

## TLR-D42 with OPA-D42

**Intelligent PI fan coil controller for modulating actuators.  
Cabinet mounted base, wall mounted operation terminal.**

### Features

- Temperature control for 2-pipe and 4-pipe fan coil systems.
- Relays switching up to 10(6)A
- Three binary outputs for fan speeds.
- Two analog output for modulating 0-10V actuators
- One binary output for a spring return zone valve, electric heat, gas heat, etc.
- Automatic fan control for three stage fans.
- Control for heating, cooling and fan only operation
- Cost saving option with Economy functionality and set point limitation
- For large rooms: Master – Slave option: One terminal may drive up to 8 base units in parallel.
- External sensor or open contact for remote control, external heat – cool change or auto-changeover on supply or outdoor temperature with selectable activation limits
- Password protected programmable user and control parameters
- Temperature display in Celsius or Fahrenheit

#### Deluxe Version:

- Clock and time schedule functions with special options for schools and universities
- Clock keeps running for 48h in case of power failure
- Display with blue backlight
- Infrared remote controller option:  
With special features for Boost and delayed switching on or off



### Applications

3 or 1 speed air handler units or fan coils, cooling and/or heating, for 2-pipe or 4-pipe systems with one or two modulating valves; and/or one ON/OFF control (electrical heat, gas heat, hot water spring return valve, etc).  
VAV units with heat and cool air supply (auto change over), fan powered option; local heating coil (electrical, hot water coil, etc.)

### General description

The TLR-D42 is a stand-alone electronic single loop controller with a fan control option and one PI heating and cooling sequence. The controller includes 1 NTC room temperature sensor, 3 + 1 relays outputs and two analog outputs. A detailed adaptation to local conditions is possible with the use of a simple configuration routine. The TLR-D42 can be configured using the standard operation terminal. No special tools or software is required.  
The TLR-D42 has been specifically developed to switch larger fans with switching power of up to 10 (6) A.

### Ordering

A working controller consists of one operation terminal and at least one base unit.

Item name	Item code	Function	Type	Key-data
TLR-D42-24	40-11 0085	24VAC	Base unit	Fan coil controller with: 1 TI int or ext
TLR-D42-230	40-11 0086	230VAC		
OPA-D42	40-10 0168	Standard	Operation Terminal	3 DO (Relay) Fan control 1 DO (Relay) Binary control 2 AO 0-10VDC
OPA-D42-D	40-10 0169	Deluxe		

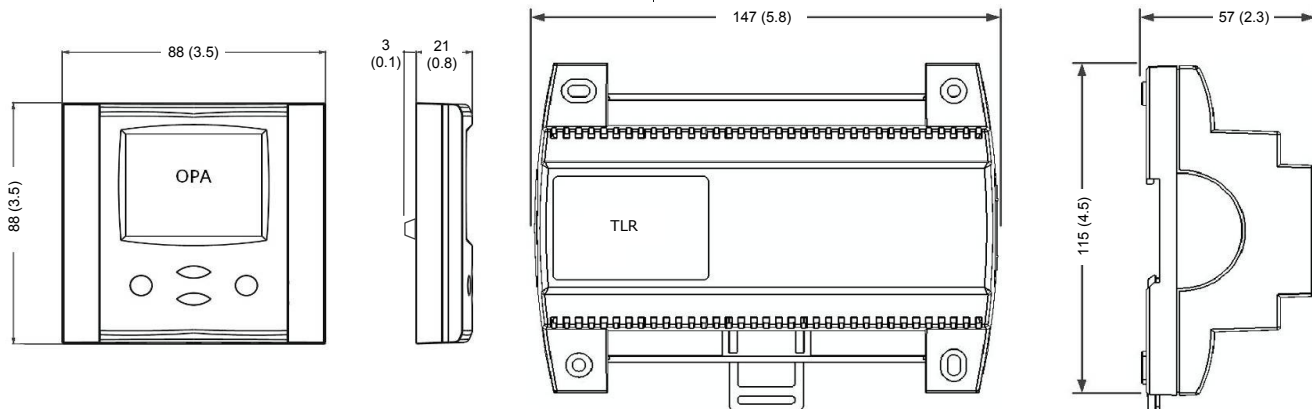
### Accessories

OPR-1	40-50 0001	2xAAA bat	Infrared remote controller
S-Tn10-2	40-20 0001	Flying lead sensor with 2 m cable	
SD-Tn10-12-2	40-20 0002	Flying lead duct sensor 12cm immersion depth, 2m cable	
SD-Tn10-20-2	40-20 0003	Flying lead duct sensor 20cm immersion depth, 2m cable	
SDB-Tn10-12	40-20 0051	Duct sensor with housing, 12cm immersion depth	
SDB-Tn10-20	40-20 0004	Duct sensor with housing, 20cm immersion depth	
SRA-Tn10	40-20 0005	Room sensor	
SOD-Tn10	40-20 0059	Outdoor sensor	

## Technical specifications

<b>Power Supply</b>	Operating voltage	TLR-D42-24	24 V AC $\pm$ 10 %, 50/60 Hz, SELV to HD 384, Class II transformer, 48VA max
		TLR-D42-230	230 V AC $\pm$ 10 %, 50/60 Hz
	Power consumption	TLR-D42-24	Max. 3 VA
		TLR-D42-230	Max. 5 VA
	Electrical connection	Terminal Connectors	Wire 0.34...2.5 mm <sup>2</sup> (AWG 24...12)
<b>Signal inputs</b>	Deluxe type only. Power backup for real time clock		Min 48h if charged for 24h
	Temperature Input	Range Accuracy	0...50 °C (32...122 °F) 0.5°C, 1°F
<b>Signal outputs</b>	Digital Switching Outputs		DO1 to DO3, DO4
	Switching Type		Relays
	AC Switching power		0...240V AC 10(6)A max. each output
	Insulation strength		
	between relays contacts and system electronics: between neighboring relays contacts between relay groups:		3750V AC to EN 60 730-1 1250V AC to EN 60 730-1 1<>2<>3 3750V AC to EN 60 730-1 1/2/3<>4
<b>Communication Base - Terminal</b>	Analog Outputs		AO1, AO2
	Output Signal		DC 0...10 V
	Maximum Load		1 mA
<b>Environment</b>	Communication type		Digital: peer to peer
	Cabletype:		Copper wire 0.8...2.5 mm <sup>2</sup> (AWG18...AWG13), shielded twisted pair
	Operation		To IEC 721-3-3
	Climatic conditions		class 3 K5
	Temperature		0...50 °C (32...122 °F)
<b>Standards</b>	Humidity		<95 % r.H. non-condensing
	Transport & storage		To IEC 721-3-2 and IEC 721-3-1
	Climatic conditions		class 3 K3 and class 1 K3
	Temperature		-25...70 °C (-13...158 °F)
	Humidity		<95 % r.H. non-condensing
<b>General Terminal</b>	Mechanical conditions		class 2M2
	<b>Standards</b>		
	CE conformity		2004/108/EC
	EMC Directive		2006/95/EC
	Low voltage directive		
<b>General Base</b>	Product standards		
	Automatic electrical controls for household and similar use		EN 60 730 - 1
	Special requirement on temperature dependent controls		EN 60 730 - 2 - 9
	Electromagnetic compatibility for domestic sector		Emissions: EN 60 730-1 Immunity: EN 60 730-1
	Safety class		III (IEC 60536)
<b>Dimensions [mm] (inch)</b>	Degree of protection		IP30 to EN 60 529
	Material	Cover, back part Mounting plate	ABS plastic (UL94 class V-0) Galvanized Steel
	Color		White RAL 9003
	Dimensions (H x W x D)		88 x 88 x 24 mm (3.5 x 3.5 x 0.9 in)
	weight including package	OPA-D42 OPA-D42-D	180g (6.3 oz) 190g (6.7 oz)
<b>General Base</b>	Safety class		II (IEC 60536)
	Degree of protection		IP20 to EN 60 529
	Housing material		PC+ABS plastic (UL94 class V-0)
	Color		Gray (RAL 7001 / 7035)
	Dimensions (H x W x D)		57 x 147 x 115 mm (2.25 x 5.8 x 4.5 in)
<b>Dimensions [mm] (inch)</b>	weight including package	TLR-D42-24 TLR-D42-230	345g (12.2 oz) 445g (15.7 oz)

## Dimensions [mm] (inch)



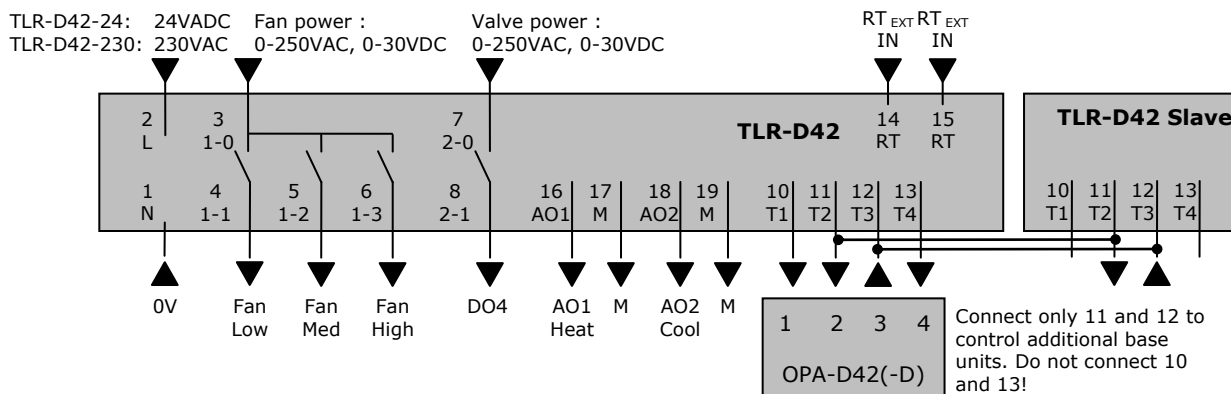
## Selection of actuators and sensors

Temperature Sensors: Use only approved NTC sensors to achieve maximum accuracy. See ordering for details.

Binary auxiliary devices: E.g. fans and on/off valves. Do not directly connect devices that exceed maximum switching currents as detailed under technical specifications. Observe startup current of fans.

Modulating actuators: Choose actuators with an input signal type of 0-10VDC. Observe maximum load as detailed under technical specifications.

## Wiring Diagram



### Description:

1	N	Power supply:	TLR-D42-24: 0V AC, 24V DC,	TLR-D42-230: 0V AC
2	L	Power supply:	TLR-D42-24: 24V AC, 24V DC,	TLR-D42-230: 230V AC
3	1-0	Switched common for fan:	0-250VAC, 0-30VDC	
4	1-1	Binary output:	Fan speed low	
5	1-2	Binary output:	Fan speed medium	
6	1-3	Binary output:	Fan speed high	
7	2-0	Switched common for valve:	0-250VAC, 0-30VDC	
8	2-1	Binary output:	Spring return valve	
10	Term1	Terminal connection 1	Connect to operation terminal	
11	Term2	Terminal connection 2	Connect to operation terminal	
12	Term3	Terminal connection 3	Connect to operation terminal	
13	Term4	Terminal connection 4	Connect to operation terminal	
14	RT	External temperature input:	Sxx-Tn10 or open contact	
15	RT	External temperature input:	Sxx-Tn10 or open contact	
16	AO1	Analog output	Proportional heating output 0-10VDC	
17	M	Signal ground	Signal ground for proportional output	
18	AO2	Analog output	Proportional cooling output 0-10VDC	
19	M	Signal ground	Signal ground for proportional output	

## Installation Base

The housing of the TLR base unit is a robust plastic enclosure. The controller may be mounted in any orientation by surface mounting on a wall or in a cabinet. 4 mounting-holes for screws up to 4mm diameter are provided. Mounting onto a standard 35mm DIN rail is also possible.

When mounting note the following:

- The controller should not be freely accessible after mounting. A protective housing should be used, if mounted outside an electrical cabinet.
- Ensure adequate air circulation to dissipate heat generated during operation.**
- Local installation regulations must be observed.

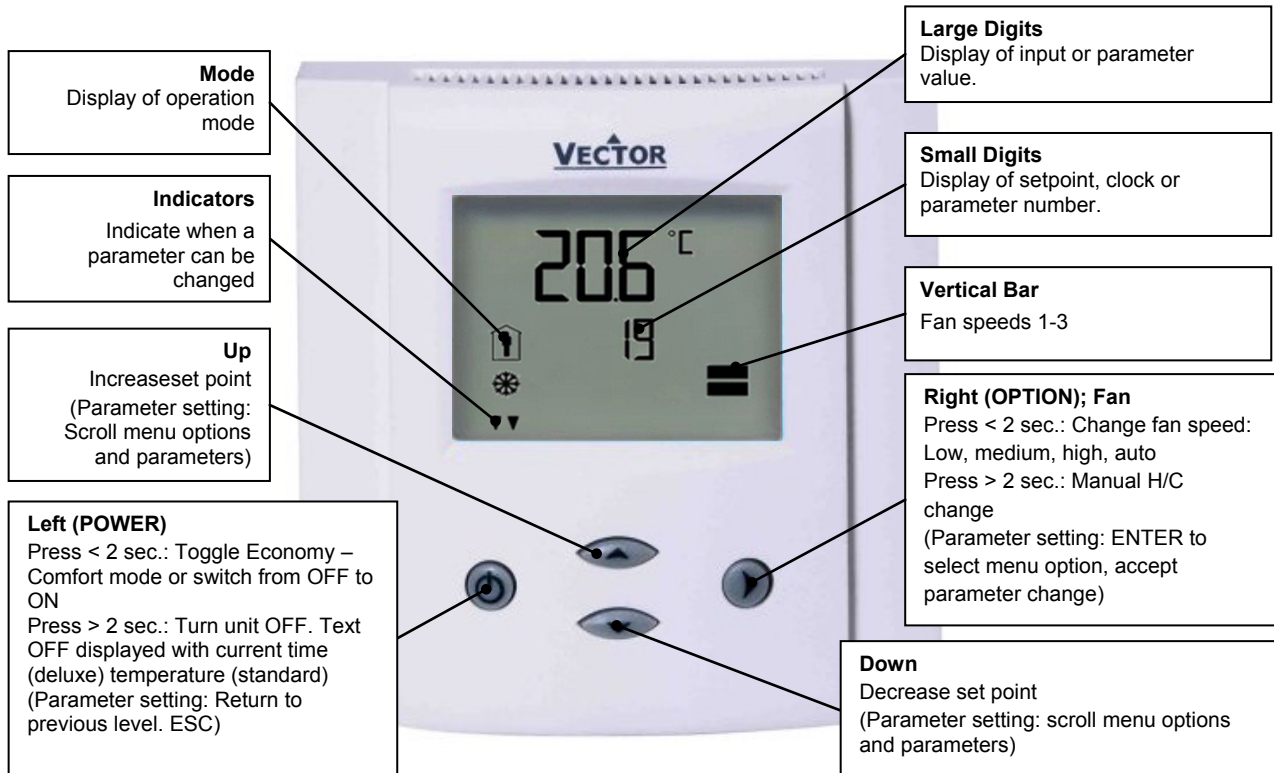
### Installation Terminal

- Install the mounting plate straight to the wall or the flush mounting box. Make sure that the nipple with the front holding screw is facing down. Make sure the screw heads do not stand out more than 5 mm of the surface of the mounting plate.
- Connect the wires of the terminals to the communication wires according wiring diagram
- Slide the two latches located on the top of the front part into the hooks of the mounting plate.
- Lower the front part until located flat on the wall and the mounting plate is not visible anymore. Make sure the connection cable does not get into the way.
- Tighten the front holding screw to secure the front part to the mounting plate.

### Connection base to terminal

- Max. Distance: 200m (565 ft.)
- Normal twisted pair copper wires maybe used for wiring in an EMC-save environment. In an impaired EMC environment use only shielded cables. The operating voltage must comply with the requirements for safety extra-low voltage (SELV) as per EN 60 730.
- 1 terminal may drive up to 8 base units. Total wire distance must not exceed 200 m.
- Conductor resistance will influence external temperature reading. 450 Ω will result in an increase of 1°C (2°F). Compensate using UP-08 if external temperature is used to control unit.

## Display and Operation



Operation mode		
	Comfort (occupied)	All control functions operating per set points.
	Economy (unoccupied):	Set points shifted according to <i>Parameters FC04</i> . Economy mode and setpoint shift may be disabled with UP06
<b>OFF</b>	Energy Hold Off	Outputs are off, inputs monitored for alarm condition
	Heating	Output activates if temperature lower than setpoint
	Cooling	Output activates if temperature higher than setpoint
	Fan	Fan is running, the vertical bars show active speed 1-3

## Power Failure

All the parameters and set points are memorized and do not need to be reentered. Depending on **UP05** the unit will remain switched off, switch on automatically or return to the operation mode it was in before the power failure.  
*Deluxe version only:* Timer operation and daytime setting will be retained for 24h. The controller has to be connected to a power supply for at least 10 hours for the backup function to operate accordingly.

## Frost Protection

The controller will enter frost protection mode if the room temperature drops below 5°C (41°F). All heating outputs will be fully opened. Frost protection mode will be left once the temperature reaches 10°C (50°F). Frost protection display will remain until a button is pressed. Frost protection can be enabled/disabled using user parameter UP-09

## Error messages

**Err1:** Temperature sensor faulty. The temperature sensor is damaged.  
**Err2:** External input for heat / cool auto change over missing or damaged.  
**FP:** Steady: Frost protection is active.  
 Blinking: Frost protection activated in the past and is now inactive. Confirm with OPTION key.

## Status LED


The status LED is located on the TLR-D5 base unit between the two low power terminal connector groups. The status LED may display the following feedback:

No light: No power or unit is damaged  
 Blink every 1s: Error, terminal – base unit do not match or signal is not clear.  
 Blink every 2s: Normal communication, base unit detected  
 Blink every 5s: Base unit operates normal, no terminal detected

## Manual heat – cool change

To manually change heating or cooling mode press the OPTION key for more than 2 seconds. Access to manual heat – cool change may be disabled by parameters.

For standard models: Press OPTION > 2 sec. SEL and H-C is displayed.  
 For deluxe models: Press OPTION > 2 sec. SEL and current time is displayed.  
 Press UP key twice. SEL and H-C is displayed.  
 Press OPTION again to toggle Heating, Cooling and Fan only modes.

SEL  
H-C  


## Clock operation

The deluxe model contains a quartz clock with battery back-up. Up to 4 time schedules with each 4 mode changes based on time and day of the week may be programmed. A blinking clock indicates that the time has not been set or if the unit was without power for longer than 48 hours. The time needs to be set to allow time schedules to operate.

### Clock setup

Press OPTION > 2 sec. SEL and current time displayed  
 Press OPTION < 2 sec. to change time,  
 Minutes blink: UP/DOWN to changes, OPTION to save,  
 Hours blink: UP/DOWN to changes, OPTION to save,  
 Press OPTION to save time,  
 DAY1 blinks: UP/DOWN to change, OPTION to save

SEL  
00:00  
DAY1 (Mon)

## Creating time schedules

### Step 1: Selection and enabling of time schedules

Press OPTION > 2 sec. SEL and current time displayed  
 Press UP:  
 SEL and PRO displayed, clock symbol blinks  
 Press OPTION:  
 PRO1 shows with 1 blinking. UP/DOWN select time schedule group  
 Press OPTION  
 OFF/ ON blinks, UP/DOWN to change, OPTION to save

SEL  
PRO  


Pro1-Pro4  
OFF/ON

### Step 2: Select weekdays

This time schedule will be active during the selected weekdays  
 Press UP/DOWN to step through available options:  
 d1-7, d1-6, d1-5, d6-7, day1, day2, day3, day4, day5, day6, day7  
 Day 1 stands for Monday, day 2 for Tuesday and so forth  
 Press OPTION to save day selection

Pro1  
d1-7

### Step 3: Selected action of first switching event

One bar on the right side indicates the first switching event  
 Press UP/DOWN to select action for first switching event:  
 No = switching event not active  
 OFF = switches unit off, Reset (UP17) active if switched to ON manually.  
 Eco = sets operation mode to On and Economy (Not occupied),  
 reset (UP17) active if set to comfort manually  
 On = sets operation mode to On and Comfort (Occupied)  
 Uni = University mode, Reset (UP17) not active if manually activated  
 Press OPTION to select switching time of first event

Pr01  
no

—

### Step 4: Selected time of first switching event

Press UP/DOWN to select switching time:  
 Select switching time 00:00 to 23:45 in 15-minute steps  
 Press OPTION to complete and select action of second switching event

Pr01  
08:00

—

### Step 5: Select actions and time of switching event 2 - 4

Repeat Step 3 and Step 4 for the remaining switching events.  
 If a switching event is not needed, set it to "no"  
 The bars on the right side indicate number of switching event  
 After completing the 4<sup>th</sup> switching event, the process returns to the selection of the time schedule on step 1.

Pr01  
08:00

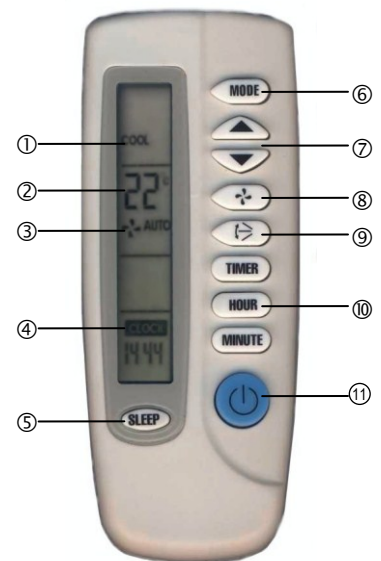
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- UNI: University mode: This switching mode is used for rooms such as lecture rooms and auditoriums that might be occupied during a certain time. During this time the reset is not active. The unit will not start itself when UNI mode is active. It still needs to be manually activated. This is to avoid unnecessary heating or cooling of such rooms while they are not occupied.
- A blinking clock indicates that the time needs to be set. Time programs will not operate if the time is not defined. See chapter operation, advanced settings for instructions on how to set the time.
- Access to time schedules may be disabled with UP-04

## Operation with OPR-1

The deluxe version may be alternatively operated with an infrared remote controller.

1. Mode indication, Auto, Dry, Cool, Fan, Heat
2. 2-digit display of setpoint
3. Fan indication
4. 4-digit display of current time or delayed switching time
5. Economy button: Toggles Economy/Comfort mode
6. Mode button, changes operation modes
7. UP/DOWN Button: Set point adjustment buttons
8. FAN Button: Changes fan speed, low – medium – high or Auto
9. Not used
10. Time related buttons: Timer, Hour, Minute
11. POWER Button: Operation mode ON – OFF



### Switching ON

The unit is switched on by pressing the POWER button. It will start up in comfort mode.

### Changing between COMFORT and ECONOMY

Pressing the SLEEP button toggles between ECONOMY and COMFORT modes.

### Switching OFF

Pressing the POWER while the unit is on, will switch the unit off. The current time will be displayed in the LCD of OPR-1.

### Changing of set points

Only the set points for the temperature loop may be changed. Set point range is 15 to 30 °C.

### Changing of fan speeds

Repeatedly pressing the fan speed button steps through low, medium, high and automatic fan speeds. Automatic fan speed will not be activated in FAN ONLY mode.

### Clock settings

The remote controller contains a daytime clock. In order to set the clock, press HOUR and MINUTE button together until the clock starts blinking. Then set the correct time with the HOUR and MINUTE buttons. Confirm by pressing the TIMER button. The clock of the OPR will set the clock of the controller.

### Delayed switching

The unit may be delayed switched on or off using the timer button. Pressing the timer button once will display Timer ON if currently in OFF mode or TIMER OFF if currently in ON mode. Set the time when the unit is supposed to switch on or off using the HOUR and MINUTE buttons.

### Mode changes

Repeatedly pressing the mode button may activate the following operation modes: HEAT, COOL and FAN ONLY. The mode change may be disabled using the UP parameters.

Note:

The remote controller is currently only available in °C mode.



## Setting of user parameters

The TLR-D5 is an *intelligent* controller and can be adapted to fit perfectly into your fan coil application. The control operation is defined by parameters. The parameters are set during operation by using the standard operation terminal. The parameters are password protected. There are two levels of parameters: User operation parameters for access control settings and Expert parameters for control functions and unit setup. The passwords for user levels and expert levels are different. Only control experts should be given the control parameter password.

The parameters can be changed as follows:

1. Press UP and DOWN button simultaneously for three seconds. The display will indicate the firmware version in the upper large digits and the revision in the lower small digits. Pressing any key will show: CODE.
2. Select a password using UP or DOWN buttons. Select 009 in order to get access to the user parameters, 241 for controls parameters.  
Press OPTION after selecting the correct password.
3. Once logged in, the parameter is displayed immediately
4. Select the parameters with the UP/DOWN keys. Change a parameter by pressing the OPTION key. The MIN and MAX symbols show up and indicate that the parameter may be modified now. Use UP and DOWN key to adjust the value.
5. After you are done, press OPTION or POWER in order to return to the parameter selection level.
6. Press the POWER key again so as to leave the menu. The unit will return to normal operation if no key is pressed for more than 5 minutes.

## User Parameters (Access code: 009)

Parameter	Description	Setting Range	Factory Setting
UP 00	Enable change of operation modes	ON, OFF	ON (Enabled)
UP 01	Enable change of set points	ON, OFF	ON (Enabled)
UP 02	Enable manual control of fan speeds	ON, OFF	ON (Enabled)
UP 03	Enable change of heating/cooling mode	ON, OFF	W00: ON (Enabled) W01: OFF (Disabled)
UP 04	Enable access to Time programs	ON, OFF	ON (Enabled)
UP 05	State after power failure: 0 = Switched OFF, 1 = Switched ON, 2 = state before power failure	0, 1, 2	2
UP 06	Enable Economy (unoccupied) Mode. Shift the set point to a lower temperature in winter or higher temperature in summer in order to save energy. Economy mode may be activated through the POWER button, or with the external input (typically for key card switches in hotel rooms or motion detectors for meeting rooms.)	ON, OFF	ON (Enabled Economy)
UP 07	Celsius or Fahrenheit, Select ON for Fahrenheit, OFF for Celsius	ON, OFF	OFF (Celsius)
UP 08	Calibration value of temperature sensor . This value is calibrated at manufacturing of the thermostat. If required it is possible to shift the temperature -10° to +10° in 0.1° K steps.	-10...10	0
UP 09	Enable Frost Protection. Activates the output independent of operation mode when the control temperature drops below 5°C or 41°F. The controller returns to normal operation when the temperature increases above 10°C or 50°F.	ON, OFF	W00 = ON (Frost Protection) W01 = OFF (No Frost Protection)
UP 10	Select contents of Large LCD digits in standard mode: 00 = OFF 01 = Setpoint 02 = Temperature sensor 03 = Output fan speed 04 = Clock 05 = Alternative sensor 06 = Output in %	0...6	02 Temperature
UP 11	Select contents of small LCD digits in standard mode: selection as in UP10	0...6	04 Deluxe: clock 01 Standard: setpoint
UP 12	Contents of vertical bar in standard mode OFF = Fan Speed ON = Control output	ON, OFF	OFF
UP 13 Deluxe only	Clock display type: OFF = Show 24hour clock ON = Show 12hour clock (AM, PM)	ON, OFF	OFF (24h)
UP 14 Deluxe only	Reset (Override length of time): applies when the unit is manually switched on, while in scheduled off mode. The unit will switch automatically back to the scheduled mode when the reset time expires. 0 = Reset of override mode is not active. 1...255 = delay in minutes to switch off device	0...255	60 (Min)

## Control configuration

### Identifying the firmware version

The parameters and functionality of controller depend on its firmware revision. It is therefore important to use a matching product version and parameter set. The firmware version is shown on the large LCD digits when pressing UP and DOWN buttons for more than 3 seconds simultaneously.

### Control Parameters (Access code: 241)

Warning! Only experts should change these settings! See user parameters for login procedure.

Parameter	Description	Range	Standard
FC 00	Minimum setpoint limit in Heating mode	-40...60°C (160°F)	16°C (61°F)
FC 01	Maximum setpoint limit in Heating mode	-40...60°C (160°F)	24°C (75°F)
FC 02	Minimum setpoint limit in Cooling mode	-40...60°C (160°F)	18°C (64°F)
FC 03	Maximum setpoint limit in Cooling mode	-40...60°C (160°F)	30°C (86°F)

### Controls configuration

FC 04	Economy (unoccupied) Mode temperature shift: The comfort (occupied) setpoint is shifted by the value set with parameter. If heating is active the comfort setpoint will be decreased, if cooling is active, the setpoint will be increased. (Enable with UP06.)	0...10.0°C (20.0°F)	5.0°C (10°F)
FC 05	Switching Span Heating, if set to 0, only 1 fan speed will be used	0...10.0°C (20.0°F)	0.9°C (1.8°F)
FC 06	Switching Span Cooling if set to 0, only 1 fan speed will be used	0...10.0°C (20.0°F)	0.7°C (1.4°F)
FC 07	Switching Hysteresis is the difference between switching on and switching off. A small hysteresis will increase the number of switching cycles and thus the wear on fan and relays contacts.	0...10.0°C (20.0°F)	0.5°C (1°F)
FC 08	Mold Protection: In mold protection, the fan keeps running independent of temperature as long as the unit is switched on.	ON, OFF	OFF
FC 09	Switching delay min running time of fan speed	0...255 s	10s
FC 10	Switching delay min stopping time of fan speed	0...255 s	10s
FC 11	Control option: 0 = Cooling only 1 = Heating only 2 = 2-pipe system 3 = 4-pipe system	0...3	3
FC 12	Dead Zone Span: The Dead Zone Span lies between the heating and the cooling setpoint. The output is off while the temperature is within the dead zone span. A negative dead zone is not possible.	0-100°C (200°F)	1.0°C (2°F)
FC 13	Heat/Cool Changeover Delay (if set to FC11 = 3): A demand to switch between heating and cooling must persist for the length of time set with this parameter before the controller switches. Prevents activation of a sequence during a short-term change in temperature in order to protect equipment (with control overshoot for example)	0...255 min	5 min

### PI control sequence

FC 14	P – band heating $X_{PH}$	0...10.0K (20°F)	2.0°C (4.0°F)
FC 15	P – band cooling $X_{PC}$	0...10.0K (20°F)	2.0° (4.0°F)
FC 16	$K_{IH}$ , Integral gain heating, in 0.1 steps, 0 disables ID part	0...25.5	0.0
FC 17	$K_{IC}$ , Integral gain cooling, in 0.1 steps	0...25.5	0.0

#### → Proportional control(P-band)

The proportional control function calculates the output based on the difference between setpoint and measured value. The proportional band (P-band) defines the difference between setpoint and measured value which will result in a 100% output. Setting the proportional band to 0 disables proportional control.

#### → Integral gain KI

The integral gain defines how fast the output increases in case the setpoint is not met by the room temperature. A low value indicates a slow reaction, a high value a fast one. If the value is chosen too high, the controller will start to swing. Depending on the room size and heating / cooling equipment used a value between 0.1 and 1.5 should be sufficient.

Below are suggested values:

Heating:  $K_{IH}$ : 0.1-0.5

Cooling:  $K_{IC}$ : 0.3-0.8



## Output Parameters

Parameter	Description	Range	Standard
FC 18	Configuration of analog output signal 0 = 0-10V 1 = 2-10V 2 = Manual override (useful for commissioning) When low fan speed: 25% output When medium fan speed 50% output When high fan speed 100% output	0-2	0 (0-10V)
FC 19	Function of analog outputs 0 = Disabled 1 = Control: Heating only (AO1 only) 2 = Control: Cooling only (AO2 only) 3 = Control: Heating and cooling (AO1 and AO2)	0...3	3
FC 20	Output of AO1 in cooling mode if FC19 = 1 or Output of AO2 in heating mode if FC19 = 2	0...100%	0%
FC 21	Function of binary output 0 = Disabled 1 = Control: Heating only 2 = Control: Cooling only 3 = Control: Heating and cooling 4 = Enable: On if device is on 5 = Enable: On if device is on and in heating mode 6 = Enable: On if device is on and in cooling mode 7 = Frost protection alarm	0...7	0
FC 22	Level to activate binary output if in dual AO-DO mode: Dual AO-DO mode = both analog and binary outputs are assigned to same control sequence.	0...100%	95%
FC 23	Level do deactivate binary output if in dual AO-DO mode Dual AO-DO mode = both analog and binary outputs are assigned to same control sequence.	0...100%	45%

## Configuration of outputs

### → Configuring the analog output:

Depending on the system in place choose if the analog outputs are active only in cooling or heating mode or if it works for both heating and cooling

- For heating only or cooling only option, the analog output may set to a fixed output while the binary sequence is active. This is used for VAV systems.

### → Configuring the binary output:

The three fan outputs are assigned to the fan speed module. Only output 4 can be assigned by this parameter (FC21). Select if the binary output should work as controls output in heating or cooling only or both for heating and cooling mode.

- Dual AO-DO mode: if both the analog and the binary output is assigned as control output to the same sequence, the binary output will then switch on when the analog output reaches the value defined in FC22 for example 95% and switch off when it drops below FC 23 for example 45%. Note: This output does not follow min running and stopping delays. It only reacts to the conditions mentioned above. In order to take advantage of this function we recommend using larger proportional bands.
- Using the binary output as enable for a variable speed fan or as reversing valve: Setting the binary output to enable, will activate it independent of controls command. It will be switched on if the condition as outlined in the parameter setting is met.
- Using the binary output as frost signal alarm. If set to this setting, the output will activate in case temperature drops below 10°C (50°F)

## Input configuration

FC 24	External input: 0 = No external input 1 = External temperature sensor 2 = Occupation sensor – Comfort / Economy 3 = Occupation sensor – Comfort / Off 4 = Heat / Cool changeover 5 = Key card with alternative setpoint 6 = Key card with full reset	0...6	0
FC 25	Activation delay (Minutes) = the time the binary input needs to be open before economy/off mode is activated.	0...255 min	5
FC 26	Auto-changeover limit heating FC24 = 4 or economy setpoint in heating mode if FC24 = 5	-40...60°C (160°F)	15°C (59°F)
FC 27	Auto-changeover limit cooling FC24 = 4 or economy setpoint in cooling mode if FC24 = 5	-40...60°C (160°F)	25°C (77°F)
FC 28	Comfort setpoint in heating mode if FC24 = 6	-40...60°C (160°F)	21°C (70°F)
FC 29	Comfort setpoint in cooling mode if FC24 = 6	-40...60°C (160°F)	24°C (75°F)

## Configuring the external input

FC24 = 0	Input not used	
FC24 = 1	External control input	The external sensor is the control input.
FC24 = 2	Switching Economy and Comfort modes	Economy (unoccupied) and Comfort (occupied) modes are controlled through an external contact by connecting the input through a dry contact to signal common. This function may be used together with key card switches for hotels or motion detectors for offices.
FC24 = 3	Switching Energy Hold OFF and Comfort modes	Opening the input will force the unit into the OFF operation mode. The operation mode cannot be overridden by using the terminal. Connecting the input to signal common returns control of the operation mode to the terminal. This function may be used as window contact to prevent loss of energy.
FC24 = 4	Heat – Cool changeover	Switch heating and cooling mode based on supply media or outside temperature or binary contact. See below for further details.
FC24 = 5	Key card with alternative setpoint	As with FC24 = 2, the key card function switches economy (unoccupied) and comfort (occupied) modes. Instead of using the setpoint shift, the setpoints in unoccupied mode are defined by parameter FC26 in heating mode and FC27 in cooling mode. Fan speed in unoccupied mode is limited to low speed. Fan speed and setpoint will be remembered after re-inserting the key card.
FC24 = 6	Key card with full reset	Similar as FC24 = 5 with the difference that setpoints, fan speed and operation mode are reset each time the key card is inserted. This is helpful for business hotels. Setpoints will be reset to FC28 or FC29.

### → Configuring auto changeover input if FC24 = 4:

The auto changeover function automatically changes heating and cooling mode based on supply media temperature or outdoor temperature. The difference between the two is in the values of the changeover limits FC26 and FC27. See table below for recommended settings.

Heating and cooling may be as well changed by an open contact switched to signal ground. Note: all signal ground levels of involved controllers must be the same in case more than one controller is switched.

### → Recommended settings for FC26 and FC27:

Change over mode FC24=4	Relation FC26 to FC27	Example FC26	Example: FC27
Supply media	FC26 > FC27	25°C (77°F)	18°C (64°F)
Outside temperature	FC26 < FC27	15°C (59°F)	25°C (77°F)
Dry contact: Heating if contact closed	FC26 > FC27	25°C (77°F)	15°C (59°F)
Dry contact: Cooling if contact closed	FC26 < FC27	15°C (59°F)	25°C (77°F)