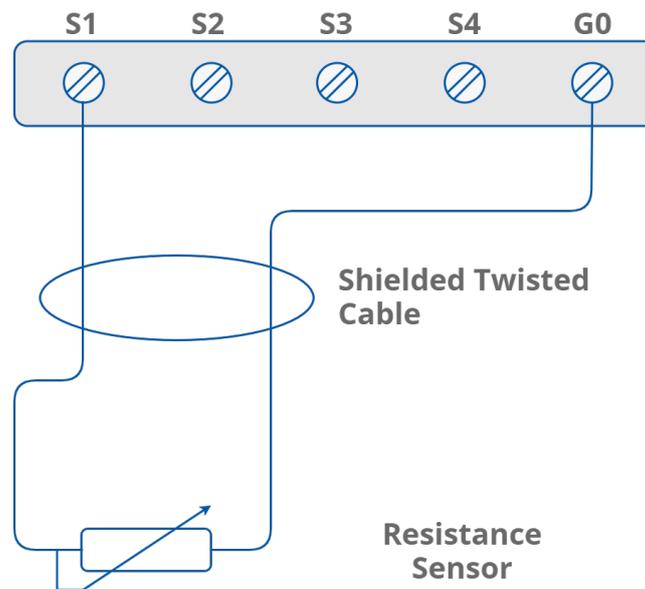


Figure 21. Special inputs in resistance mode connection

## Special Input in Temperature Mode

In this mode, the special input measures NTC sensor resistance with the voltage driver and converts to temperature value. The special input is equipped with a built-in conversion table for the following NTC sensors:

- 10K3A1 NTC B=3975K temperature sensor;
- 10K4A1 NTC B=3695K temperature sensor;
- 10K NTC B=3435K Carel temperature sensor;
- 20K6A1 NTC B=4262K temperature sensor;
- 2K3A1 NTC B=3975K temperature sensor;

- 3K3A1 NTC B=3975K temperature sensor;
- 30K6A1 NTC B=4262K temperature sensor;
- SIE1 temperature sensor;
- TAC1 temperature sensor;
- SAT1 temperature sensor.

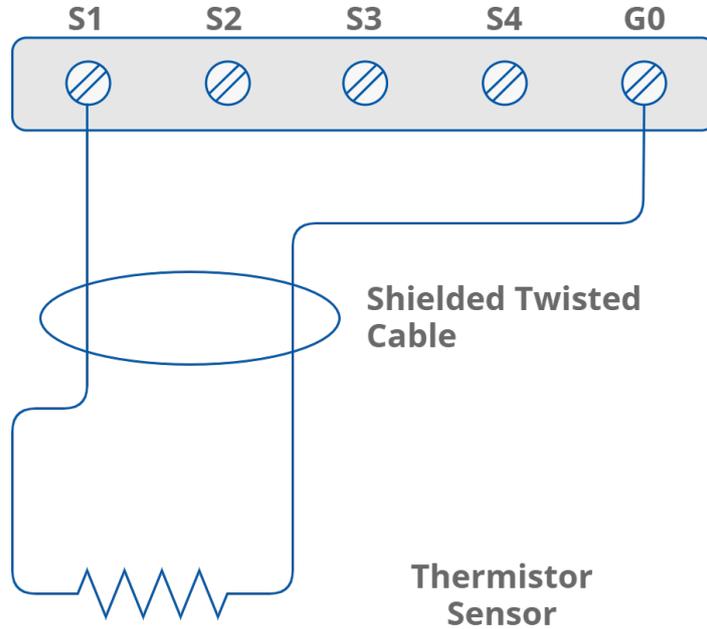


Figure 22. Special inputs in temperature mode connection

### 5.1.2 Digital Inputs

The iSMA-B-FCU device is equipped with 4 digital inputs. The figure below presents the way they are connected.

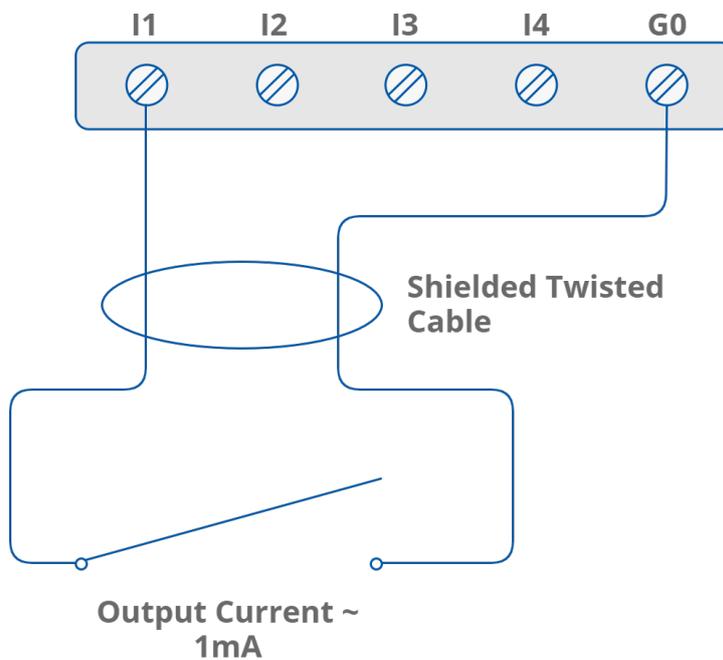


Figure 23. Digital inputs connection

## Digital Input Fast Counter

The digital input can work as a counter of dry contact pulses up to 100 Hz. The counter value is saved in the non-volatile EEPROM memory.

### Warning!

If the default settings are restored, the value of the counter is set to 0.

## 5.2 Outputs

The iSMA-B-FCU device is equipped with three types of outputs: 2 triac outputs, 5 digital outputs, and 4 analog outputs.

### 5.2.1 Triac Outputs

The iSMA-B-FCU device is equipped with two triac outputs designed for heating and cooling thermal valve actuators. Depending on controller model, triac outputs can be connected to actuators with 230 V AC supply (for iSMA-B-FCU-HH) or to actuators with 24 V AC supply (for iSMA-B-FCU-HL and iSMA-B-FCU-LL). In the iSMA-B-FCU-HL version, triac outputs are supplied with 24 V AC from a build-in transformer, whereas in iSMA-B-FCU-LL and iSMA-B-FCU-HH triac outputs are connected directly to power supply terminals.

Triac outputs can work as typical binary outputs (for the binary temperature control) or with PWM modulation. The PWM mode has two parameters:

- duration time in seconds (this value depends on valve parameters);
- fill out (percentage value of signal fill out).

### Warning!

In case of the iSMA-B-FCU-HH or iSMA-B-FCU-LL hardware versions, the actuators connected to each triac output may consume up to 0.5 A under constant load. In some cases, the current can be higher for a limited time, 1.5 A up to 30 seconds.

In case of the iSMA-B-FCU-HL controller, the sum of power consumption of both triac outputs and 24 V AC output cannot exceed 0.3 A (7 VA):

$$I_{\max} = 0.3 \text{ A} = I_{T01} + I_{T02} + I_{24VOut}$$

The figure below presents the way actuators are connected to triac outputs (for 4-pipe mode).

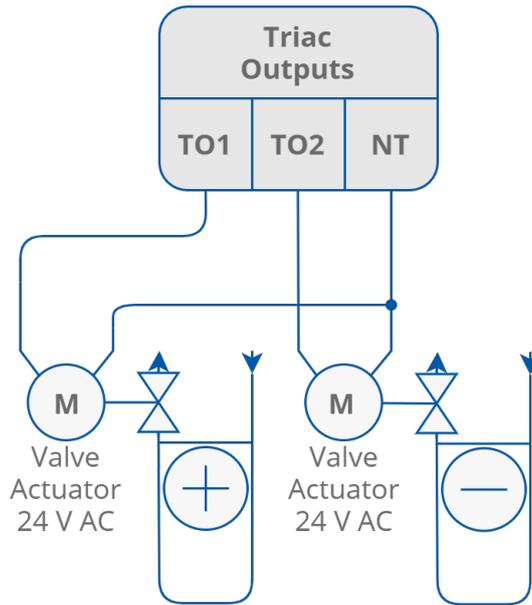


Figure 24. Triac outputs connection

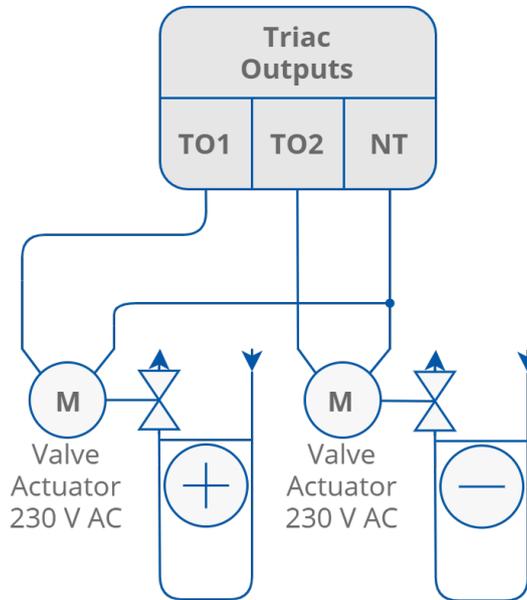


Figure 25. Triac outputs connection

## 5.2.2 Digital Outputs

All digital outputs are based on relays, which can operate with 230 V AC voltage (in iSMA-B-FCU-LL, digital outputs are working with 24 V AC). The iSMA-B-FCU device has 2 types of digital outputs:

- O1-03 and 05: relay outputs connected directly to power supply terminal;
- O4: a relay separated from iSMA-B-FCU device circuits.

### 01-03 Fan Relays

The iSMA-B-FCU device is equipped with three relay outputs, designed for connecting up to 3 speed fans. The way the fans are connected (depending on the number of speeds) is presented in the figure below. The common terminal for those outputs is connected directly to the power supply "L" terminal.

**Warning!**

Outputs O1-O3 and output O5 are protected by a built-in 6 A fuse. Total current for digital relays outputs O1-03 and O5 cannot exceed 6 A.

**Warning!**

It is forbidden to use a fuse with current exceeding 6 A! Higher current may permanently damage device and cause danger to the user and to the equipment!

**Warning!**

In iSMA-B-FCU-LL, the 24 V AC fan motor is required.

The exemplary fan connection is presented in the figure below.

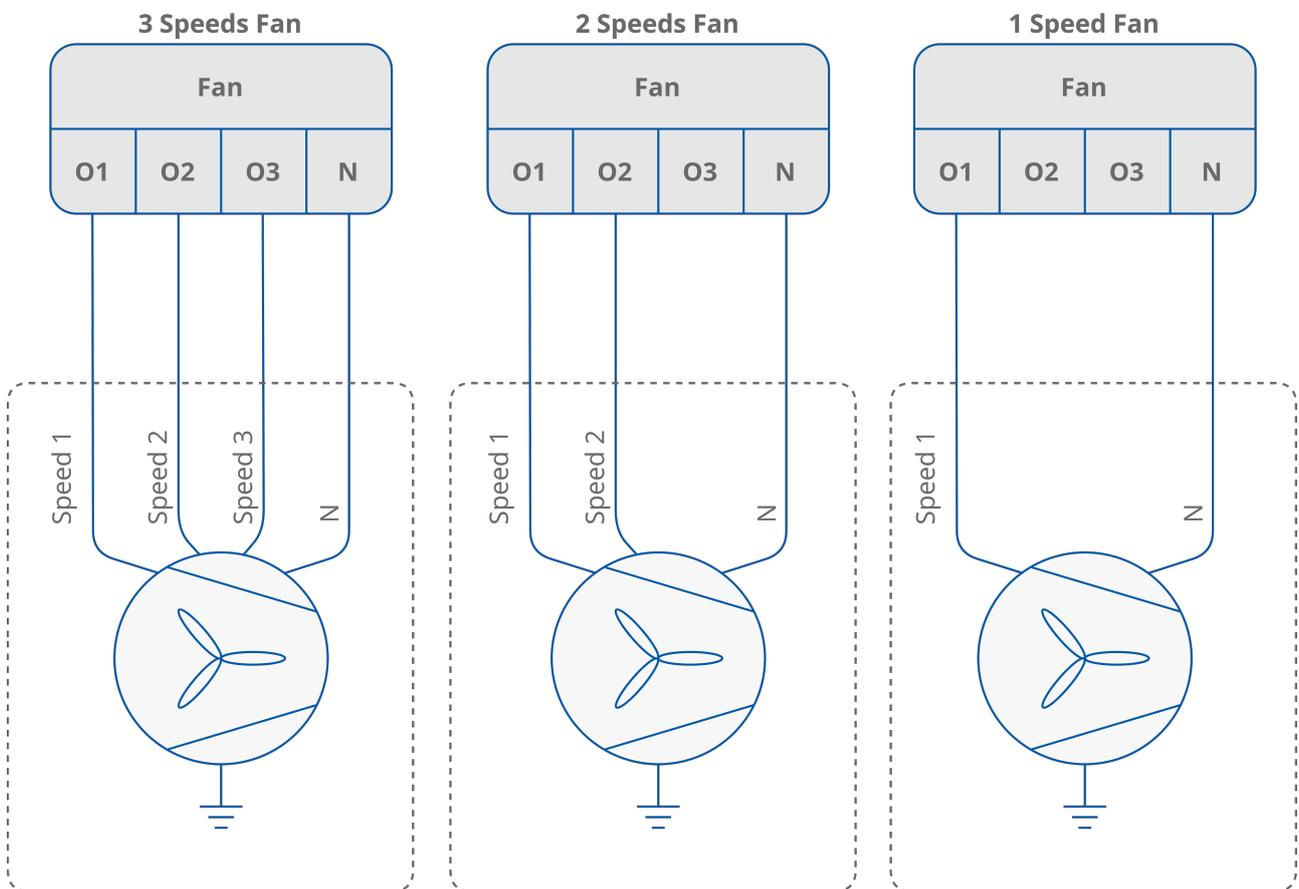


Figure 26. O1-O3 digital outputs, examples of connections

**O4 HTG Relay**

The iSMA-B-FCU device is equipped with relay output, which in the FCU application is dedicated to an external heater. This relay is separated from the rest of the control circuit. Current consumption cannot exceed 10 A with 250 V AC power supply. The figure below presents the way of connecting.

**Warning!**

HTG relay voltage is always limited to 250 V AC, irrespectively of the power supply version of the FCU controller.

**Warning!**

This digital output is equipped with a separate circuit with 10 A relay. This circuit requires using external fuse protection up to 10 A. The current higher than 10 A may permanently damage device and cause danger to the user and to the equipment!

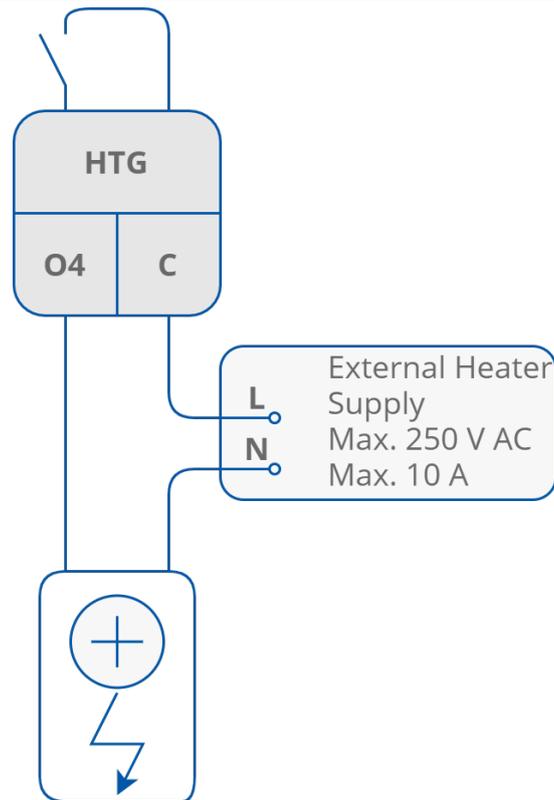


Figure 27. Example of an electrical heater connection

## O5 CLG Relay

The iSMA-B-FCU device is equipped with a relay output, which in the FCU application is dedicated to an external cooler. This relay output is internally connected to the power supply, therefore there is no need to connect external supply. In iSMA-B-FCU-HH and iSMA-B-FCU-HL the output voltage in high state is 230 V AC, and in iSMA-B-FCU-LL version the high state voltage is 24 V AC. Current consumption cannot exceed 6 A. An exemplary way of connecting is presented in the figure below.

**Warning!**

Output O4 and outputs O1-O3 are protected by a 6 A fuse. Total current for digital relay outputs cannot exceed 6 A.

**Warning!**

It is forbidden to use a fuse with current exceeding 6 A! Higher current may permanently damage the device and cause a danger to the user and to the equipment!

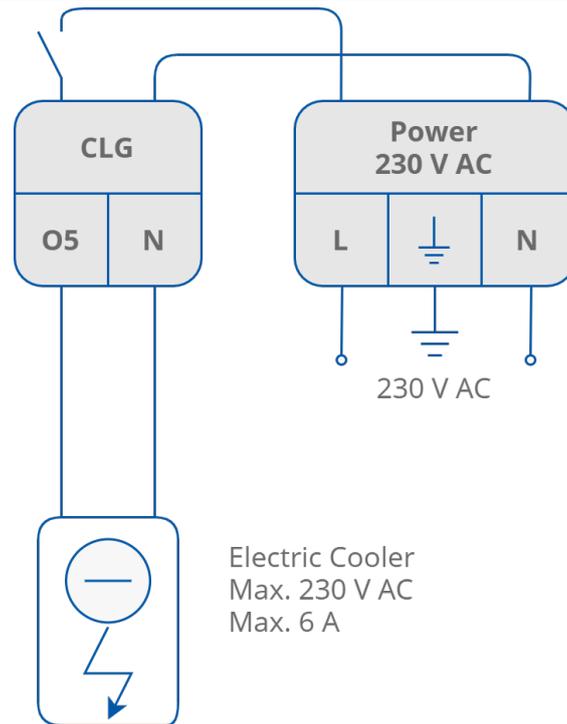


Figure 28. O5 digital output, example of 230 V AC electrical cooler connection (iSMA-B-FCU-HH, iSMA-B-FCU-HL)

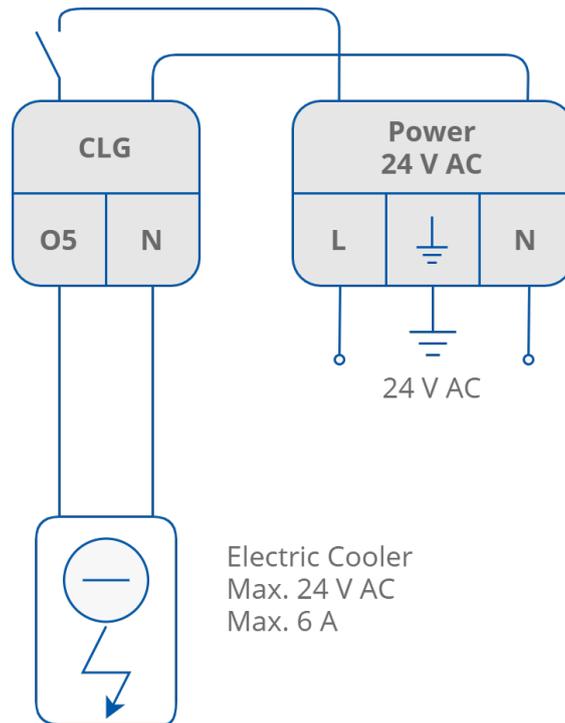


Figure 29. O5 digital output, example of 24 V AC electrical cooler connection (iSMA-B-FCU-LL)

### 5.2.3 Analog Outputs

The iSMA-B-FCU device is equipped with 3 analog outputs 0-10 V DC. These outputs are designed for controlling the following actuators:

- A1 (HTG), analog heating valve actuator;
- A2 (CTG), analog cooling valve actuator;
- A3 (FAN), analog fan speed control.

The recommended way of connecting analog outputs is presented in the figures below.

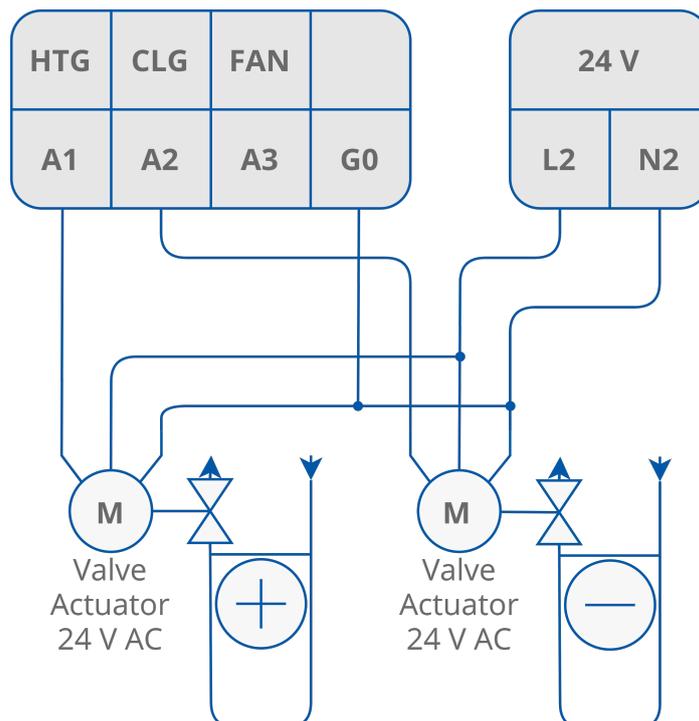


Figure 30. Analog outputs, example of connecting 0-10 V analog valve actuators

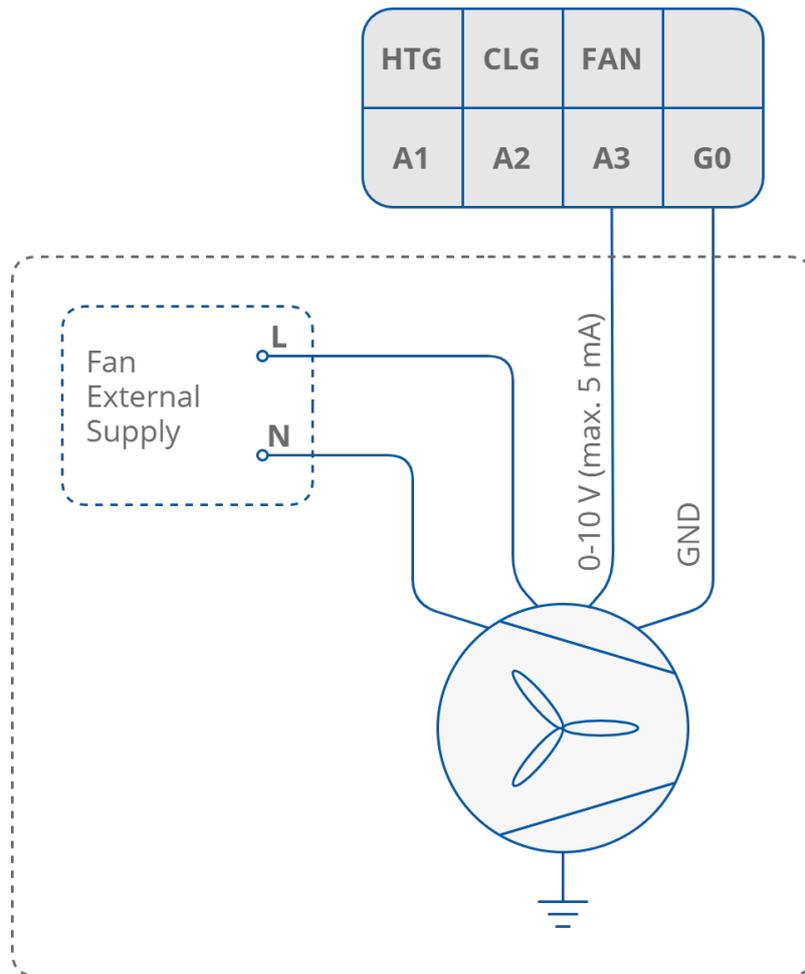


Figure 31. Analog outputs, example of connecting 0-10 V analog fan control

## 6 List of Supported Temperature Sensors

- 10K3A1
- 10K4A1
- 10K
- 20K6A1
- 2.2K3A1
- 3K3A1
- 30K6A1
- SIE1
- TAC1
- SAT1

No.	1
Sensor	<b>10K3A1</b>
$\beta$ coefficient	3975K
Manufacturers	Cylon, Honeywell, Johnson, Satchwell, Seachange
$^{\circ}\text{C}$	$\Omega$
-45	491749
-40	335671
-35	241840
-30	176683
-25	131251
-20	96974
-15	72895
-10	55298
-5	42314
0	32650
5	25396
10	19904
15	15714
20	12494
25	10000

No.	1
30	8056
35	6530
40	5325
45	4367
50	3601
55	2985
60	2487
65	2082
70	1751
75	1480
80	1256
85	1070
90	916
95	787
100	678
105	587
110	510
115	444
120	388
125	340
No.	2
Sensor	<b>10K4A1</b>
$\beta$ coefficient	3695K
Manufacturers	Andover, Delta Controls, Siebe, York
°C	$\Omega$
-45	330749

No.	2
-40	239831
-35	181532
-30	135233
-25	105081
-20	78930
-15	61030
-10	47549
-5	37316
0	29490
5	23462
10	18787
15	15136
20	12268
25	10000
30	8197
35	6754
40	5594
45	4656
50	3893
55	3271
60	2760
65	2339
70	1990
75	1700
80	1458
85	1255

No.	2
90	1084
95	939
100	817
105	713
110	624
115	547
120	482
125	426

No.	3
Sensor	<b>10K</b>
$\beta$ coefficient	3435K
Manufacturers	Carel
$^{\circ}\text{C}$	$\Omega$
-40	188500
-35	144100
-30	111300
-25	86430
-20	67770
-15	53410
-10	42470
-5	33900
0	27280
5	22050
10	17960
15	14690

No.	3
20	12090
25	10000
30	8313
35	6940
40	5827
45	4912
50	4161
55	3536
60	3020
65	2588
70	2228
75	1924
80	1668
85	1451
90	1266
95	1108
100	973
105	857
110	758
115	672
120	597
125	531

No.	4
Sensor	<b>20K6A1</b>
$\beta$ coefficient	4262K

No.	4
Manufacturers	Honeywell
°C	$\Omega$
-40	806800
-35	574400
-30	413400
-25	300400
-20	220600
-15	163480
-10	122260
-5	92220
0	70140
5	53780
10	41540
15	32340
20	25340
25	20000
30	15886
35	12698
40	10212
45	8260
50	6718
55	5494
60	4518
65	3732
70	3098
75	2586

No.	4
80	2166
85	1823
90	1541
95	1308
100	1114
105	953
110	818
115	704
120	609
125	528

No.	5
Sensor	<b>2.2K3A1</b>
$\beta$ coefficient	3975K
Manufacturers	Ambiflex, Johnson
$^{\circ}\text{C}$	$\Omega$
-50	154464
-45	
-40	77081
-35	
-30	40330
-25	
-20	22032
-15	
-10	12519
-5	9529

No.	5
0	7373
5	5719
10	4487
15	3539
20	2814
25	2252
30	1814
35	1471
40	1199
45	983
50	812
55	672
60	561
65	469
70	395
75	333
80	284
85	241
90	207
95	177
100	154
105	132
110	116
115	
120	88
125	

No.	6
Sensor	<b>3K3A1</b>
$\beta$ coefficient	3975K
Manufacturers	Alerton
$^{\circ}\text{C}$	$\Omega$
-50	200348
-45	150524
-40	100701
-35	76853
-30	53005
-25	41048
-20	29092
-15	21868
-10	16589
-5	12694
0	9795
5	7619
10	5971
15	4714
20	3748
25	3000
30	2417
35	1959
40	1598
45	1310
50	1080
55	896

No.	6
60	746
65	625
70	526
75	444
80	377
85	321
90	275
95	236
100	204
105	176
110	153
115	133
120	117
125	102

No.	7
Sensor	<b>30K6A1</b>
$\beta$ coefficient	4262K
Manufacturers	Drayton
$^{\circ}\text{C}$	$\Omega$
-30	622911
-25	477393
-20	331876
-15	245785
-10	183697
-5	138502

No.	7
0	105305
5	60713
10	62347
15	48511
20	38019
25	30000
30	23828
35	19046
40	15317
45	12390
50	10079
55	8243
60	6777
65	5600
70	4650
75	3879
80	3251
85	2737
90	2313
95	1963
100	1672
105	1430
110	1228
115	1058
120	915
125	793

No.	8
Sensor	<b>SIE1</b>
Manufacturers	Barber Colman, Siebe
°C	$\Omega$
-50	10732
-45	10624
-40	10517
-35	10344
-30	10172
-25	9913
-20	9654
-15	9320
-10	8933
-5	8496
0	8044
5	7489
10	6938
15	6370
20	5798
25	5238
30	4696
35	4185
40	3707
45	3271
50	2875
55	2521
60	2206

No.	8
65	1929
70	1685
75	1472
80	1287
85	1127
90	986
95	866
100	760
105	670
110	590
115	522
120	462
125	410

No.	9
Sensor	<b>TAC1</b>
$\beta$ coefficient	3500K
Manufacturers	TAC
$^{\circ}\text{C}$	$\Omega$
-40	39024
-35	29358
-30	22284
-25	17073
-20	13192
-15	10276
-10	8068

No.	9
-5	6382
0	5085
5	4078
10	3294
15	2676
20	2188
25	1800
30	1488
35	1237
40	1034
45	869
50	733
55	622
60	529
65	453
70	389
75	335
80	290
85	252
90	220
95	192
100	169
105	149
110	131
115	116
120	103

No.	9
125	92

No.	10
Sensor	<b>SAT1</b>
Manufacturers	Satchwell
°C	Ω
-45	9652
-40	9584
-35	9467
-30	9349
-25	9159
-20	8968
-15	8708
-10	8396
-5	8031
0	7614
5	7150
10	6649
15	6121
20	5580
25	5039
30	4513
35	4012
40	3545
45	3117
50	2730

No.	10
55	2386
60	2082
65	1816
70	1585
75	1385
80	1213
85	1064
90	937
95	828
100	734
105	654
110	585
115	525
120	474
125	429

## 7 MAC DIP Switch Addressing Table

Address	S1	S2	S3	S4	S5	S6	S7	S8
1	On							
2		On						
3	On	On						
4			On					
5	On		On					
6		On	On					
7	On	On	On					
8				On				
9	On			On				
10		On		On				
11	On	On		On				
12			On	On				
13	On		On	On				
14		On	On	On				
15	On	On	On	On				
16					On			
17	On				On			
18		On			On			
19	On	On			On			
20			On		On			
21	On		On		On			
22		On	On		On			
23	On	On	On		On			
24				On	On			
25	On			On	On			
26		On		On	On			

27	On	On		On	On			
28			On	On	On			
29	On		On	On	On			
30		On	On	On	On			
31	On	On	On	On	On			
32						On		
33	On					On		
34		On				On		
35	On	On				On		
36			On			On		
37	On		On			On		
38		On	On			On		
39	On	On	On			On		
40				On		On		
41	On			On		On		
42		On		On		On		
43	On	On		On		On		
44			On	On		On		
45	On		On	On		On		
46		On	On	On		On		
47	On	On	On	On		On		
48					On	On		
49	On				On	On		
50		On			On	On		
51	On	On			On	On		
52			On		On	On		
53	On		On		On	On		
54		On	On		On	On		

55	On	On	On		On	On		
56				On	On	On		
57	On			On	On	On		
58		On		On	On	On		
59	On	On		On	On	On		
60			On	On	On	On		
61	On		On	On	On	On		
62		On	On	On	On	On		
63	On	On	On	On	On	On		
64							On	
65	On						On	
66		On					On	
67	On	On					On	
68			On				On	
69	On		On				On	
70		On	On				On	
71	On	On	On				On	
72				On			On	
73	On			On			On	
74		On		On			On	
75	On	On		On			On	
76			On	On			On	
77	On		On	On			On	
78		On	On	On			On	
79	On	On	On	On			On	
80					On		On	
81	On				On		On	
82		On			On		On	

83	On	On			On		On	
84			On		On		On	
85	On		On		On		On	
86		On	On		On		On	
87	On	On	On		On		On	
88				On	On		On	
89	On			On	On		On	
90		On		On	On		On	
91	On	On		On	On		On	
92			On	On	On		On	
93	On		On	On	On		On	
94		On	On	On	On		On	
95	On	On	On	On	On		On	
96						On	On	
97	On					On	On	
98		On				On	On	
99	On	On				On	On	
100			On			On	On	
101	On		On			On	On	
102		On	On			On	On	
103	On	On	On			On	On	
104				On		On	On	
105	On			On		On	On	
106		On		On		On	On	
107	On	On		On		On	On	
108			On	On		On	On	
109	On		On	On		On	On	
110		On	On	On		On	On	

111	On	On	On	On		On	On	
112					On	On	On	
113	On				On	On	On	
114		On			On	On	On	
115	On	On			On	On	On	
116			On		On	On	On	
117	On		On		On	On	On	
118		On	On		On	On	On	
119	On	On	On		On	On	On	
120				On	On	On	On	
121	On			On	On	On	On	
122		On		On	On	On	On	
123	On	On		On	On	On	On	
124			On	On	On	On	On	
125	On		On	On	On	On	On	
126		On	On	On	On	On	On	
127	On							
<b>BACnet WARNING! Addressing in the range below will run devices in BACnet slave mode</b>								
128								On
129	On							On
130		On						On
131	On	On						On
132			On					On
133	On		On					On
134		On	On					On
135	On	On	On					On
136				On				On

137	On			On				On
138		On		On				On
139	On	On		On				On
140			On	On				On
141	On		On	On				On
142		On	On	On				On
143	On	On	On	On				On
144					On			On
145	On				On			On
146		On			On			On
147	On	On			On			On
148			On		On			On
149	On		On		On			On
150		On	On		On			On
151	On	On	On		On			On
152				On	On			On
153	On			On	On			On
154		On		On	On			On
155	On	On		On	On			On
156			On	On	On			On
157	On		On	On	On			On
158		On	On	On	On			On
159	On	On	On	On	On			On
160						On		On
161	On					On		On
162		On				On		On
163	On	On				On		On
164			On			On		On

165	On		On			On		On
166		On	On			On		On
167	On	On	On			On		On
168				On		On		On
169	On			On		On		On
170		On		On		On		On
171	On	On		On		On		On
172			On	On		On		On
173	On		On	On		On		On
174		On	On	On		On		On
175	On	On	On	On		On		On
176					On	On		On
177	On				On	On		On
178		On			On	On		On
179	On	On			On	On		On
180			On		On	On		On
181	On		On		On	On		On
182		On	On		On	On		On
183	On	On	On		On	On		On
184				On	On	On		On
185	On			On	On	On		On
186		On		On	On	On		On
187	On	On		On	On	On		On
188			On	On	On	On		On
189	On		On	On	On	On		On
190		On	On	On	On	On		On
191	On	On	On	On	On	On		On
192							On	On

193	On						On	On
194		On					On	On
195	On	On					On	On
196			On				On	On
197	On		On				On	On
198		On	On				On	On
199	On	On	On				On	On
200				On			On	On
201	On			On			On	On
202		On		On			On	On
203	On	On		On			On	On
204			On	On			On	On
205	On		On	On			On	On
206		On	On	On			On	On
207	On	On	On	On			On	On
208					On		On	On
209	On				On		On	On
210		On			On		On	On
211	On	On			On		On	On
212			On		On		On	On
213	On		On		On		On	On
214		On	On		On		On	On
215	On	On	On		On		On	On
216				On	On		On	On
217	On			On	On		On	On
218		On		On	On		On	On
219	On	On		On	On		On	On
220			On	On	On		On	On

221	On		On	On	On		On	On
222		On	On	On	On		On	On
223	On	On	On	On	On		On	On
224						On	On	On
225	On					On	On	On
226		On				On	On	On
227	On	On				On	On	On
228			On			On	On	On
229	On		On			On	On	On
230		On	On			On	On	On
231	On	On	On			On	On	On
232				On		On	On	On
233	On			On		On	On	On
234		On		On		On	On	On
235	On	On		On		On	On	On
236			On	On		On	On	On
237	On		On	On		On	On	On
238		On	On	On		On	On	On
239	On	On	On	On		On	On	On
240					On	On	On	On
241	On				On	On	On	On
242		On			On	On	On	On
243	On	On			On	On	On	On
244			On		On	On	On	On
245	On		On		On	On	On	On
246		On	On		On	On	On	On
247	On	On	On		On	On	On	On
248				On	On	On	On	On

249	On			On	On	On	On	On
250		On		On	On	On	On	On
251	On	On		On	On	On	On	On
252			On	On	On	On	On	On
253	On		On	On	On	On	On	On
254		On						
255	On							

Table 4. MAC addresses