


# Fan coil controller TRA-F22x-A

**Fan coil controller for 3-speed fans with modulating valves and two external inputs standalone, BACnet MS/TP or Modbus.**

## General Description

The TRA-F22x-A is an electronic fan coil controller for room temperature control. It supports motorized valves and 1- or 3-speed fans in 2-pipe and 4-pipe fan coil units for heating or cooling. Additional inputs can be used for an external temperature sensor, room occupancy (motion) detection and other functions. The controller offers Comfort, Economy and Protection operating modes. The TRA-F221-A includes a MODBUS RTU and the TRA-F222-A a BACnet MS/TP interface. Both types can be easily integrated into a building automation system.

Typical application includes:

- Fan coil systems
  - 2-pipe fan coil (cooling or heating on/off or modulating valves)
  - 2-pipe fan coil with 3-point valve (cooling or heating valve)
  - 2-pipe fan coil and electric heater
  - 4-pipe fan coil (cooling and heating on/off or modulating valve)
- Floor heating systems (on/off or 3-point valve)
- Chilled/Heated ceilings or chilled beams systems (on/off or 3-point valve)

## Features

- LCD display with backlight
- Room temperature control via built-in temperature sensor
- 2 configurable inputs temperature or digital
- 2 analog outputs for modulating valve control or analog fan
- 3 digital outputs for 1- or 3-speed fan control or digital valves (on/off or 3-position valve)
- Comfort, Economy and Protection operating mode
- Display of current room temperature or temperature set point in °C or °F
- Display of outdoor temperature received from Modbus master
- Manual or automatic heating / cooling changeover
- Select operating mode via operating mode button on the controller
- Minimum and maximum limitation of room temperature set point
- Floor heating temperature limitation
- Key lock function
- BACnet MS/TP interface (TRA-F222 only)
- RTU Modbus slave interface (TRA-F221 only)
- Reload default settings for commissioning and control parameters
- 100…240 VAC operating voltage
- Flush mount on all 75x75x35mm wall mounting box or larger boxes
- Selection of application via parameter
- No data loss on power fail


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## Types and Ordering

| Product Name | Product No. | Description / Type | Size / Length | Weight |
|---|---|---|---|---|
| ***Controller*** | | | | |
| TRA-F220-A | 40-100274 | Fan coil controller standalone | 88 x 88 x 41 mm (3.5 x 3.5 x 1.6 in) | 168 g (5.92 oz) |
| TRA-F221-A | 40-100256 | Fan coil controller with Modbus | 88 x 88 x 41 mm (3.5 x 3.5 x 1.6 in) | 168 g (5.92 oz) |
| TRA-F222-A | 40-100311 | Fan coil controller with BACnet | 88 x 88 x 41 mm (3.5 x 3.5 x 1.6 in) | 168 g (5.92 oz) |
| ***Installation box (optional)*** | | | | |
| AMB-001 | 40-510009 | Flush mounting installation box | 80 x 80 x 40 mm (3.2 x 3.2 x 1.6 in) | 40 g (1.41 oz) |
| AMB-006 | 40-510101 | Surface mounting installation box | 82 x 82 x 36 mm (3.2 x 3.2 x 1.4 in) | 41 g (1.44 oz) |
| ***Passive temperature sensor with flying lead (NTC 10kΩ at 25 ºC (77 °F))*** | | | | |
| S-Tn10-2 | 40-200001 | - | 2 m (6 ft.) PVC cable | - |
| S-Tn10-6 | 40-200142 | - | 6 m (19 ft.) PVC cable | - |
| ***Passive temperature sensor for duct mounting (NTC 10kΩ at 25 ºC (77 °F))*** | | | | |
| SD-Tn10-12-2 | 40-200002 | 12 cm (4.7 inch) probe | 2 m (6 ft.) PVC cable | - |
| SD-Tn10-20-2 | 40-200003 | 20 cm (7.8 inch) probe | 2 m (6 ft.) PVC cable | - |
| SDB-Tn10-12-1 | 40-200124 | 12 cm (4.7 inch) probe | - | - |
| SDB-Tn10-20-1 | 40-200133 | 20 cm (7.8 inch) probe | - | - |
| ***Passive temperature sensor for contact mounting on pipes (NTC 10kΩ at 25 ºC (77 °F))*** | | | | |
| SC-Tn10-2 | 40-200095 | - | 2 m (6 ft.) PVC cable | - |
| SC-Tn10-6 | 40-200159 | - | 6 m (19 ft.) PVC cable | - |
| ***Passive temperature sensor for indoor mounting (NTC 10kΩ at 25 ºC (77 °F))*** | | | | |
| SRA-Tn10 | 40-200005 | Indoor temperature sensor | 88 x 88 x 21 mm (3.5 x 3.5 x 0.8 in) | - |
| ***Passive temperature sensor for outdoor mounting (NTC 10kΩ at 25 ºC (77 °F))*** | | | | |
| SOD-Tn10-1 | 40-200108 | Outdoor temperature sensor | 64 x 64 x 36 mm (2.5 x 2.5 x 1.4 in) | - |

Additional sensors and accessories can be found on the Vector Controls home page www.vectorcontrols.com.

## Technical Specifications

Caution! This device is intended to be used for comfort applications. Where a device failure endangers human life and/or property, it is the responsibility of the owner, designer and installer to add additional safety devices to prevent or detect a system failure caused by such a device failure. Vector Controls or its affiliates cannot be held liable for any damage caused by such a failure. Failure to follow specifications and local regulations may endanger life, cause equipment damage and void warranty.

| | | |
|---|---|---|
| **Power supply** | Power requirements | 100…240 VAC, 50/60 Hz |
| | Power consumption | Max. 5 VA |
| | Electrical connection | Screw terminals<br>Wire 0.15…2.05 mm2 (AWG 26…14) |
| **Built-in sensor** | Temperature range | 0…50 °C (32…122 °F) |
| | Accuracy 0…50 °C | 0.5 °C (1 °F) |
| **Signal inputs** | Digital and temperature input | Selectable via parameter |
| | Temperature range | -20…80 °C (-4…176 °F) |
| | Temperature accuracy | 0.5 °C (1 °F) at 0…50 °C (32…122 °F)<br>1.0 °C (2 °F) at <0 °C (<32 °F), >50 °C (>122 °F) |
| | Type & range of temperature sensor | NTC (Sxx-Tn10): -40…140 °C (-40…284 °F) |
| **Signal outputs** | Relays outputs (SPST NO) | 0…250 VAC, resistive load current 5A, inductive 2A |
| | Insulation strength<br>between relays and system electronics<br>between neighboring contacts | <br>2500V to EN 60 730-1<br>2500V to EN 60 730-1 |
| | Electronic control type | 2.B (micro-disconnection) |
| | Analog outputs<br>Output signal<br>Resolution<br>Maximal load | <br>0…10 VDC<br>10 bit, 9,7 mV<br>Voltage signal: ≥1kΩ |


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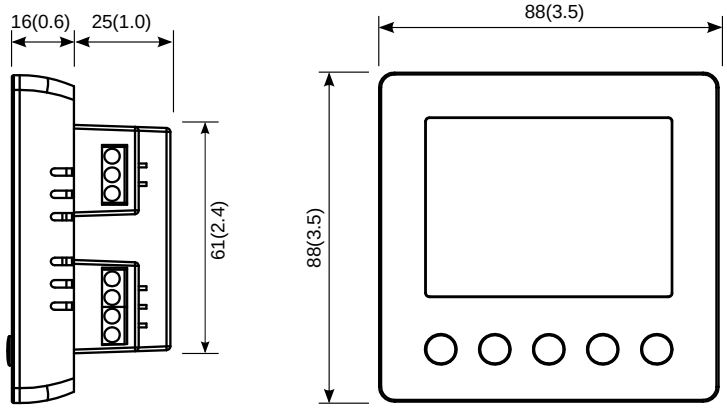
| | | |
|---|---|---|
| **Temperature resolution** | Displayed temperature | 0.1 °C (0.5 °F) |
| | Set point | 0.5 °C (1 °F) |
| **Network** | Hardware interface<br>Max nodes per network<br>Max nodes per segment | RS485 in accordance with EIA/TIA 485<br>247<br>128 |
| | Conductor wire<br>Impedance | Shielded Twisted Pair (STP) cable<br>100 – 130 Ω |
| | Galvanic isolation | The communication circuitry is isolated |
| | Network topology | According Modbus manual (Modbus over serial line) |
| | Recommended maximum length per chain | 1200 m (4000 ft.) |
| **Modbus**<br>TRA-F221-A | Communication standard | Modbus RTU (www.modbus.org) |
| | Default setting | 38400 baud rate, even parity, 1 stop bit |
| | Communication speed (baud rate) | 2400, 4800, 9600, 19200, 38400, 57600, 115200 |
| | Modbus RTU protocol (8 data bits) | no parity – 1 or 2 stop bits;<br>even or odd parity – 1 stop bit |
| **BACnet**<br>TRA-F222-A | Communication standard | BACnet MS/TP |
| | Default setting | 38400 baud rate |
| | Communication speed (baud rate) | 9600, 19200, 38400, 57600, 76800, 115200 |
| **Environment** | Operation<br>Climatic conditions<br>Temperature<br>Humidity | To IEC 721-3-3<br>class 3K5<br>0…50 °C (32…122 °F)<br><85 % RH non-condensing |
| | Transport & storage<br>Climatic conditions<br>Temperature<br>Humidity<br>Mechanical conditions | To IEC 721-3-2 and IEC 721-3-1<br>class 3K3 and class 1K3<br>0…50 °C (32…122 °F)<br><95 % RH non-condensing<br>class 2M2 |
| **Standards** | Safety class | II (IEC 61140) |
| | Degree of protection | IP30 to EN 60529 |
| **General** | Material | Fire proof PC+ABS plastic (UL94 class V-0) |
| | Dimensions front part (H x W x D)<br>Dimensions back part (H x W x D) | 88 x 88 x 16 mm (3.5 x 3.5 x 0.6 in)<br>67 x 61 x 25 mm (2.6 x 2.4 x 1.0 in) |
| | Weight (including package) | 250 g (8.81 oz) |

## Product testing and certification

CE Declaration of Conformity

Information on the conformity of our products can be found on our website www.vectorcontrols.com on the corresponding product page under "Downloads".

## Dimensions, mm (inch)




For flush mounting, a 75 x 75 x 35 mm (3.0 x 3.0 x 1,4 inch) installation box or larger must be used. See section "Types and Ordering" for recommended installation boxes.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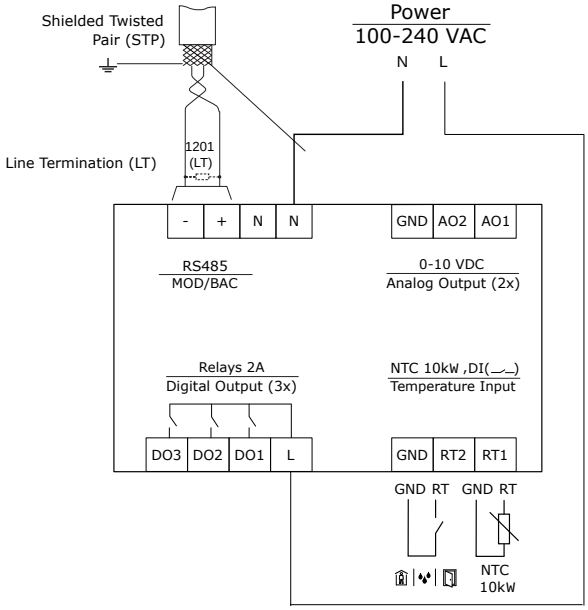
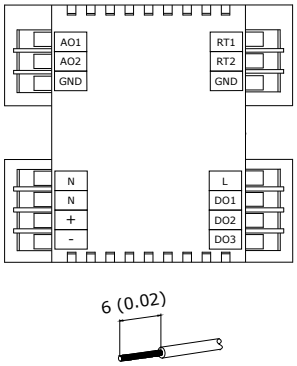
## Connection diagram

The wiring for the different predefined TRA-F22x-A applications can be found in the engineering manual (section "Application modes: Wiring diagrams of outputs").

A typical connection of the TRA-F22x-A is shown below:




TRA-F220-A: Stand alone
TRA-F221-A: Modbus RTU
TRA-F222-A: BACnet MS/TP







## Selection of actuators and sensors

**Temperature sensors:**
Use Vector Controls NTC sensors to achieve maximum accuracy, see ordering list in section "Types and Ordering".

**Binary auxiliary devices** (e.g. fans, on/off valves, etc.)**:**
Do not directly connect devices that exceed specified limits in technical specifications – observe startup current on inductive loads.

## Mounting and installation

For details see the TRA-F22x-A installation sheet no. 70-000957 (www.vectorcontrols.com).

## Sealing of cable entries

**Important!** All cable entries into the connection box must be sealed to prevent air draft, which could otherwise affect the sensors in the device and prevent correct measurements!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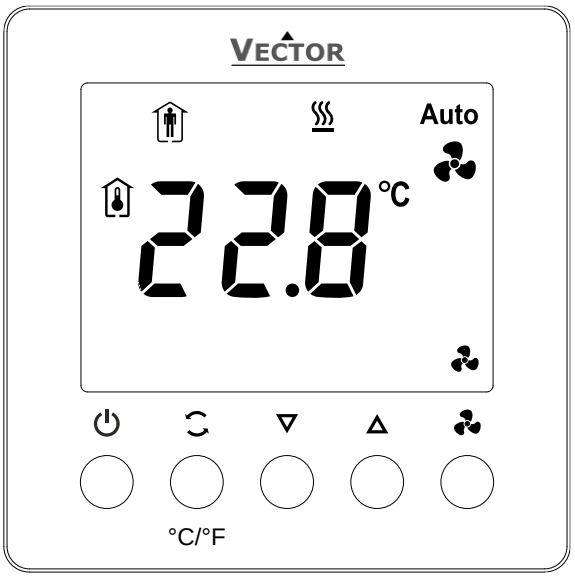
## Display and operation

### User interface




**Button operation**

| Symbol | Function | Description |
|---|---|---|
| ⏻ | Operating mode<br>(Return) | Operating mode selection (Comfort Mode, Economy Mode, Protection Mode)<br>Menu navigation: Return to top menu |
| ⟳ | Controlling mode<br>(Return) | Controlling mode selection (Heating Mode, Cooling Mode, Fan Only)<br>Menu navigation: Return to top menu point<br>Long press: Switch °C/ °F |
| ▽ | Down<br>(-) | Adjust temperature set points and control parameters |
| △ | Up<br>(+) | Adjust temperature set points and control parameters |
| ✣ | Fan<br>(Enter, Save) | Change fan mode (auto mode or fan speed)<br>Menu navigation: Enter menu point<br>Parameter change: Save parameter<br>Long press: Display external input status |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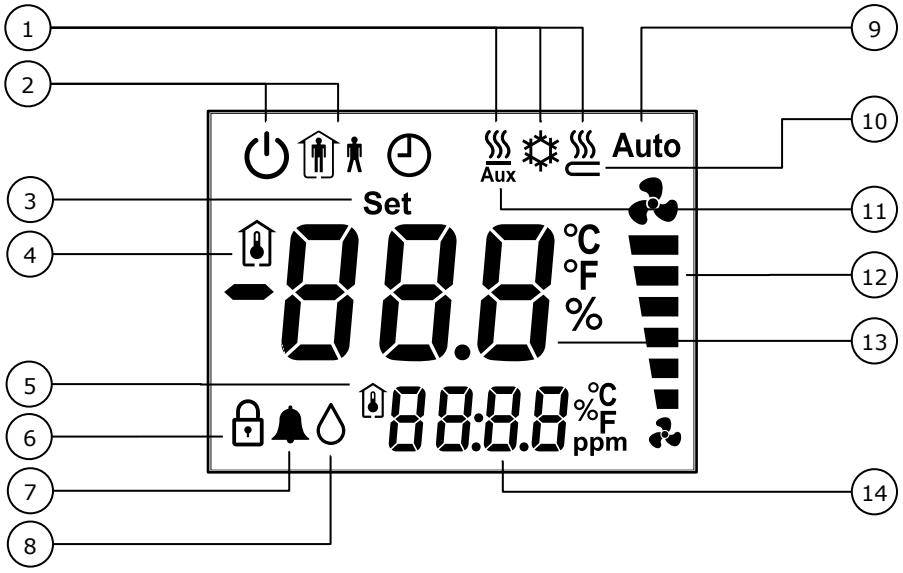
## LCD Display




| | | | |
|---|---|---|---|
| 1 | Controlling Mode (see section "Controlling modes") | 8 | Dew point alarm (see section "Alarm messages") |
| 2 | Operating Mode (see section "Operating modes") | 9 | Fan auto mode |
| 3 | Temperature set point or parameter setting active | 10 | Floor heating |
| 4 | Room temperature large digits | 11 | Electric heater |
| 5 | Room temperature small digits | 12 | Fan speed (low, medium, high) |
| 6 | Keys locked | 13 | Large digits (see section "Large and small digits") |
| 7 | Alarm (see section "Alarm messages") | 14 | Small digits (see section "Large and small digits", "Alarm messages", "Error messages") |

ⓘ ◴, % and ppm not used.

**Operating modes**

| Display | Mode | Description |
|---|---|---|
| | Comfort (occupied) | The controller maintains the Comfort temperature set point defined with parameter P300.<br>In Comfort mode, the fan can be set to auto or manual fan speed: Low, medium or high. |
| | Economy (unoccupied) | Controller maintains the Economy temperature set points defined with parameter P301 and P302. |
| | Protection | The controller runs in standby. The system is protected against overheating and frost if enabled with parameter P303 and P304. |

**Controlling modes**

| Display | Mode | Description |
|---|---|---|
| | Heating | Heating mode activates heater for temperatures below set point.<br>When the heating symbol is blinking, the heating valve is turned on. Also, the electric heater or floor heating symbols are blinking if the heating valve is turned on. |
| | Cooling | Cooling mode activates cooling equipment for temperatures above the set point.<br>When the cooling symbol is blinking the cooling valve is turned on. |
| | Fan Only | The bars between the fan symbols show the fan speed. |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#### Large and small digits

The large digits show the measured room temperature (default setting) or the Comfort temperature set point (configurable via parameter P101).

The small digits are off (default setting) or show the outdoor temperature (configurable via parameter P101). Also, alarms and error messages are shown on the small digits.

The room temperature and temperature set point are given in °C or °F (according to parameter P102).

#### Alarm messages

Alarm messages with alarm symbol are shown on the small digits.

| Small Digits | LCD symbol | | Alarm condition |
|---|---|---|---|
| ALA1 | | Alarm<br>Dew point | Dew point alarm from input RT1/2 (parameter P500/P502 = 7) |
| ALA2 | | Alarm | Overheat protection alarm (only in Protection mode) |
| ALA3 | | Alarm | Frost protection alarm (only in Protection mode) |
| ALA4 | | Alarm | Electric heater overheat alarm |
| ALA5 | | Alarm | Monitoring alarm to notify user |

#### Error messages

Error messages are shown on the small digits.

| Small Digits | Error condition |
|---|---|
| Err1 | Built-in temperature sensor error. Sensor is damaged (open or short circuit). |
| Err2 | Temperature sensor RT1/RT2 error. The temperature sensor is not present. Verify wiring or parameter configuration. -99.9 is shown on large digits. |
| Err3 | Digital input error. RT1/2 is not fully opened or closed (resistor between 1.25kΩ and 350kΩ). Verify wiring or parameter configuration. |
| Err4 | Configuration error: A parameter is set in an invalid combination with another parameter. Err4 and one of the conflicting parameters are displayed alternating. |
| Err5 | Time error: Set time and acknowledge error. |

## Temperature control

The controller measures room temperature with the built-in sensor or an external room temperature sensor and maintains the setpoint by controlling fan speed and the heating and/or cooling valve (or the electric heater). The following control outputs are available:

- on/off valve
- Modulating valve
- 3-position valve (only for 2-pipe systems)

The switching differential or proportional band is 2 °C for heating mode and 1 °C in cooling mode (configurable via parameters P400 and P401).

The default integral time is 5 minutes (adjustable via parameter P402 with 300 seconds as default value).


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## Controller operation

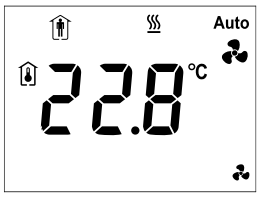
Enable or disable of economy mode and change of set point, fan speed, controlling mode or any user operation can be done via parameter settings (see parameter P104 to P108, default is ON and key lock disabled).

### Operating mode

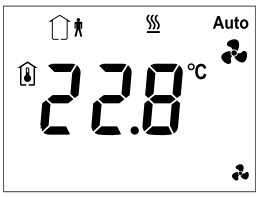
The controller operating mode can be switched between **Comfort** and **Economy Mode** with the operating mode button (⏻).

The controller is switched to **Protection Mode** by pressing the operating mode button (⏻) for 2 seconds.

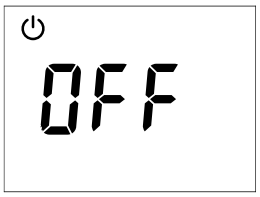
Comfort Mode




Economy Mode




Protection Mode




If Economy mode is disabled (see parameter P103), the controller operating mode is switched between Comfort and Protection mode with the operating mode button (⏻).

**Comfort Mode**

In Comfort mode, the controller measures the room temperature via built-in sensor or external room temperature sensor and maintains the temperature of the Comfort set point by controlling the fan speeds and the heating and/or cooling valve (or the electric heater).

**Economy Mode**

In Economy mode, the controller measures the room temperature via built-in sensor or external room temperature sensor and maintains the temperature of the Economy set point by controlling the fan speeds and the heating and/or cooling valve (or the electric heater).

The temperature of the Economy set point depends on the controller configuration (see parameter P301 and P302).

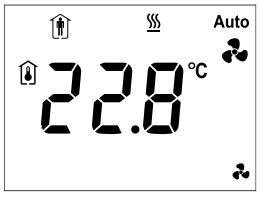
**Protection Mode**

In Protection mode, the system is protected against frost (default 5 °C, see parameter P304) and protected against overheating (default OFF) (see parameter P303).

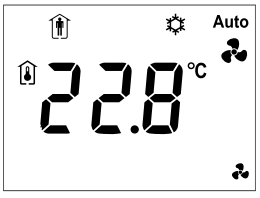
### Controlling Mode

The controlling mode of the controller can be switched between **Heating Mode**, **Cooling Mode** and **Fan Only** by pressing the controlling mode button (↻).

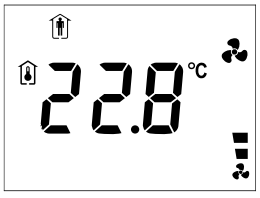
Heating Mode




Cooling Mode




Fan Only




Depending on the configured application (see parameter P200), cooling or heating can't be selected as controlling mode.

**Heating Mode**

In heating mode, the controller measures room temperature with the built-in sensor or an external room temperature sensor and maintains the requested temperature (Comfort, Economy or manual setpoint) by controlling fan speed and the heating valve (or the electric heater).

**Cooling Mode**

In cooling mode, the controller measures room temperature with the built-in sensor or an external room temperature sensor and maintains the requested temperature (Comfort, Economy or manual setpoint) by controlling fan speed and the cooling valve.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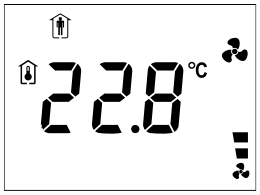
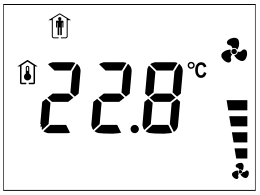
**Fan Only**

In fan only mode, the fan speed can be set with the up (△) or down (▽) button.
Heating or cooling is deactivated.

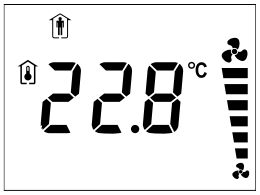
Fan Only (low)




Fan Only (medium)




Fan Only (high)

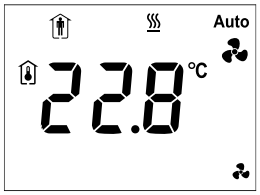



Note: The graphics shown are with 3-stage fan setting.

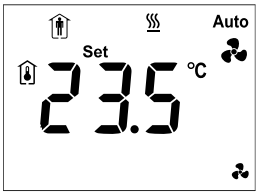
**Temperature control**

The comfort temperature set point can be adjusted in 0.5 °C (1 °F) steps with the up (△) and down (▽) button and saved either with the operating mode button (⏻), the controlling mode button (↻) or the fan button (✣). The Set symbol is shown on the display while changing the temperature.

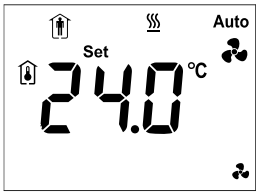
Comfort mode (example)




Temperature up




Temperature up

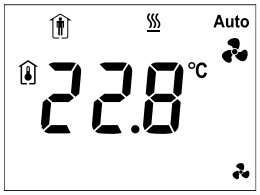



If the Economy mode is active, pressing the up (△) or down (▽) button will change the controller into the comfort mode.

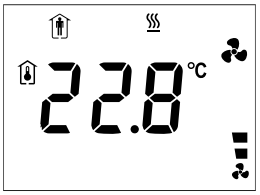
**Fan speed**

The fan speed can be changed between auto, low, medium and high fan speed by pressing the fan button (✣).
With analog fan, the fan speed can be changed between auto and 1 to 6.

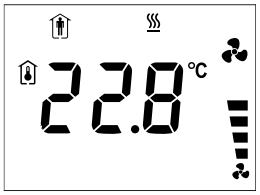
Fan auto



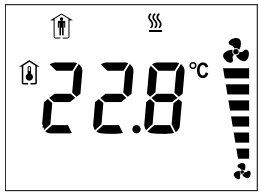

Fan low




Fan medium




Fan high



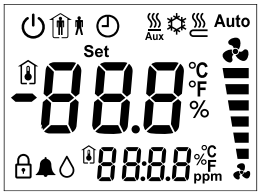

**Controller start up**

**Normal start-up**

During start-up, the display backlight and all LCD segments are shown for two seconds. The software version and revision are then shown for two seconds on the small digits (format 1r0 = version 1, revision 0).

On the TRA-F221-A and TRA-F222-A, the address of the controller is also shown for two seconds.

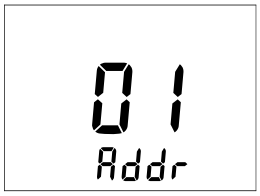
Display test




Software version (example)




Modbus address (example)





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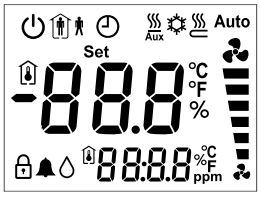
**Start-up when the communication address is not set (after initial installation)**

During start-up, the display backlight and all LCD segments are shown for two seconds. The software version and revision are then shown for two seconds on the small digits (format 1r0 = version 1, revision 0).
After the software version, the communication address can be set with the up (▲) or down (▼) button and stored with the fan (🌀) button.
To leave the menu without saving the communication address, press the operating- (⏻) or controlling mode (↻) button.

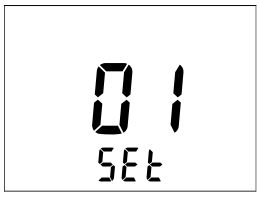
Display test




Software version (example)




Set Modbus address menu (alternating)







If no address is entered, set mode is left automatically after 10 minutes. The address set menu will appear again on the next start-up.

After these steps the controller runs in comfort, economy or protection mode.

**Power Failure**

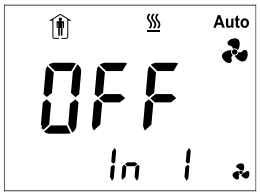
All temperature set points and parameters are automatically saved and do not need to be re-entered.

Upon return of power, the controller will start in Protection, Comfort or the same mode, according to the controller configuration (see parameter P110).

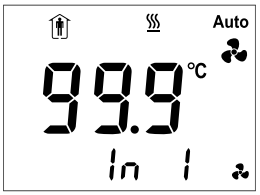
## View input status (RT1/RT2)

Press the fan button (🌀) for minimum 3 seconds to enter the input menu. The input status of RT1 and RT2 is displayed in alternation.

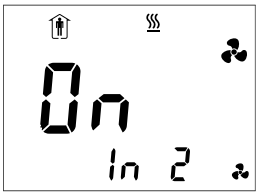
RT1 as digital input



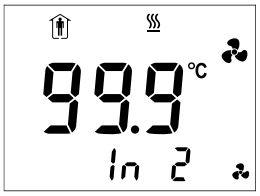

RT1 as temperature input




RT2 as digital input




RT2 as temperature input




The status of the inputs is displayed:

| Condition | Large digits show | Small digits show |
|---|---|---|
| RT1 configured as NO/NC digital input | on/off | In 1 |
| RT1 configured as NTC temperature sensor | Temperature in °C/ °F | In 1 |
| RT2 configured as NO/NC digital input | on/off | In 2 |
| RT2 configured as NTC temperature sensor | Temperature in °C/ °F | In 2 |

Press the Operating (⏻) or Controlling (↻) Mode button to leave the menu. After one minute the input menu is left automatically.

# Additional Information

## Conventions

The following presentation conventions apply to this manual:

**DANGER**
Indicates a hazard with a high degree of risk. Failure to observe this warning may result in immediate danger of serious injury or death.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**Information**
Further information, important operating instructions, other details.

Reference to another document or other text passages in this document.

## Abbreviations used

| Abbr. | Meaning |
|---|---|
| AO (n) | Analog output |
| DI | Digital input |
| DO (n) | Digital output |
| GND | Ground |
| L | Line voltage |
| N | Neutral voltage |
| NC | Normally closed |
| NO | Normally open |
| NTC | Negative Temperature Coefficient |
| REF | Reference |
| RH | Relative humidity |
| RT (n) | Input (DI or NTC sensor) |
| STP | Shielded Twisted Pair (Cable) |


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