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05 - 2011

V3000 KNX

Installation
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Mise en service
Maintenance

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Werking
Indienst stelling
Onderhoud

Installation
Operation
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CIAT

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General Information

The V3000 system can be adapted to all CIAT comfort unit applications.

This manual sets out the various V3000 system applications, according to the installation configuration.

The main specifications for this regulation are:

- ✓ PID regulation
- ✓ Modulating action on the valves and electric heater
- ✓ Automatic or manual ventilation speed selection
- ✓ Temperature measurement in room or at return
- ✓ Regulator fitted on comfort unit
- ✓ Optional user terminal fitted on comfort unit or wall-mounted
- ✓ Communication via BUS KNX protocol:

  Already meeting the requirements of two European standards Cenelec EN 50 090 and CEN EN 13 321-1, the KNX standard for house and building management systems has just been recognised by international standard ISO/IEC 14 543-3.

  The KONNEX association currently numbers over one hundred members worldwide.

  KNX was created from the merger of Batibus and EIBA, giving rise to a uniform standard that is applicable worldwide to building management systems.

  For further information on KNX, refer to our manual N08.51A

Eubac certification

- ✓ The V3000 controller is Eubac-certified under licence No. 211145
- ✓ The corresponding CA values are:

Applications :	→ 2 Pipes:	Heating: 0.3	Cooling: 0.2
	→ 2 Pipes -2 Wires:	Heating: 0.1	Cooling: 0.2
	→ 4 Pipes:	Heating: 0.2	Cooling: 0.2

Note :

- These values are obtained with the NTC 10kΩ at 25°C return air temperature sensor
- These values can be viewed on the Eubac certification website: http://www.eubaccert.eu

User terminals

- ✓ 5 user terminals are available.
- ✓ The wall terminals are interchangeable.
- ✓ The display terminals are effective configuration and diagnostics tools.
- ✓ The radio-frequency remote control has an associated radio receiver prewired in the factory in the comfort unit.

Dial terminal

Terminal with display

Flush-mounted terminal

Blank terminal

Radio-frequency receiver

Radio-frequency Remote control

User controls

✓ Temperature +/- adjustment (± 4.5°C)

✓ Automatic or manual ventilation selection

✓ On/off selection (corresponding to Comfort/Frost protection operating mode as standard)

Setpoint adjustment

Whatever the terminal, adjusting the temperature setpoint affects both the hot comfort setpoint and the cold comfort setpoint. So it works with a fixed neutral zone.

For the purpose of energy saving, the V3000 system has 4 operating modes, which can be controlled either manually via the user terminal, or automatically via a central management unit with time programming:

EN

✓ **Comfort mode**

TC = 19°C

TF = 26°C

The user may modify their comfort temperatures using the user terminal (+/- 4.5°C).

They can also be modified and limited by a central management unit.

✓ **Standby mode**

TC = 17°C

TF = 28°C

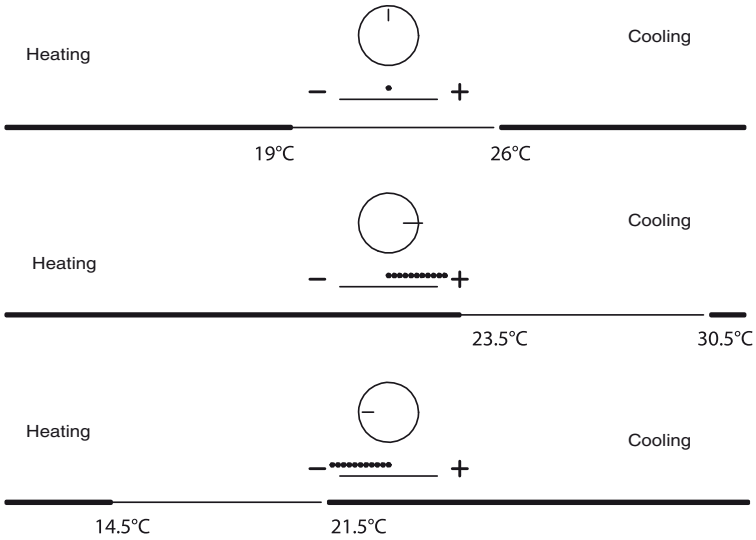
✓ **Economy mode**

TC = 14°C

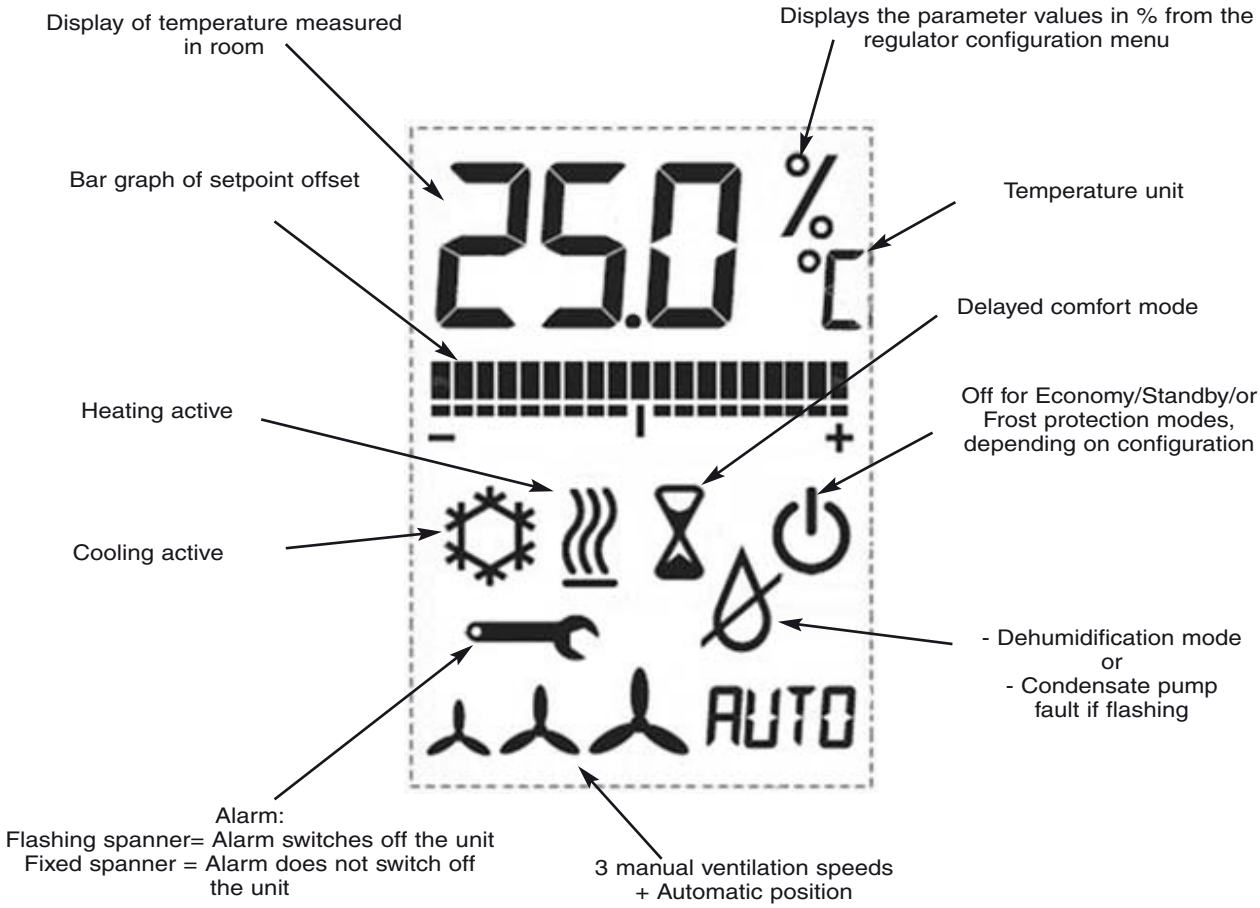
TF = 32°C

✓ **Frost protection mode**

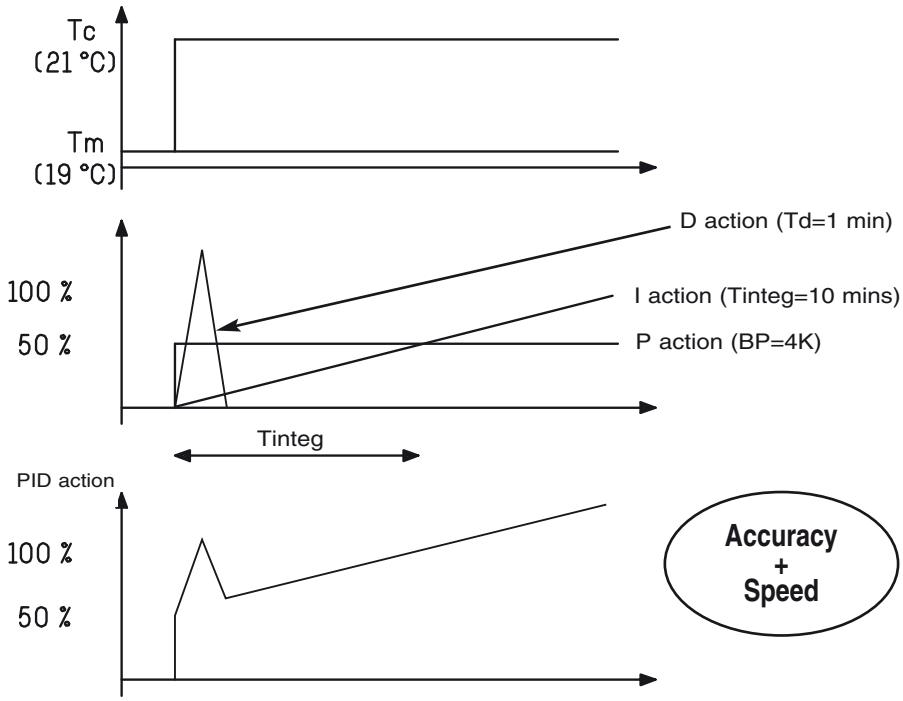
TC = 8°C



Close-up of display terminal screens



PID regulation



Tm: Measured temperature

Tc: Hot setpoint

BP: Proportional band = difference (setpoint - measurement) causing 100% valve opening

Tinteg: integration time = Time after which action I is equal to action P

Td: Derivative time= system's speed of action

To understand how Proportional Integral Derivative regulation works, you need to break down the 3 actions, proportional, integral and derivative actions, and start from an example where you suddenly create a difference between the measurement and setpoint.

The overall PID action corresponds to the valve opening, or the electric heater duty cycle requested by the regulator.

The proportional action performs the basic adjustment function.

A bigger Proportional Band enables you to have a slower system.

The integral action provides precision.

A short Integration Time gives a more responsive system. A long Integration Time gives a system which is slower, but with more inertia.

The derivative action can anticipate future variations. So it provides stability and speeds up the system

A long derivative time provides fast system action even with low variations in difference.

A short derivative time smooths out this action.

Straight from the factory, the V3000 has the following settings:

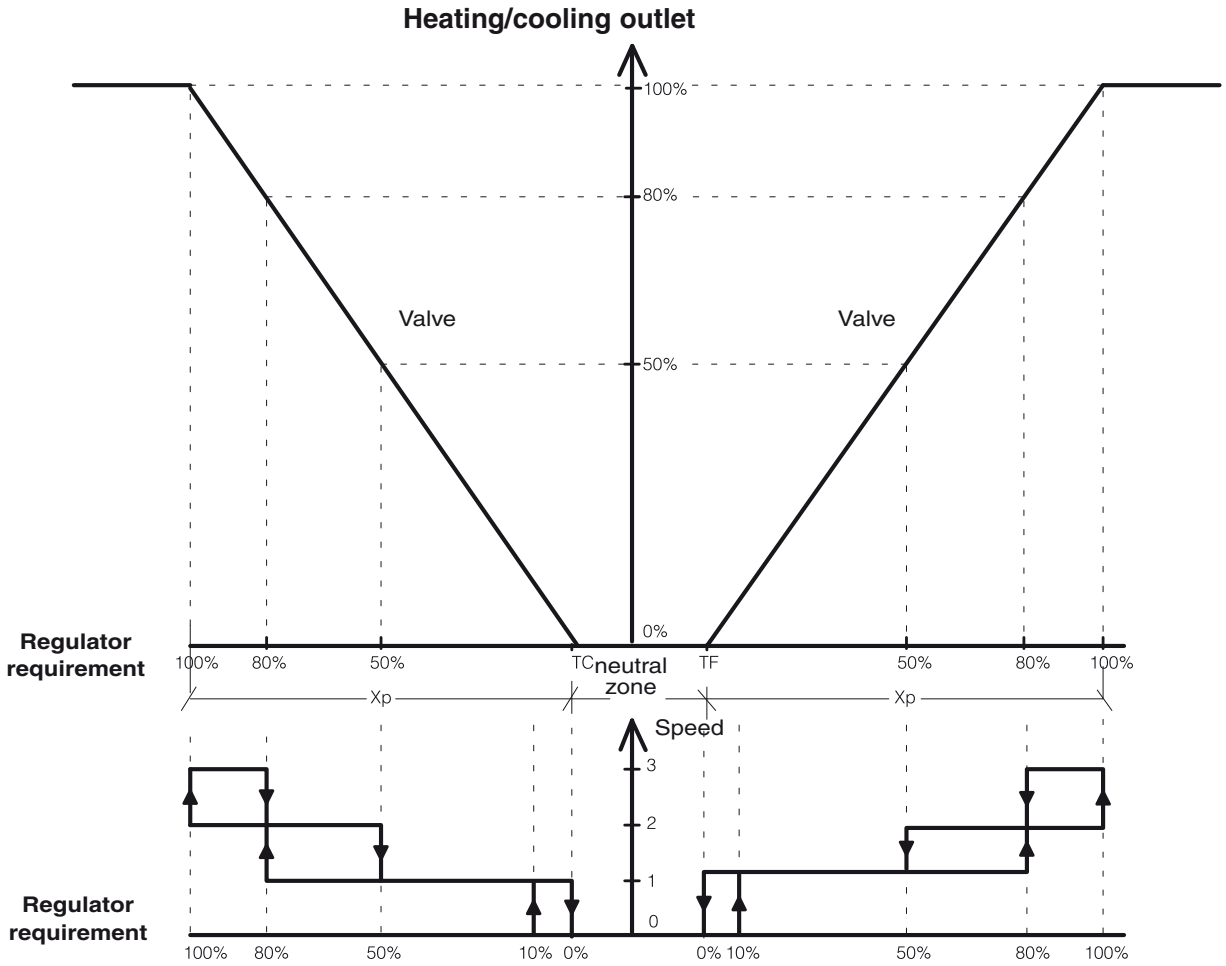
Hot BP = 4 K, Hot Td = 1 min, Hot TI = 5 mins,

Cold BP = 2 K, Cold Td = 1 min, Cold TI = 10 mins.

These values, validated in the laboratory, are fine for most installations. On the other hand, it is sometimes necessary to adjust one of these parameters to optimise system operation

NB: reducing the proportional band and integration time and increasing the derivative time does not necessarily reduce the system response time. This gives a more responsive system, which may lead to instability in the regulation if the setting is not suited to the room's inertia.

2-pipe regulation algorithm



2-pipe regulation enables the following applications:

- ✓ Cold only,
- ✓ Hot only,
- ✓ Hot/Cold with temperature sensor (changeover) fitted on unit,
- ✓ Hot/Cold with changeover from central management unit or a KNX signal

The regulator acts simultaneously on:

- ✓ progressive opening or closure of the regulation valve,
- ✓ the 3 fan speeds, or switches off the fan.

Priority is given to low speed operation (average speed activated once valve is 80% opened).

Note: the algorithm above assumes that the ventilation speed selection is in automatic position and that ventilation is off in the neutral zone. It only shows the proportional specification. In reality it is Proportional Integral Derivative type regulation. In addition, the ventilation speeds are delayed: the minimum fan run time for a given speed in automatic position is 2 mins (factory value, adjusted via parameter).

Cooling or heating requirements and supply

■ In Comfort, Standby or Economy mode

- Water network supplied with cold water

Cooling requirement

➠ The regulation valve opens, i.e. **Cold released**.

- Water network supplied with hot water

Heating requirement

➠ The regulation valve opens, i.e. **Heat released**.

■ In Off mode

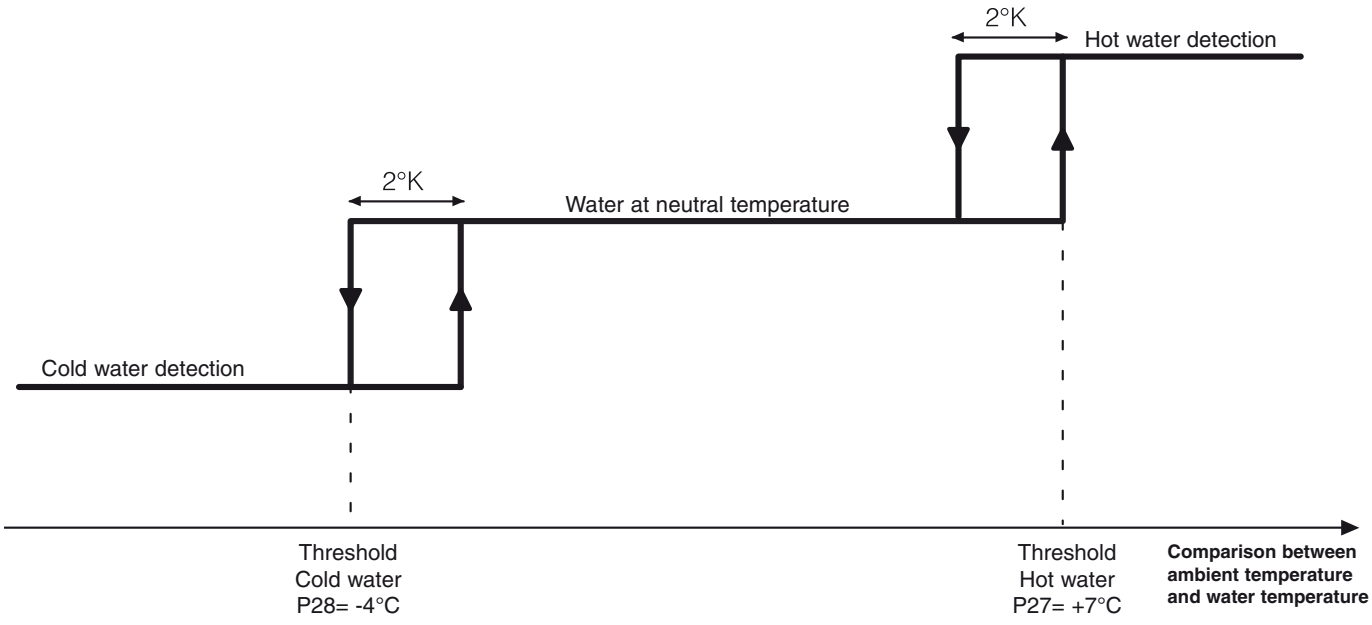
- Water network supplied with cold water

➠ There is no FROST PROTECTION, but cold locking

- Water network supplied with hot water

➠ FROST PROTECTION is activated by the regulation valve opening

Changeover sensor



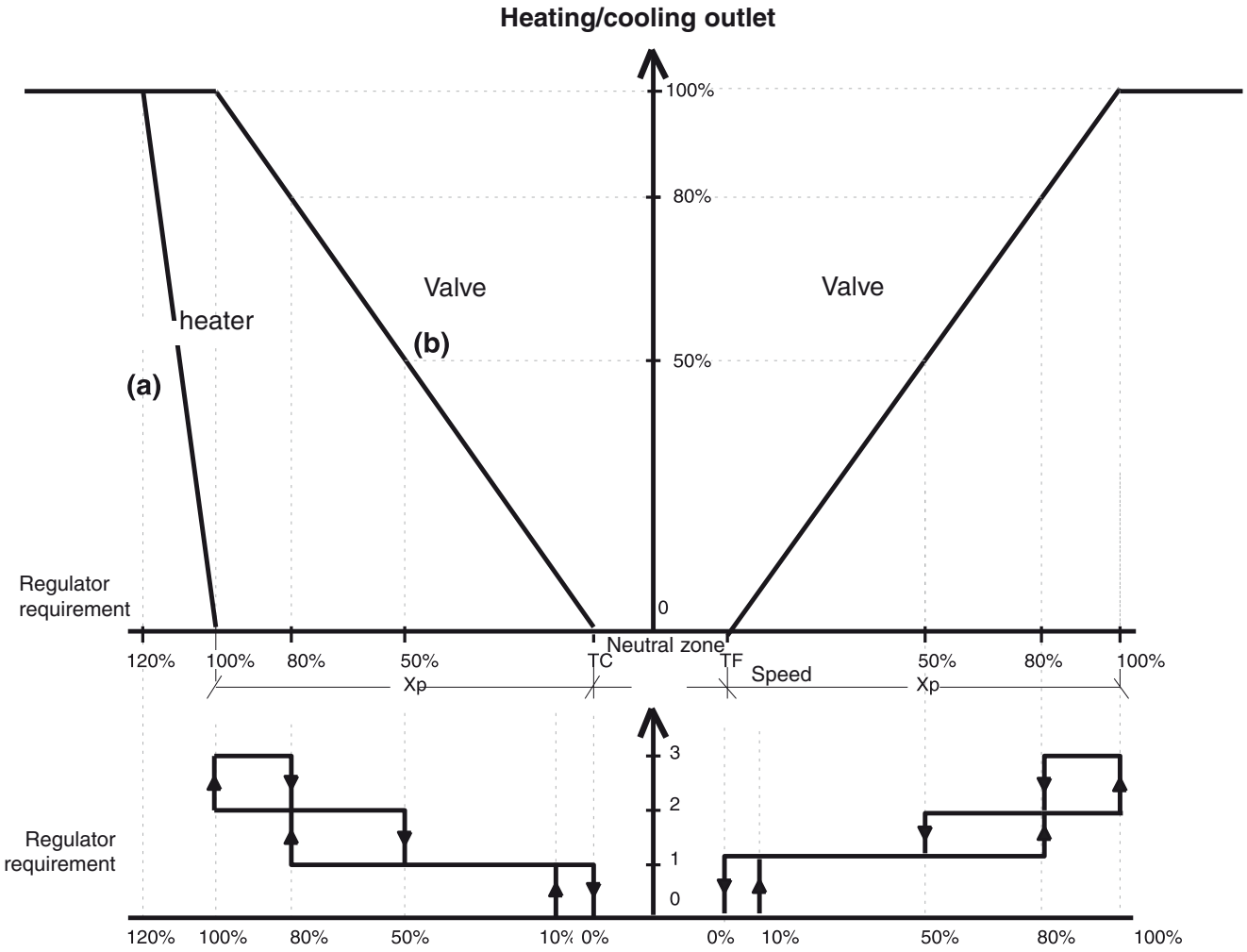
✓ The regulator constantly compares the water temperature available in the installation and the ambient (or return) temperature to authorise a hot sequence or cold sequence.

✓ If a so-called neutral temperature is detected, the V3000 authorises test cycles on the valve to acquire the actual water temperature and thereby be able to authorise the appropriate regulation sequence again.

The changeover sensor is used for detecting the water temperature. Since it must be placed upstream of the valve on the pipe, it can only be fitted on-site. Very special care should be taken when fitting this sensor, and it should be insulated.

N.B.: the changeover sensor measures the surface temperature of the piping. There inevitably will be a difference between the actual temperature of the water flowing inside the pipe and the surface temperature. The water speed will therefore be selected so as to guarantee changeover switching.

2-pipe/2-wire regulation algorithm



N.B.: Electric heater

- ✓ Hot water present, electric heater operates as shown by (a), provided that the water temperature is less than 50°C (otherwise electric heater is disabled)
- ✓ No hot water, electric heater operates as shown by (b).

2-pipe/2-wire regulation enables the following applications:

- ✓ Cold + electric heater,
- ✓ Hot + electric heater,
- ✓ Hot/Cold + electric heater with temperature sensor (changeover) fitted on unit,
- ✓ Hot/Cold + electric heater with changeover from a central management unit or a KNX signal.

The regulator acts simultaneously on:

- ✓ progressive opening or closure of the regulation valve,
- ✓ the electric heater in chrono-proportional operation (max 2000 Watts direct),
- ✓ the 3 fan speeds, or switches off the fan.

Priority is given to low speed operation (average speed activated once valve is 80% opened). In the scenario Hot/Cold + electric heater, priority is given to hot water heating, with the electric heater only activated as an addition. If there is no hot water, the electric heater is activated once there is a heating requirement.

Comment: The algorithm above assumes that the ventilation speed selection is automatic and that ventilation is off in the neutral zone. It only shows the proportional specification. In reality it is Proportional Integral Derivative type regulation. In addition, the ventilation speeds are delayed: the minimum fan run time for a given speed in automatic position is 2 mins (factory value, adjusted via parameter).

Requirements and supply (cooling or heating)

■ In Comfort, Standby or Economy mode

- Water network supplied with cold water

Cooling requirement

➠ The cold water regulation valve opens, i.e. **Cold released.**

Heating requirement

➠ The electric heater is turned on, i.e. **Heat released.**

A minimum 2 K neutral zone ensures that regulation works properly by preventing heat and cold overlap, and maintaining a difference between the two temperature setpoints.

- Water network supplied with hot water

Heating requirement

➠ The regulation valve opens and the electric heater is turned on (as back-up if necessary), i.e. **Heat released.**

■ In Off mode

- Water network supplied with cold water

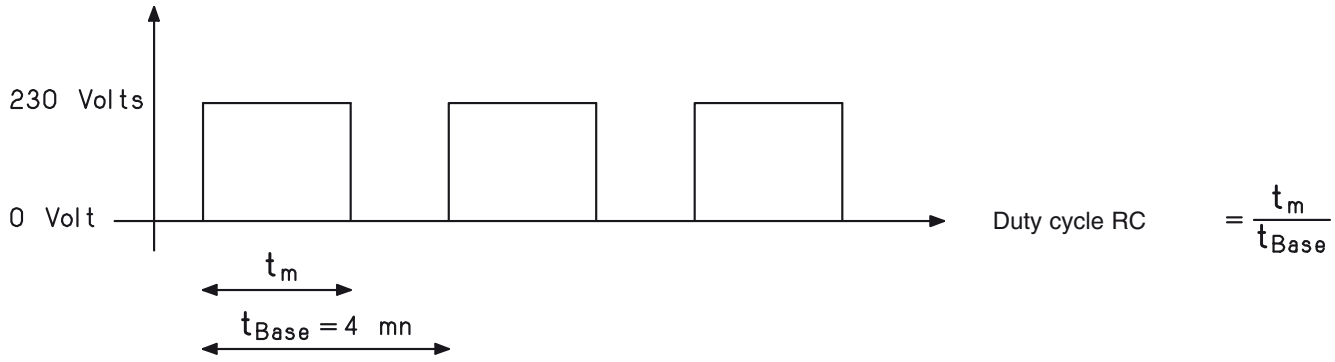
➠ FROST PROTECTION is activated by turning on the electric heater.

➠ Cold locking.

- Water network supplied with hot water

➠ FROST PROTECTION is activated by the regulating valve opening and electric heater activation (as back-up if necessary).

■ Electric heater operation



Variation of the duty cycle is used for modulating the heating energy, thereby ensuring similar operation to that of a progressive valve:

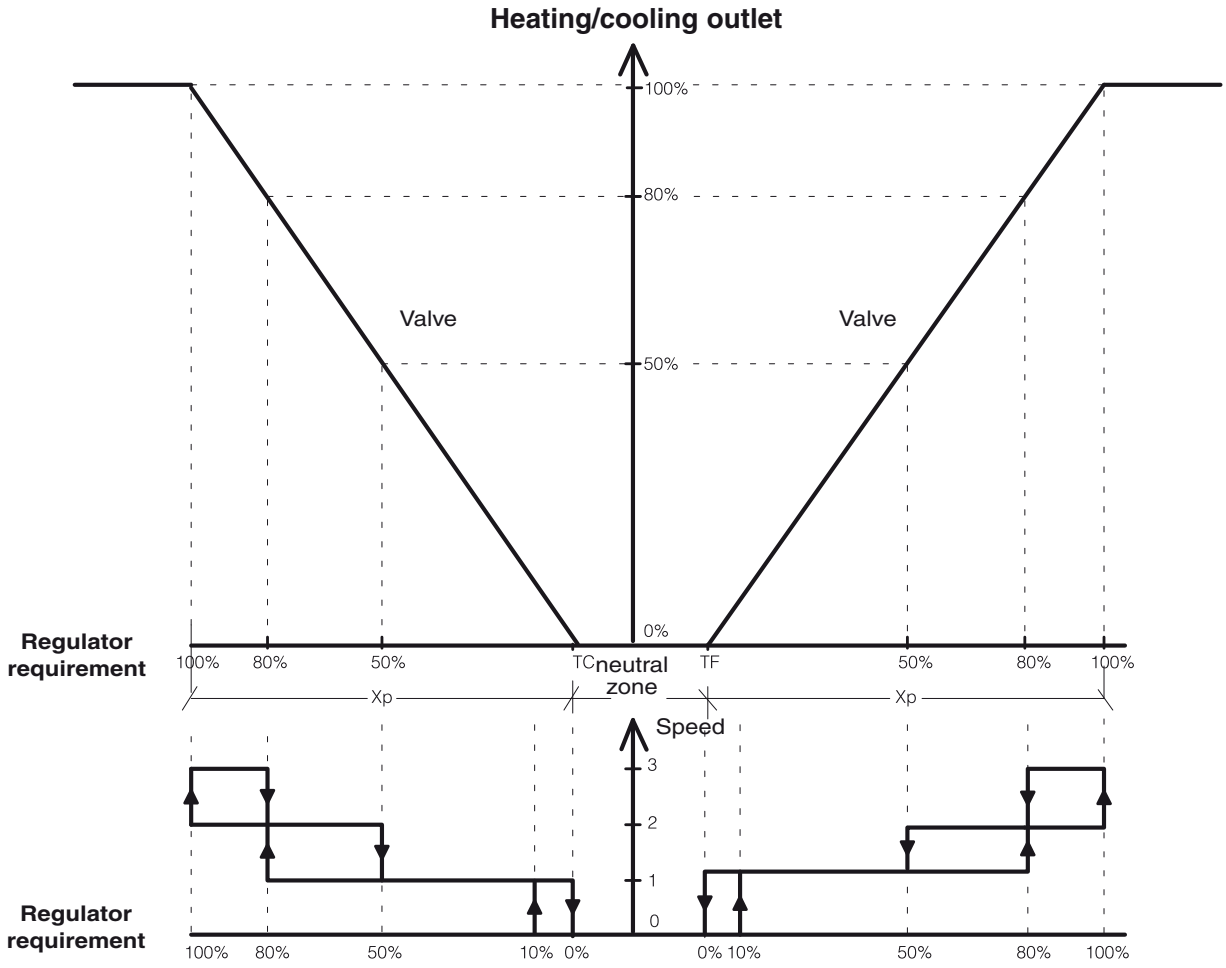
W = P x T = P x RC x tBase where:

W: energy, **P**: electric heater power, **T**: time, **RC**: duty cycle, **tBase**: time base.

The 4 min time base limits the number of relay manoeuvres. Tests conducted in a heat chamber at EDF showed that this time base provides a good level of comfort.

In conjunction with an outdoor temperature sensor or a central management unit, the regulator can limit the duty cycle according to the outdoor temperature or to limiting instructions provided by a Building Management System.

4-pipe regulation algorithm



4-pipe regulation enables the following application:

✓ Hot - Cold with two hydraulic coils (with neutral zone).

The regulator acts simultaneously on:

✓ progressive opening or closure of one of the two hot water or cold water regulation valves,

✓ the 3 fan speeds, or switches off the fan. Priority is given to low speed operation (average speed activated once valve is 80% opened).

Note: the algorithm above assumes that the ventilation speed selection is in automatic position and that ventilation is off in the neutral zone. It only shows the proportional specification. In reality it is Proportional Integral Derivative type regulation. In addition, the ventilation speeds are delayed: the minimum fan run time for a given speed in automatic position is 1 min (factory value, adjusted via parameter).

◗ Requirements and supply (cooling or heating)

■ In Comfort, Standby or Economy mode

Cooling requirement

➠ The cold water regulation valve opens, i.e. **Cold released.**

Heating requirement

➠ The hot water regulation valve opens, i.e. **Heat released**.

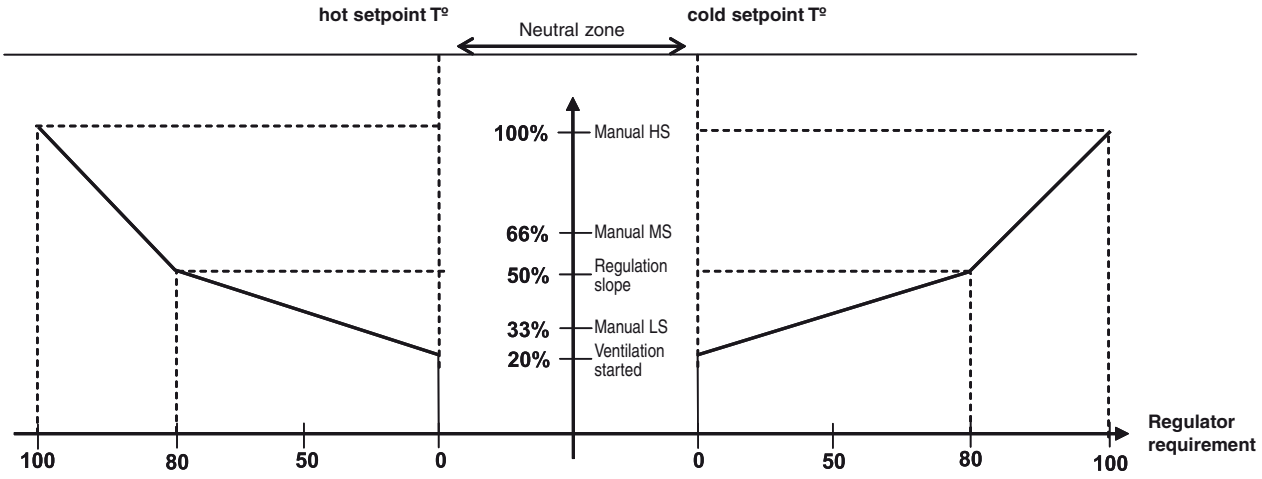
A minimum 2 K neutral zone ensures that regulation works properly by preventing heat and cold overlap, and maintaining a difference between the two temperature setpoints.

■ In Off mode

➠ FROST PROTECTION is activated by the hot water regulation valve opening.

➠ Cold locking.

HEE CIAT motor regulation algorithm



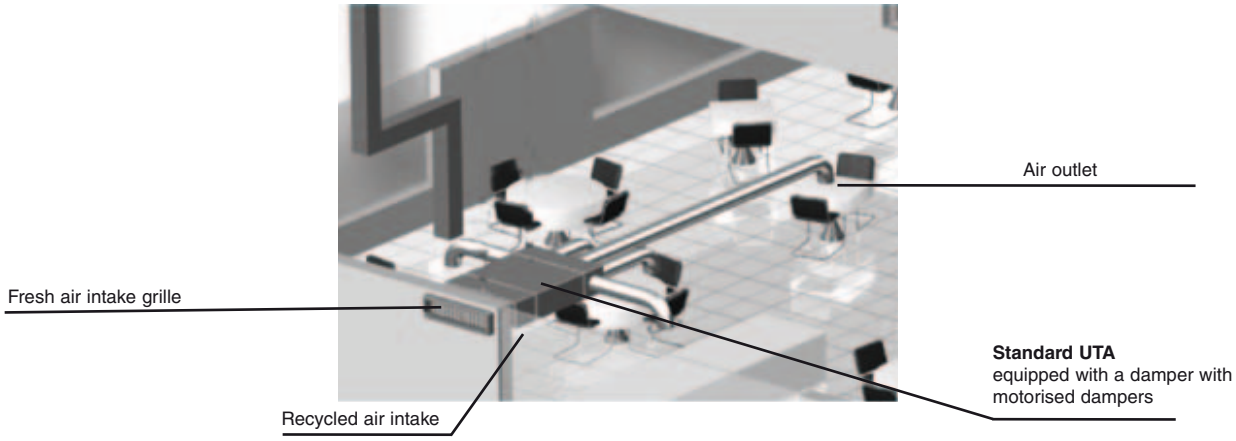
✓ The regulator ensures modulating variable speed control of the HEE CIAT fan unit (output 0/10V) according to the calculated requirement.

✓ The regulation slope setting is used for assigning priority either to "low" fan speed operation (acoustic prioritised) or to a steeper slope (thermal prioritised).

✓ The 3 "manual" speeds which can be activated from the user terminal, can also be configured.

Note:
The algorithm above assumes that the ventilation selection is in automatic position, and that it is off in the neutral zone. It only shows the proportional specification. In reality it is **Proportional Integral Derivative type regulation**

Room/Supply air series fresh air regulation



The purpose of this regulation is to introduce fresh air and control the ambient temperature in a room.
This regulation is available with the following applications:

✓ 2 hot pipes,

✓ 2 hot/cold pipes,

✓ 4 pipes

With a recycled air type system, the regulator also controls a fresh air inlet valve as follows:

✓ Valve opened if in comfort mode without anti-frost detection

✓ Valve closed if in standby, economy or frost protection mode, or anti-frost detection

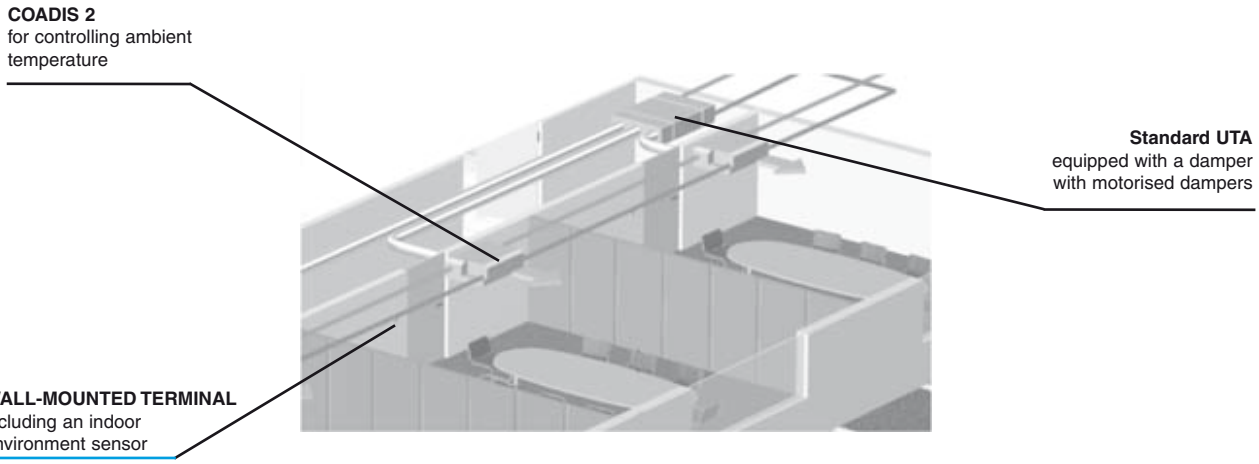
In normal operation, the regulator applies proportional integral derivative type room regulation, but if the supply air temperature drops below the (adjustable) supply air setpoint while the room regulation is in the neutral zone or heating, then the regulation switches to supply air regulation cycle with a proportional algorithm.
In winter, this function prevents the cold shower effect, a source of discomfort, by supplying preheated fresh air even if no heat gain is required in the room. In cooling mode, the supply air regulation is locked.

The regulator detects a frost risk if the heating valve is 100% open, or if the frost protection bulb is triggered (frost protection is provided by a bulb thermostat with automatic reset).

If a frost risk is detected, the valve closes and the fan switches off, and the heating valve is opened 100%. The frost protection cycle is maintained for at least 5 mins. The comfort unit will automatically restart after 5 minutes if the antifreeze thermostat is re-triggered.

NB: air extraction activation must be slaved to the valve position (customer wiring).

Fresh air regulation at constant supply air temperature



EN

The purpose of this regulation is to introduce fresh air at a constant supply air temperature in a room with its own comfort unit in order to control the ambient temperature and deal with the room's losses.
This regulation is available with the following applications:

- ✓ 2 hot pipes,
- ✓ 2 hot/cold pipes.

With a recycled air type system, the regulator also controls a fresh air inlet valve as follows:

- ✓ Valve opened if in comfort mode without anti-frost detection
- ✓ Valve closed if in standby, economy or frost protection mode, or anti-frost detection

The regulation operates with a Proportional algorithm. It measures the supply air temperature and triggers a heating or cooling cycle according to the hot and cold setpoints.

The regulator detects a frost risk if the heating valve is 100% open, or if the frost protection bulb is triggered (protection provided by a bulb thermostat with automatic reset).

If a frost risk is detected, the valve is closed and the fan switched off. The heating valve is 100% opened. The frost protection cycle is maintained for at least 5 mins. The comfort unit automatically restarts after 5 minutes if the antifreeze thermostat is re-triggered.
Note: air extraction activation must be slaved to the valve position (customer wiring).

Important: another unit must be provided for to protect against frost and counteracting the room's losses.

Dry contact inputs

- ✓ 2 configurable dry contact inputs
- ✓ Direction action selection via configuration
- ✓ Function selection via configuration:
  - ❑ Inactive
  - ❑ Window contact (for frost protection switchover, control without local override possible)
  - ❑ Presence contact (for switchover to Standby or Economy mode, control without local override possible)
  - ❑ Condensate pump alarm
  - ❑ Fan unit alarm
  - ❑ General alarm
  - ❑ Fresh air frost protection thermostat
  - ❑ Clock (for switchover to frost protection mode, with local override permitted)
  - ❑ Clock (for switchover to Economy mode, with local override permitted)
  - ❑ The contacts are released from the factory configured "Normally Closed" (open upon a fault). A bridge is made if the inputs are unused.

It is therefore possible to combine several control systems on the regulator via contacts D1 and D2

Example:

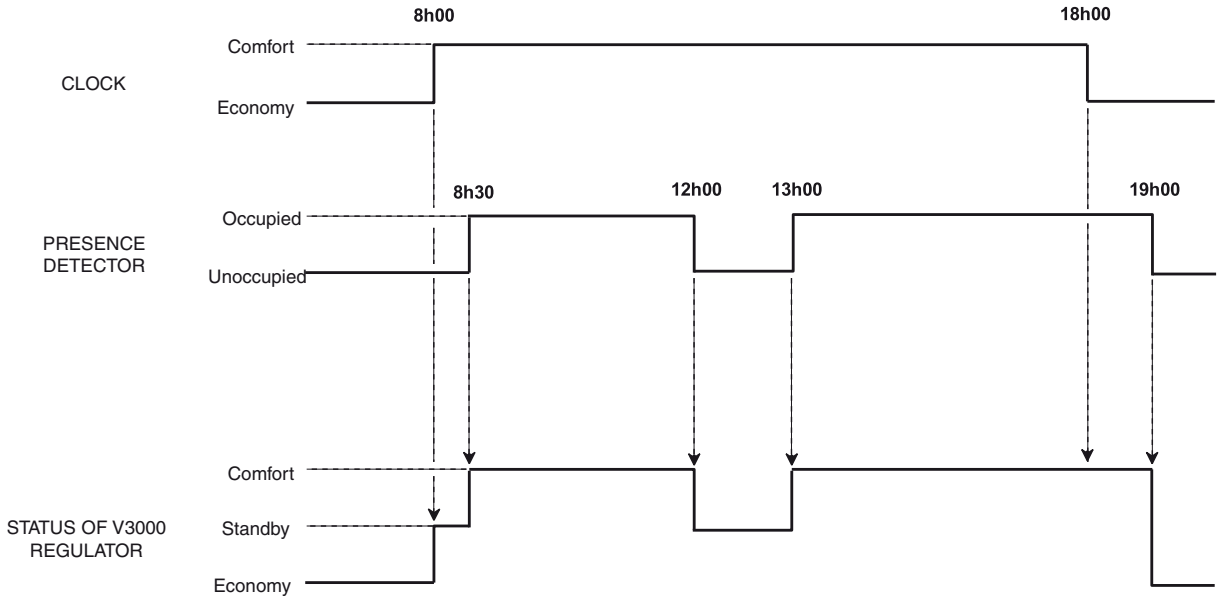
D1 = Overall building clock, Comfort ↔ Eco
D2 = Standby Mode presence detector

→ The clock applies Economy mode to the entire building at night

→ The presence detector: enables Standby Mode when the room is no longer occupied.

→ Optimisation of the different operating modes is achieved through combining information from the (overall building) Clock and whether the room is occupied or not.

Note: The same control system can be managed via the KNX bus by using the HvacMode variables for the clock and PresenceStatus for presence detection, for instance.



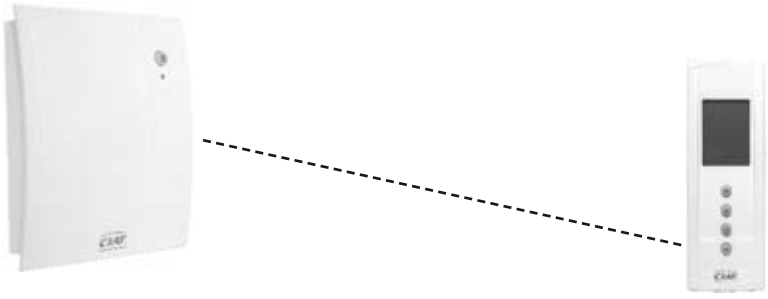
✗ If nobody is present when the clock authorises comfort mode in the building at 8.00, the V3000 is set to the intermediate **Standby** mode.

✗ The V3000 will switch to **Comfort** mode if somebody is actually present at 8.30.

✗ When the clock signals **Night** (Economy) mode at 18.00, the V3000 will only switch to this mode if all people had left the room by 19.00.

Radio-frequency remote control

Radio Receiver:
- Pre-wired to the unit in the factory
Or
- Its design enables it to be put in a visible position within the room



✓ The radio-frequency remote control can only be used with a radio-frequency receiver. The receiver is pre-wired to the unit in the factory. Its design enables it to be put in a visible position within the room, if necessary.

✓ This remote control enables you to remote control a comfort unit equipped with a radio receiver (d= 10 m, no restrictions on direction)

When the comfort unit equipped with this system is first switched on, you need to "pair" the remote control with its radio receiver (refer to manual N08-35A to perform this configuration).

Note: The  button on the receiver enables you to switch the unit on/off.

✓ Master/slave operation is possible by associating 1 radio remote control with up to 6 different receivers

✓ The features of this remote control are the same as those of the wall-mounted display terminal

✓ Refer to manual N08-35 for the possible display options.

✓ Batteries: the CIAT remote control operates with 2 LR03 batteries provided. The lifetime of these batteries depends on how frequently this remote control is used.

Configuration

Choice of air temperature sensor

You can opt for operation based either on the indoor environment sensor, or on the return sensor. If the selected air sensor is faulty, the other automatically takes over. An error message is indicated by a pictogram, which can be looked up in the regulator's diagnostic menu.

Supply air limit sensor

It is possible to set up a supply air sensor enabling an upper or lower limit to the supply air temperature (on 2-p and 4-p version only).
Upper limit: 40°C
Lower limit: 16°C
This option is only available with a room wall-mounted terminal, and requires a 3-point modulating valve to be used.

Calibration

It is possible to calibrate the indoor environment sensor and return sensors separately.

Changeover thresholds

The changeover thresholds can be adjusted.
Important: the pre-set values are generally suitable, and they must not be modified to enable intermediate water temperature conditions that would lead to reduced fan coil unit power.

Regulation parameters

The hot Proportional Band, the hot Integration time, the hot Derivative time, the cold Proportional Band, the cold Integration time and the cold Derivative time are adjustable. The factory setting is suitable for conventional comfort use.

Neutral zone ventilation

For each operating mode (Comfort, Standby, Economy or Frost protection), it is possible to set the neutral zone ventilation: permanent ventilation, ventilation off, combination of the 2 according to the season, periodic ventilation every half-hour for an adjustable time.

Minimum ventilation speed operating period

In automatic ventilation selection, this parameter limits the number of speed changes.

Override timer

This is applied when a user opts to switch to comfort. The override can be prohibited, with or without a time limit.

Direction of window contact

It may be closed when the window is closed, or open when the window is closed. Opening the window results in switching to frost protection mode.
More generally, the regulator's 2 dry contact inputs may be set up as NO or NC

Calculating comfort unit energy consumption

Electric coil capacity

It is possible to set this value so that the regulator estimates the electric heater's energy consumption, and can send this information to the Building Management System.

LS, MS and HS fan power

It is possible to set the power consumption value of the fan motor for each of the 3 ventilation speeds. The regulator estimates the electrical energy consumed by the fan, and can send it to the Building Management System.

Hot and cold water coil nominal capacity

It is possible to set the nominal capacity of the hot water coil and cold water coil. The regulator deduces from this an average energy consumption for heating and cooling, and can send it to the Building Management System.

Electric heater limitation

The regulator is capable of limiting the electric heater duty cycle by collecting the outdoor temperature information sent via the KNX bus.

Fresh air parameters
Different parameters allow the type of fresh air regulation, the supply air temperature set point and the supply air Proportional Band to be selected.

Bus parameters
These enable you to define applications of varying levels of sophistication. It is recommended that these parameters be only used by specialists.

Diagnostics

Temperature setpoints
It is possible to read the current value of the comfort setpoint.

Application type
Enables you to check whether the application (2-pipe, 2-pipe/2-wire, 4-pipe) is correct.

Changeover information
The regulator indicates whether the hydraulic coil is still cold, still hot, whether the changeover information is coming from the central management unit, or indicates the temperature detected by the sensor.

Temperature measurements
It is possible to read the return and indoor environment sensor values, regardless if which sensor is selected for regulation.

Current fault
The current fault on the regulator is indicated in the form of an alarm code (display “E07” for example).
This information can be recovered by a central management unit.

Last fault indicated
The regulator stores the last fault that occurred.

Window contact status
On a display terminal, the window opening is indicated (display "- - - -").

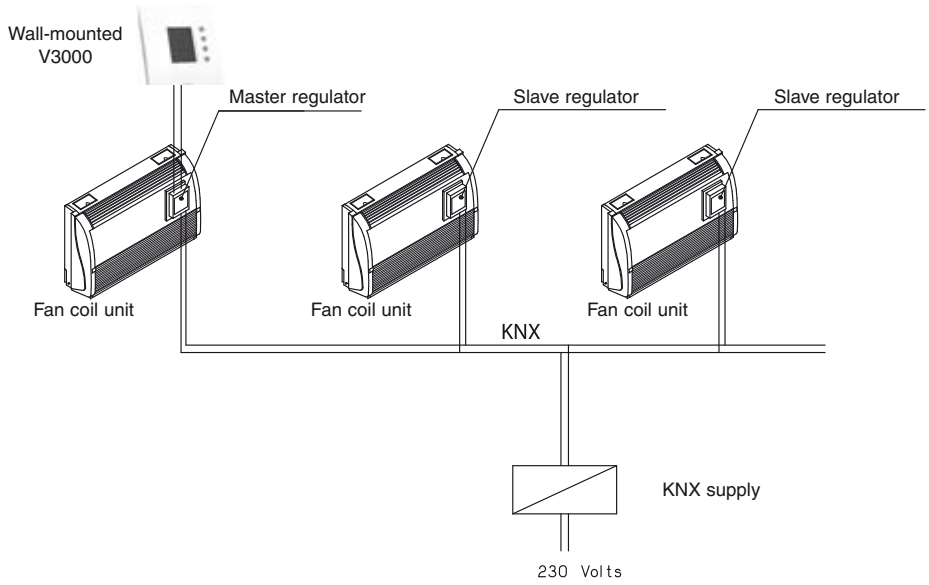
Outdoor temperature
Outdoor temperature value if an outdoor sensor is connected to the KNX bus

Electrical and heat consumption
In this case the diagnostic estimates the thermal energy consumption for heating or air conditioning and the electrical consumption of the electrical stage and the fan.

Software version of regulator and terminal

- Version launched in December 2008:
- Regulator version: 1.01
- Terminal version: 1.01

Master/Slave without central supervision unit



A KNX supply needs to be provided, for 64 regulators at most.

It is possible to define **several master/slave functions for the same bus.**
Allow a maximum of 15 Slaves for 1 Master.
There are **3 ways of performing the master/slave function**:

✓ By **Hot/Cold Authorisation**.

Each regulator works according to its own temperature measurement. A slave can only heat if the master is heating. A slave can only cool if the master is cooling. In certain cases, it is possible to combine a recycled air fan coil unit and a fresh air fan coil unit in room/supply air series in a single same master/slave function.

✓ By **feedback of the temperature measured by the master**

The master sends its own temperature measurement to all its slaves. All the units in the room therefore work with an identical measurement.

✓ By **feedback of master outputs position**

The master sends the position of its outputs to all the slaves. All the units in the room therefore work with the same outputs position (valves, electric heater, fan).

Refer to the Commissioning manual (N08.35A) for configuring the units with this operating mode.

Customer connections

✓230 Volt fan coil unit +regulator supply (to the fused isolator(s) on standby in the comfort unit electrics box).
✓ Wall-mounted user terminal (2-wire)
✓ KNX 2 wires (shield continuity needed.)
✓ Window contact/Presence contacts...
✓ Hydraulic connections

CIAT service

Supply of a complete system
✓ Regulation assembled, set-up and tested in the factory
✓ Complete regulation loop (regulator, terminal, sensors, valves, valve motors)
✓ Fused isolator
✓ Return sensor as standard

Provision of complete services
✓ Help with installation design
✓ Commissioning
✓ After-sales technical assistance

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