

## NRFC 413, 422...424: Modbus fan coil thermostat

### How energy efficiency is improved

Precise comfort control in individual rooms through precise temperature detection

### Features

- Single-room controller for heating and cooling by means of air conditioning units in commercial and residential buildings
- For 2- or 4-pipe fan coil units, two-stage heating systems or water-bearing heat pumps
- Can be integrated into building management systems via Modbus/RTU
- Large configurable display with backlight
- Integrated ON/OFF timer
- Deactivatable button operation for public installations
- Valve control via 2-point or 0...10 V output
- Supports 3-speed fans or fans with EC motor
- Summertime/wintertime change-over in 2-pipe applications
- Automatic deactivation of internal temperature sensor when using a cable temperature sensor
- Installation via mounting plate without opening the controller
- Universal design and low installation height of 14 mm for inconspicuous fitting



NRFC413MF111

### Technical data

#### Power supply

Power supply	100...240 V~, 50/60 Hz
Power consumption	5 VA

#### Ambient conditions

Ambient temperature	0...40 °C
Ambient humidity	10...90% rh, no condensation
Storage and transport temperature	-10...60 °C

#### Inputs/outputs

Inputs	Temperature sensor	NTC 10k
	Digital input	closed < 0.3 V= open > 0.7 V=
	Analogue input	0...10 V
Outputs	Analogue output U	0...10 V (100 kΩ)
	Relay output	2.2 A (I <sub>R</sub> ); 3.6 A (I <sub>X</sub> ) cos φ 0.98 each at 240 V~

#### Interfaces, communication

RS-485	Communication protocol	Modbus/RTU
	Connection	Screw terminal, 3-pole 0.14...1.5 mm <sup>2</sup> rigid A (D+) / B (D-)
	Bus speed	4800, 9600 bit/s (adjustable)
	Address range	164
	Function codes	01, 03, 04, 06, 16
	CRC check	CRC-16
	Data type	u16
	Data format	10 bit, 1 start, 8 data, 1 stop, no parity
	Indicator/display	LCD display with backlight (adjustable)
	Buttons	6

#### Construction

Weight	0.3 kg
Dimensions W × H × D	88 × 88 × 46.2 mm
Housing	Upper and lower part white
Housing material	Polycarbonate
Fitting	On round or square recessed box



Standards, directives		
	Type of protection	IP20 (EN 60529)
	Protection class	II as per IEC 60730
CE conformity according to	EMC Directive 2014/30/EU	EN 60730-1, EN 60730-2-9 residential premises Type1.C
	Low-Voltage Directive 2014/35/EU	EN 60730-1, EN 60730-2-9
	RoHS Directive 2011/65/EU	EN IEC 63000

### Inputs/outputs

Type	AI	DI	AO	DO
NRFC413MF111	1 × NTC, 1 × 0...10 V	1	1	3 × relay (single-pole normally-open contact)
NRFC422MF111	1 × NTC	1	0	5 × relay (single-pole normally-open contact)
NRFC423MF111	1 × NTC	1	2	3 × relay (single-pole normally-open contact)
NRFC424MF112	1 × NTC	1	2	3 × relay (single-pole normally-open contact)

### Overview of types

Type	Description	Fan
NRFC413MF111	2-pipe, continuous, with positional feedback signal	3 speeds
NRFC422MF111	2-pipe or 4-pipe, 2-point	3 speeds
NRFC423MF111	2-pipe or 4-pipe, continuous	3 speeds
NRFC424MF112	2-pipe or 4-pipe, 2-point or 2-pipe, continuous	EC motor with cut-off function

## Description of operation

NRFC4\* is a parameterisable single-room controller with Modbus/RTU communication function. With its fixed applications, the NRFC4\* is specially designed for use with fan coil units (FCU) and can be used as a zone controller in residential and commercial buildings in combination with a Modbus/RTU network.

The single-room controller detects the room temperature with its integrated temperature sensor and compares it with the setpoint temperature. In the event of a deviation, the heating valve is opened in heating mode, and the cooling valve is opened for cooling mode. At the same time, the connected fan is activated depending on the control deviation and the set configuration. A connectable remote sensor can be used either for detecting the room temperature or as a changeover (C/O) sensor in 2-pipe systems. By means of parameterisation, the digital input can be assigned the presence signal function, dew point monitor or detection of a fault message in combination with a filter.

### NRFC413MF111

The NRFC413MF111 is suitable for use in 2-pipe systems in combination with a valve for dynamic hydronic balancing (PICV) and 0...10 V actuator control. If an analogue feedback signal is available on the actuator, this can be transmitted to the building management system via Modbus for monitoring. A 3-speed fan can be controlled via three integrated relays. In a 2-pipe configuration, summertime/wintertime changeover (auto-changeover) can be automatically detected if an NTC cable temperature sensor is installed on the supply pipe.

### NRFC422MF111

The NRFC422MF111 is suitable for 2-pipe or 4-pipe systems. The valve actuator is controlled via 2-point control. A 3-speed fan can be controlled via three integrated relays. In a 2-pipe configuration, summertime/wintertime changeover (auto-changeover) can be automatically detected if an NTC cable temperature sensor is installed on the supply pipe.

The configuration for the underfloor heating is 2-step heating. In wintertime mode, the valve for the underfloor heating is activated in the first step. The second step is activated when the temperature difference between the setpoint and the room temperature is greater than the value of the intermediate step, which was set in the configuration. In the second step, the second valve opens and the fan starts. In summertime mode, the single-room controller operates as a 2-pipe system with a cooling register and a 3-speed fan. The valve for the underfloor heating is then not activated.

In the configuration with an electrostatic filter (TiO<sub>2</sub>/ESP)<sup>1)</sup> this can be activated via the single-room controller. In this case, the digital input can be used to detect a fault in the air purifier.

<sup>1)</sup> Titanium oxide/electrostatic precipitator: Air purifier with (photo)catalytic filter

### NRFC423MF111

In conjunction with a 3-speed fan, the NRFC423MF111 can be used in 2-pipe and 4-pipe systems with continuous valve actuators for heating and cooling. In a 2-pipe configuration, summertime/wintertime changeover (auto-changeover) can be automatically detected if an NTC cable temperature sensor is installed on the supply pipe.

### NRFC424MF112

For fan coil units with EC motor<sup>2)</sup> the NRFC424MF112 provides a 0...10 V signal to control the motor. This can be limited by means of min. and max. parameters. A relay can be used to interrupt the supply voltage to the motor when the single-room controller is switched off. The single-room controller supports 2-pipe and 4-pipe applications with 2-point actuators as well as 2-pipe applications with 0...10 V actuators. In a 2-pipe configuration, summertime/wintertime changeover (auto-changeover) can be automatically detected if an NTC cable temperature sensor is installed on the supply pipe.

The configuration for the underfloor heating is 2-step heating. In winter mode, the valve for the underfloor heating is activated in the first step. The second step is activated when the temperature difference between the setpoint and the room temperature is greater than the value of the intermediate step, which was set in the configuration. In the second step, the second valve opens and the fan starts. In summertime mode, the single-room controller operates as a 2-pipe system with a cooling register and a 3-speed fan. The valve for the underfloor heating is then not activated.

In the configuration with an electrostatic filter (TiO<sub>2</sub>/ESP<sup>3)</sup>, this can be activated via the single-room controller. In this case, the digital input can be used to detect a fault in the air purifier

### Intended use

This product is only suitable for the purpose intended by the manufacturer, as described in the "Description of operation" section. All related product regulations must also be adhered to. Modifying or converting the product is not admissible.

Only use this single-room controller as a control element. In cases where a failure or malfunction of the single-room controller could result in personal injury or damage to the controlled system or other property, additional precautions must be built into the system. Other devices such as monitoring or alarm systems or safety or limit controls that are intended to warn or protect against failure or malfunction of the single-room controller must be integrated into the system and maintained.

### Engineering notes

The NRFC4\* is a single-room controller suitable for indoor installation. The most suitable place of installation is approx. 1.5 m above the floor and must be protected from direct sunlight, draughts and sources of heat or cold. The installation is carried out on recessed junction boxes with a minimum diameter of 60 mm.

### Fitting and installation



#### Danger - Electrical voltage!

Contact with components carrying dangerous voltages, an ungrounded thermostat as well as uninsulated, unsecured cables can cause electric shock and result in property damage, serious injury, or death.

- ▶ Disconnect the device from power supply before making any electrical connections.
- ▶ Insulate and secure all unused cables and wires before applying voltage to the thermostat.

The following conditions must be met or observed during the installation:

- Connection may only be performed when the system is disconnected from the electrical supply.
- The unit must be protected against contact.
- There must be an external primary isolating facility.
- The connection to terminal MM may not be interrupted by switching elements.
- The device must not be installed in vibrating systems (e.g. means of transport such as ships) because the vibrations can cause micro-interruptions in the relays.
- In series to terminal L (power supply 230 V~), a suitable external fuse (5 A slow-blow) must be installed in accordance with applicable installation regulations.
- The plant devices are connected via screw terminals with the appropriate torques (see fitting instructions).

<sup>2)</sup> EC motor: Electronically commutated synchronous motor

<sup>3)</sup> Titanium oxide/electrostatic precipitator: Air purifier with (photo)catalytic filter

- For terminals on the terminal block for the signal low voltage, the permissible conductor cross-section is min. 0.14 mm<sup>2</sup> and max. 1.5 mm<sup>2</sup>.
- For the terminals on the terminal block for the mains power supply and relays, the permissible conductor cross-section is min. 1.0 mm<sup>2</sup> and max. 1.5 mm<sup>2</sup>.
- Remove the plastic cover of the LCD before use.

Special standards such as IEC/EN 61508, IEC/EN 61511, IEC/EN 61131-1 and -2 and similar were not taken into account. Local requirements regarding installation, usage, access, access rights, accident prevention, safety, dismantling and disposal must be taken into account. Furthermore, installation standards EN 50178, 50310, 50110, 50274, 61140 and similar must be observed. The communication wiring (RS-485) must be isolated from current-carrying and live installations.

#### Note



- When installing on a recessed junction box, make sure that if the cable is routed through an installation pipe, this is protected against draughts. Otherwise, temperature measurement errors may occur.
  - Terminals in the connection area that are not labelled must not be used.
  - Do not install the device in environments with condensation or which are wet or humid. Humidity can cause damage to the single-room controller.
  - Do not remove the printed circuit board from the housing cover. Removing the PCB from the housing cover will void the product warranty.
  - Do not use chemicals aggressive to polycarbonate or sharp and pointed objects to clean the surfaces.
- For further safety instructions, information and guidelines, see fitting instructions P100019338.

### Power supply

The device is suitable for operation at 100...240 V~.

### Commissioning

#### Note



- After commissioning, it may take up to one hour for a thermal balance to be set in the single-room controller and for the measured values to be stable.
- When installing on a recessed junction box, make sure that if the cable is routed through an installation pipe, this is protected against draughts. Otherwise, temperature measurement errors may occur. In the event of a measurement deviation, this can be compensated.

### Operation

All devices have the same number of buttons and operating logic.



- (1) ON/OFF. The NRFC can be switched off with the ON/OFF button. When switching off, the power supply to the fan and the valve is interrupted
- (2) Selection of operating mode: Auto/Heat/Cool/Ventilate. In a 2-pipe application, this button can be used to switch between heating, cooling and ventilation only. In a 4-pipe application, this can be used to switch between heating, cooling and AUTO operating modes

- (3) Activate TiO<sub>2</sub>/ESP filter relay output (press for 1 second), program ON/OFF timer (press for 3 seconds). The Timer ON/OFF function allows the user to activate a delay for the room controller to switch off. A delay time of up to 24 hours in 30 minute increments is possible. A start-up delay for the device can also be defined. The electrostatic filter (TiO<sub>2</sub>/ESP) can be switched on/off with button (3). Alternatively, the filter operation is defined to work in parallel with the fan. In this configuration, one of the relays will then be used to operate the filter unit
- (4) Fan speed selection: low, medium, high and automatic
- (5) Up button: Increases a value, e.g. the setpoint
- (6) Down button: Decreases a value, e.g. the setpoint

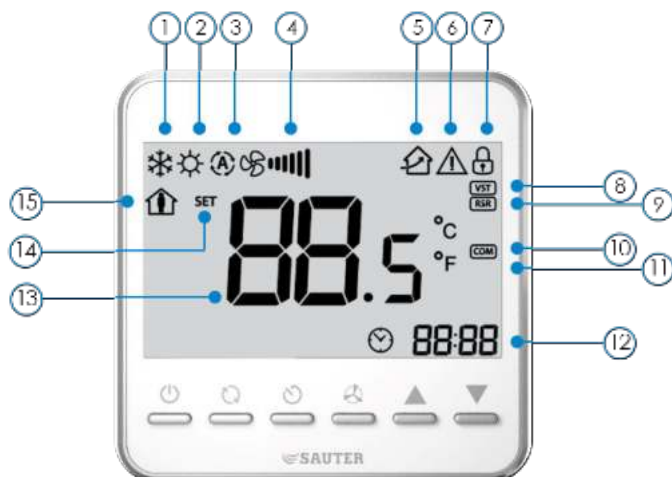
### Button lock

To prevent unwanted or improper operation in public areas, the buttons can be disabled. The following button combinations can be disabled:

- All buttons,
- All buttons except fan and setpoint,
- On/Off only and clock functions.

When a button lock is active, pressing the fan button for 5 seconds will temporarily unlock it. The button lock can be activated or deactivated via parameter input on the display or by setting a Modbus parameter.

### Display functions








- (1) Cooling mode
- (2) Heating mode
- (3) Automatic mode if the changeover is set to Auto
- (4) Fan speed: low, medium, high, automatic
- (5) Filter alarm flashes when active
- (6) Error or dew point alarm
- (7) Keys locked
- (8) Valve open
- (9) Remote sensor connected
- (10) Flashes when Modbus communication is lost
- (11) Temperature unit; Celsius or Fahrenheit
- (12) Timer ON/OFF indicates next activation in hh:mm
- (13) Temperature setpoint and actual value display
- (14) SET is activated when setpoint is displayed
- (15) Status indicator: occupied / not occupied

### Backlight

The NRFC4\* has a backlight that makes the display easy to read. The backlight switches on when a key is pressed and switches off automatically after a parameterised time.

## Service parameters

To activate the service menu, when the NRFC4\* is switched off, press the  and  keys simultaneously for 5 seconds. The code 01 is displayed. Pressing the operating mode selector  activates the next code. The parameter value can be set using the  and  keys. Set parameters are automatically adopted. The available parameters depend on the model installed (see parameter table).

Code	Parameter	Default	Function	NRFC 423MF111	NRFC 424MF112	NRFC 422MF111	NRFC 413MF111
01	Max. setpoint limit	35 °C	Setting range 0...40 °C (36...99 °F)	•	•	•	•
02	Min. setpoint limit	5 °C	Setting range 0...38 °C (32...95 °F)	•	•	•	•
03	Application		00: 2-pipe ON/OFF valve 01: 4-pipe ON/OFF valve 02: 2-pipe ON/OFF 3-point valve 03: 2-pipe ON/OFF valve with TiO <sub>2</sub> /ESP relay 04: 2-pipe ON/OFF valve with underfloor heating 05: Water heat pump 06: 2-pipe proportional valve		•		
03	Application		00: 2-pipe proportional valve 01: 4-pipe proportional valve	•			
03	Application		00: 2-pipe ON/OFF valve 01: 4-pipe ON/OFF valve 02: 2-pipe ON/OFF 3-point valve 03: 2-Pipe ON/OFF valve with TiO <sub>2</sub> /ESP relay 04: 2-pipe ON/OFF valve with underfloor heating 05: Water heat pump			•	
04	Cooling setpoint not occupied	26 °C	Setting range 22...32 °C (72...90 °F)	•	•	•	•
05	Heating setpoint not occupied	18 °C	Setting range 10...21 °C (50...70 °F)	•	•	•	•
06	Frost protection		00: ON 01: OFF	•	•	•	•
07	Frost protection setpoint	5 °C	Setting range 0...20 °C (32...68 °F)	•	•	•	•
08	Fan speed in AUTO mode as soon as the controller is in the dead zone (room temperature reaches setpoint)	01	00: Fan off 01: LOW	•	•	•	•
09	Fan speed not occupied	00	00: LOW 01: Fan speed manually adjustable	•	•	•	•
10	ECM min. voltage	3 V	Min. voltage below which the fan output is 0%. Adjustable range 0...10 V (0.5 V increments)		•		
11	ECM max. voltage	10 V	Max. voltage above which the fan output is 100%. Adjustable range 0...10 V (0.5 V increments)		•		
12	ECM relay (F-ON)	00	00: Deactivated 01: Activated		•		
13	Operation after return of power supply		00: Last status 01: ON 02: OFF	•	•	•	•
14	Keys locked	00	00: No keys locked 01: Lock all keys 02: Lock all keys except fan speed and setpoint entry 03: Lock ON/OFF and ON/OFF timer 04: Lock all keys except ON/OFF key	•	•	•	•
15	Display	00	00: Room temperature 01: Room setpoint	•	•	•	•
16	Automatic changeover	00	00: Deactivated 01: Activated (2-pipe systems require 10k NTC installed on the pipe)	•	•	•	•



Code	Parameter	Default	Function	NRFC 423MF111	NRFC 424MF112	NRFC 422MF111	NRFC 413MF111
17	Function of digital input (OCC)	00	00: open → occupied, closed → not occupied (setpoint decrease) 01: closed → occupied, open → not occupied (setpoint decrease) 02: closed → dew point reached, open → dew point not reached 03: open → dew point reached, closed → dew point not reached 04: open → occupied, closed → not occupied (fan off, valve closed) 05: closed → filter alarm 06: open → filter alarm	.	.	.	.
18	Temperature unit	00	00: Degrees Celsius (°C) 01: Degrees Fahrenheit (°F)	.	.	.	.
19	Sensor compensation	0	Setting range -5...5 °C (-9...9 °F)	.	.	.	.
20	Fan speed limitation (not available with ECM fan in AUTO mode)	00	00: 3-speed 01: 2-speed (wiring MED, LOW) 02: 1-speed (wiring LOW) 03: Fan deactivated	.	.	.	.
21	Language	01	00: Chinese 01: English	.	.	.	.
22	Operating modes	00	00: Heating/cooling/ventilation 01: Cooling only 02: Heating only	.	.	.	.
23	Display backlight	30	Setting range 0...60 seconds; backlight is deactivated after set time	.	.	.	.
25	Remote sensor	01	00: Third-party 10k NTC 01: SAUTER 10k NTC	.	.	.	.
26	Modbus address	1	1...64	.	.	.	.
27	Baud rate	00	00: 9600 01: 4800	.	.	.	.
28	Scan time	10	Setting range 1...99 seconds (floating point number *10)	.	.	.	.
29	Dead zone	1	Setting range 0...10 °C (32...50 °F)	.	.	.	.
30	KP (PB = 100/KP)	10	Setting range 1...99	.	.	.	.
31	KI (integral gain)	01	Setting range 1...99	.	.	.	.
32	TiO <sub>2</sub> /ESP control	00	00: Separate control (briefly press timer button to activate) 01: Common control with fan-coil controller	.	.	.	.
33	Switching difference for underfloor heating	3	Setting range 0...10 °C (32...50 °F)	.	.	.	.
34	Number of switch positions for underfloor heating	00	00: 2-position 01: 1-position	.	.	.	.
37	Timer for fan switch-off (setting of time delay for fan switch-off)	00	0...99 seconds	.	.	.	.

## Error messages

### Error message on the display

The following errors are displayed instead of the temperature when they occur:

Error code	Meaning
E1	Warning: Internal sensor short-circuited. Valve and fan are switched off.
E2	Warning: Internal sensor is open. Valve and fan are switched off.
HI	Warning: High temperature. Room temperature > 55 °C
LO	Warning: Low temperature. Room temperature < 0 °C
E3	Remote sensor short-circuited. Active only with 2-pipe application and auto changeover.
E4	Remote sensor is interrupted. Active only with 2-pipe application and auto changeover.
E5	Warning: Dew point risk. Valve and fan are switched off.
<b>COM</b>	Symbol flashes when Modbus connection is interrupted.

Error code	Meaning
	Symbol flashes when a filter alarm is active.
	Symbol active when an error has been detected and/or a dew point alarm is active.

### Error message via Modbus

The following error messages can be read out via Modbus.

Function code	Address	Description
03 + 04	4	01: Warning: Internal sensor short-circuited. Valve and fan are switched off 02: Warning: Internal sensor is open. Valve and fan are switched off 03: Warning: High temperature. Room temperature > 55 °C. Warning: Low temperature. Room temperature < 0 °C 04: Remote sensor short-circuited. Active only with 2-pipe application and auto changeover 05: Remote sensor is interrupted. Active only with 2-pipe application and auto changeover 06: Warning: Dew point risk. Valve and fan are now switched off

### Modbus/RTU

All NRFC4\*\* have Modbus/RTU communication, which can be used to transfer information to a higher-level building automation system. Up to 32 single-room controllers can be addressed on a bus. The following states can be read out, or commands sent, via Modbus:

- Switch single-room controller on/off
- Read out room temperature
- Change the setpoint of the room temperature
- Determine fan speed
- Set occupied or unoccupied status with corresponding setpoint reduction
- Lock the keypad
- Change the application

The following function codes are supported:

	Function code
01	Read Coil
03	Read Holding Registers
04	Read Input Registers
06	Write Single Holding Register
16	Write Multiple Holding Registers

### Modbus – parameter list

Function code	Address	Description	Value
01	1	Relay 4	0: OFF 1: ON
01	2	Relay 5	0: OFF 1: ON
01	3	Relay 1	0: OFF 1: ON
01	4	Relay 2	0: OFF 1: ON
01	5	Relay 3	0: OFF 1: ON
04	1	Device type	Device type and application <sup>4)</sup>
04	2	Room temperature	Room temperature (0...99 °C) <sup>5)</sup>
04	3	Occupancy status	00: Not occupied 01: Occupied

<sup>4)</sup> Store higher 8 bits device type and store low bits application parameters.

<sup>5)</sup> Raw values for temperatures must be calculated using a factor of 10. Example: 265 / 10 = 26.5 °C



Function code	Address	Description	Value
04	4	Error messages	01: Warning: Internal sensor short-circuited. Valve and fan are switched off 02: Warning: Internal sensor is open. Valve and fan are switched off 03: Warning: High temperature. Room temperature > 55 °C Warning: Low temperature. Room temperature < 0 °C 04: Remote sensor short-circuited. Active only with 2-pipe application and auto changeover 05: Remote sensor is interrupted. Active only with 2-pipe application and auto changeover 06: Warning: Dew point risk. Valve and fan are now switched off
03 + 06 + 16	1	Device type	Device type and application <sup>6)</sup>
03 + 06 + 16	2	Room temperature	Room temperature (0...99 °C) <sup>7)</sup>
03 + 06 + 16	3	Occupancy status	00: Not occupied 01: Occupied
03 + 06 + 16	4	Error messages	01: Warning: Internal sensor short-circuited. Valve and fan are switched off 02: Warning: Internal sensor is open. Valve and fan are switched off 03: Warning: High temperature. Room temperature > 55 °C Warning: Low temperature. Room temperature < 0 °C 04: Remote sensor short-circuited. Active only with 2-pipe application and auto changeover 05: Remote sensor is interrupted. Active only with 2-pipe application and auto changeover 06: Warning: Dew point risk. Valve and fan are now switched off
03 + 06 + 16	5	Power	0: OFF 1: ON
03 + 06 + 16	6	Operating mode	0: Cooling 1: Heating 2: Ventilation
03 + 06 + 16	7	Setpoint	Room temperature setpoint (0...99 °C) <sup>8)</sup>
03 + 06 + 16	8	Fan speed	00: Low 01: Medium 02: High 03: Auto
03 + 06 + 16	9	Max. setpoint limit	Setting range 0...40 °C <sup>8)</sup>
03 + 06 + 16	10	Min. setpoint limit	Setting range 0...38 °C <sup>8)</sup>
03 + 06 + 16	11	Cooling setpoint not occupied	Setting range 22...32 °C <sup>8)</sup>
03 + 06 + 16	12	Heating setpoint not occupied	Setting range 10...21 °C <sup>8)</sup>
03 + 06 + 16	13	Frost protection	0: OFF 1: ON
03 + 06 + 16	14	Frost protection setpoint	Setting range 0...20 °C <sup>8)</sup>
03 + 06 + 16	15	Fan dead zone	00: OFF 01: LOW
03 + 06 + 16	16	Fan speed not occupied	00: LOW 01: Fan speed manually adjustable
03 + 06 + 16	17	Operation after return of power supply	00: Last status 01: ON 02: OFF
03 + 06 + 16	18	Keys locked	00: No keys locked 01: Lock all keys 02: Lock all keys except fan speed and setpoint entry 03: Lock ON/OFF and ON/OFF timer 04: Lock all keys except ON/OFF key
03 + 06 + 16	19	Display	00: Room temperature 01: Room setpoint
03 + 06 + 16	20	Function of digital input	00: Open → occupied, closed → not occupied (setpoint decrease) 01: Closed → occupied, open → not occupied (setpoint decrease) 02: Closed → dew point reached, open → dew point not reached 03: Open → dew point reached, closed → dew point not reached 04: Open → occupied, closed → not occupied (fan off, valve closed) 05: Closed → filter alarm 06: Open → filter alarm
03 + 06 + 16	21	Temperature unit	00: Degrees Celsius (°C) 01: Degrees Fahrenheit (°F)
03 + 06 + 16	22	Sensor compensation	Setting range -5...5 °C <sup>8)</sup>

<sup>6)</sup> Store higher 8 bits device type and store low bits application parameters.

<sup>7)</sup> Raw values for temperatures must be calculated using a factor of 10. Example: 265 / 10 = 26.5 °C

<sup>8)</sup> Raw values for temperatures must be calculated using a factor of 10. Example: 26.5 °C \* 10 = 265

Function code	Address	Description	Value
03 + 06 + 16	23	Limitation of fan speed	00: 3-speed 01: 2-speed 02: 1-speed 03: Fan deactivated
03 + 06 + 16	24	Language	00: Chinese 01: English
03 + 06 + 16	25	Operating modes	00: Heating/cooling/ventilation 01: Cooling only 02: Heating only
03 + 06 + 16	26	Display backlight	Setting range 0...60 seconds; backlight is deactivated after set time
03 + 06 + 16	28	Remote sensor	00: Third-party 10k NTC 01: SAUTER 10k NTC
03 + 06 + 16	29	Dead zone	Setting range 0...10 °C <sup>9)</sup>
03 + 06 + 16	30	Automatic changeover	00: Deactivated 01: Activated
03 + 06 + 16	31	ECM min. voltage	Min. voltage below which the fan output is 0%. Adjustable range 0...10 V (0.5 V increments) <sup>10)</sup>
03 + 06 + 16	32	ECM max. voltage	Max. voltage above which the fan output is 100%. Adjustable range 0...10 V (0.5 V increments) <sup>10)</sup>
03 + 06 + 16	33	ECM relay	00: Deactivated 01: Activated
03 + 06 + 16	34	Scan time	Setting range 1...99 seconds <sup>10)</sup>
03 + 06 + 16	35	P band	Setting range 1...99 <sup>10)</sup>
03 + 06 + 16	36	Integral gain	Setting range 1...99 <sup>10)</sup>
03 + 06 + 16	37	Switching difference for under-floor heating	Setting range 0...10 °C <sup>9)</sup> Switching between level 1 and level 2
03 + 06 + 16	38	Number of switch positions for underfloor heating	00: 2-position 01: 1-position
03 + 06 + 16	39	TiO <sub>2</sub> /ESP control	00: Separate control 01: Common control with fan-coil controller
03 + 06 + 16	43	TiO <sub>2</sub> /ESP relay	00: OFF 01: ON
03 + 06 + 16	44	AO1	PWM switch-on time 0...100%
03 + 06 + 16	45	AO2/AI	AO → PWM switch-on time 0...100% AI → 0...10 V (0...100%) <sup>9)</sup>

## Additional information

Fitting instructions

P100019338

## Disposal

When disposing of the product, observe the currently applicable local laws.

More information on materials can be found in the Declaration on materials and the environment for this product.

## RS-485 bus wiring

The RS-485 network for field bus protocols must be implemented as per ANSI/TIA/EIA-485-A [half duplex (A (D+)/ B (D-)), galvanically isolated (COM reference), network resistors with Pull-Up (PU), Pull-Down (PD), line-end resistors (EOL: End of Line Termination)]. The devices do not have internal terminating resistors. Therefore, a terminating resistor of 120 Ω (0.25 W) must be connected at the start and end of the bus line, parallel to the A (D+) / B (D-) data lines. It is recommended to use a shielded, twisted cable (1×2+1-wire, 2×2-wire) specifically for RS-485. It is also possible to use J-Y(ST)Y cables taking into account the cable impedance of 100...120 Ω and sufficient diameter (0.8 mm or 0.5 mm<sup>2</sup>). The cable routing must be carried out in line topology. The cable shield of the entire bus line must be connected continuously, and connected to protective earth as directly as possible at one location. The shielding is to be earthed in the plant as follows:

<sup>9)</sup> Raw values for temperatures must be calculated using a factor of 10. Example: 26.5 °C \* 10 = 265

<sup>10)</sup> Raw values for floating point numbers must be calculated using a factor of 10

- Shielding earthed at one end is suitable for protection from electrical interference (from overhead power lines, static charges etc.)
- Shielding earthed at both ends is suitable for protection from electromagnetic interference (from frequency converters, electric motors, coils etc.)

The maximum cable length is 1000 m and depends on the cable type used and the correct termination. The length of the bus wiring is limited by the following parameters:

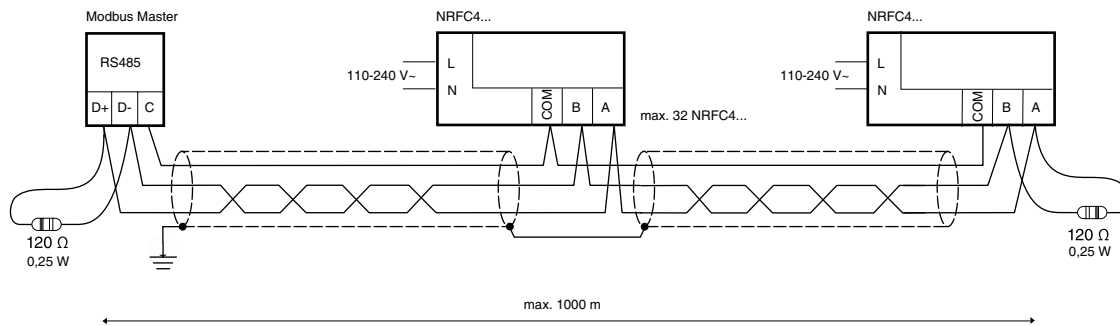
- Number of connected devices
- Cross-section of cable used

The baud rate can be 4800 or 9600 bit/s.

**Note**



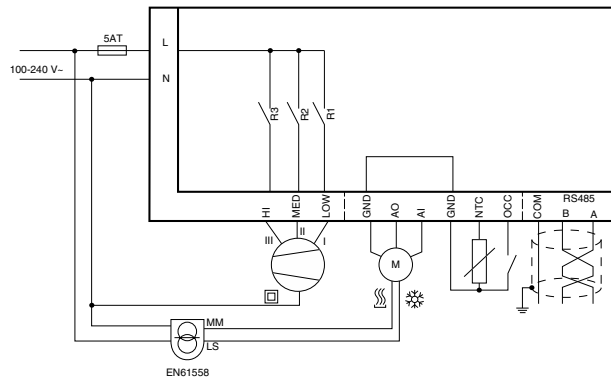
Faulty wiring can result in damage to the device. All the devices in a network must be connected to the same power supply.



**Connection diagrams**

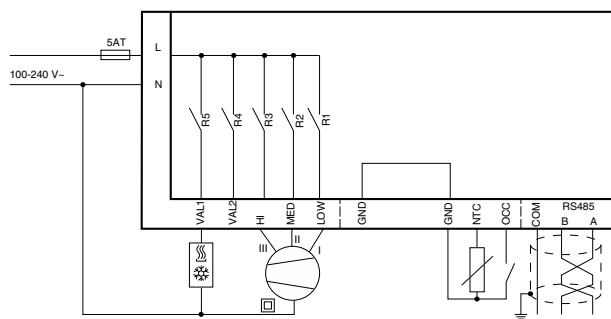
**NRFC413MF111**

2-pipe, proportional, with PICV (not configurable)



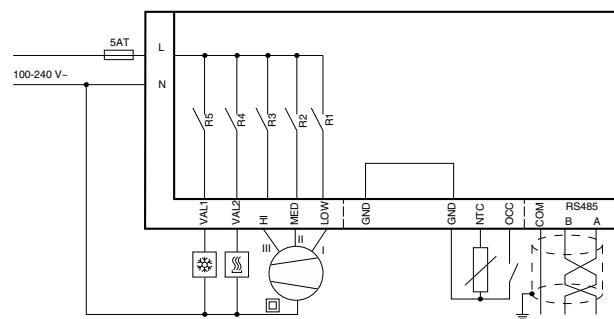
**NRFC422MF111**

2-pipe, ON/OFF, 3-speed fan (parameter 03 set to 00)

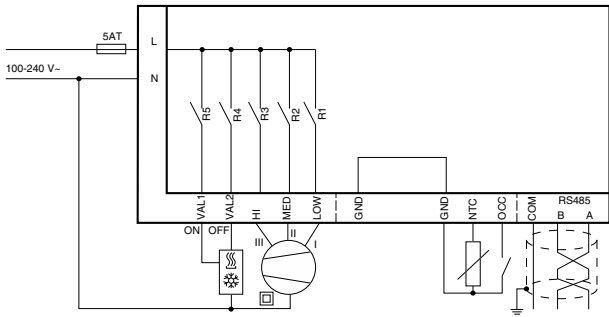


2-pipe, ON/OFF, 3-wire valve (parameter 03 set to 02)

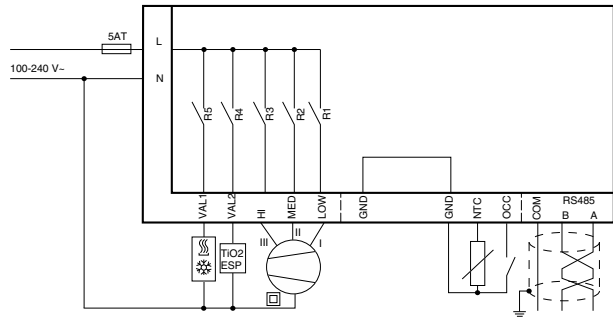
4-pipe, ON/OFF, 3-speed fan (parameter 03 set to 01)



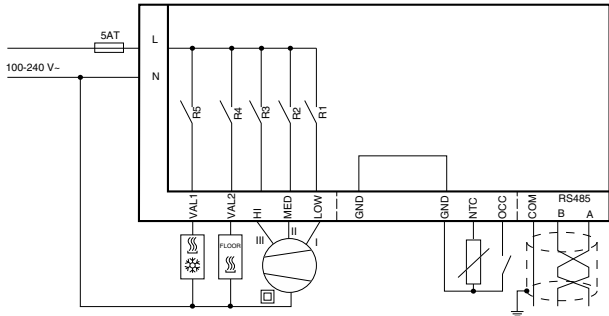
2-pipe, ON/OFF, with TiO<sub>2</sub>/ESP (parameter 03 set to 03)



2-pipe, ON/OFF, with underfloor heating (parameter 03 set to 04)

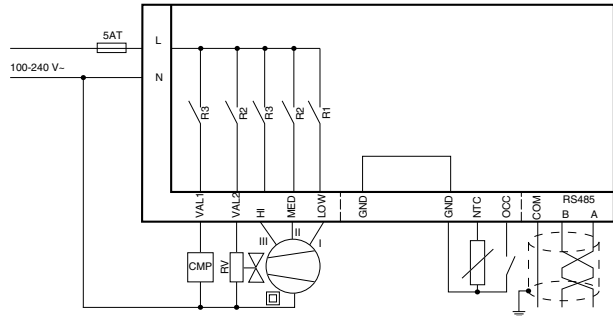


Water supply heat pump (parameter 03 set to 05)

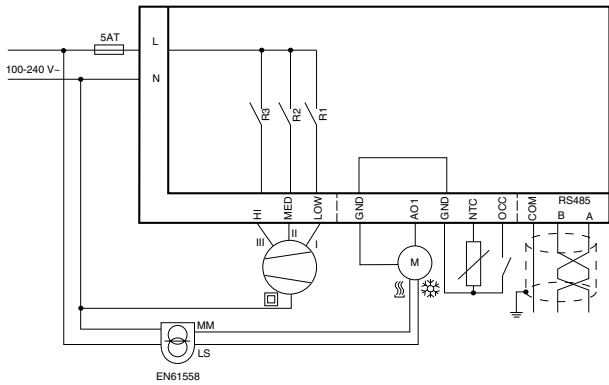


**NRFC423MF111**

2-pipe, proportional, 3-speed fan (parameter 03 set to 00)

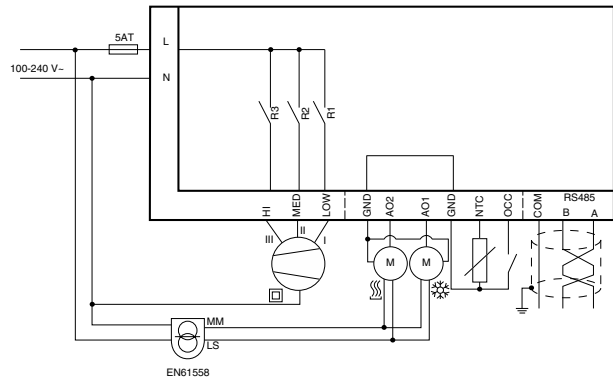


4-pipe, proportional, 3-speed fan (parameter 03 set to 01)

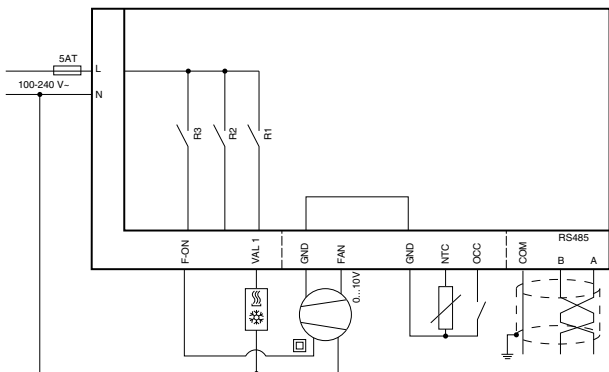


**NRFC424MF112**

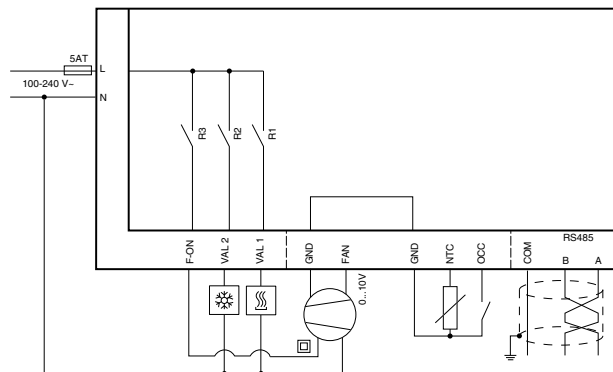
2-pipe, ON/OFF, with ECM fan (parameter 03 set to 00)



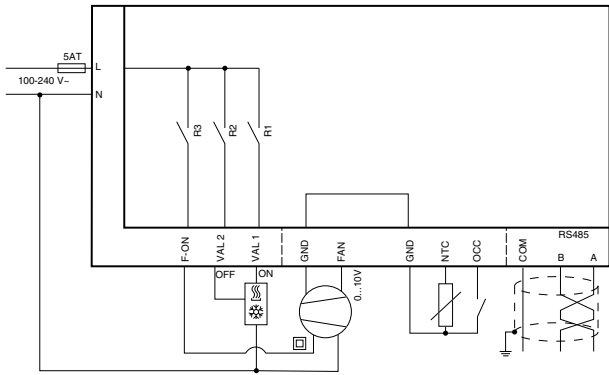
4-pipe, ON/OFF, with ECM fan (parameter 03 set to 01)



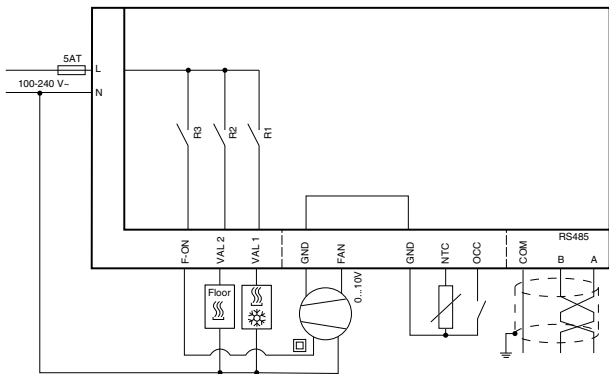
2-pipe, ON/OFF, 3-wire valve (parameter 03 set to 02)



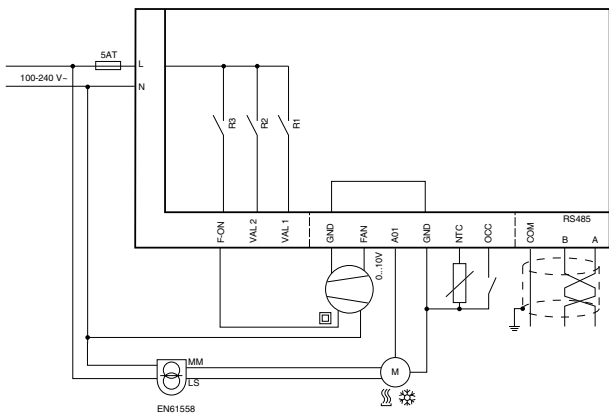
2-pipe, ON/OFF, with TIO<sub>2</sub>/ESP (parameter 03 set to 03)



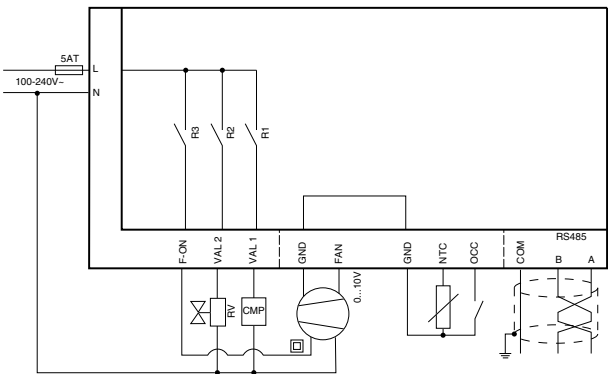
2-pipe, ON/OFF, with underfloor heating (parameter 03 set to 04)



2-pipe, proportional, ECM fan (parameter 03 set to 06)



Water supply heat pump (parameter 03 set to 05)



## Dimension drawing

All dimensions in mm.

