



Flexible Space

Under Floor Air Conditioning

FATRONIC EVOLUTION
PRODUCT DESCRIPTION

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Section One - Introduction

1.0 General

This User Manual describes the Fatronic Evolution (Fatronic) controller. It contains information concerning the architecture of the control systems as well as the settings required to obtain the desired operation.



1.1 Models

There is one type of Fatronic controller available. This has been upgraded to be fully compatible with all previous versions whilst offering new functions to serve EC and AC fan options.

1.2 Software

Different software versions are available to achieve compatibility. The software version loaded on to the Fatronic can be inspected and verified by selecting the programming mode.

1.3 Connectivity

Every controller can be connected in a Flexbus network.

1.4 Applications

The electronic controller here described shall provide control for an AET Flexible Space system terminal unit (TUx) which can be installed in the floor (Fantiles) or on the floor (Console Terminal Units). These devices may be used in combination with AET Flexible Space zone units (CAM) for full communication, but can stand alone if desired. The self-contained air terminal unit (TUx) can be installed in a variety of indoor or protected locations throughout the world. The Fatronic controller is water resistant.

1.5 Description

The Fatronic controller has been developed specifically for UFAC application to monitor and control the cooling and heating function of all TUx models in the AET Flexible Space range. This unit is able to sense both the under floor air temperature and the room air temperature; it maintains full comfort of the cooled/heated ambient by controlling the damper, fan speed and optional electric heater as required.

1.6 Compatibility

Additionally to hardware changes there are major software changes in the Fatronic Version 2.xx.xxx

For this reason **Fatronics with version 1.xx.xxx must not be connected with version 2.xx.xxx** because they will not be able to communicate.

Users should check the CAM Eprom version too. Since an automatic Firmware Upgrade mechanism in the CAM has been installed, please check the compatibility table for which Fatronic and CAM versions can be connected to a Network.

Compatibility Table

FATRONIC Evolution	CAM Version	Automatic Fatronic E Firmware Upgrade
3.00.024	Less than HVM 1.00.051	no
3.00.024	Greater than HVM 1.00.070	yes

Fantile Model Range TUx

Model	Description
TU4 (AC)	In Floor AC Fan Unit
TU4 (EC)	In Floor EC Fan Unit
TUS (AC)	In Floor Slimline AC Fan Unit
TUS (EC)	In Floor Slimline EC Fan Unit
TUC	On Floor Console AC Fan Unit

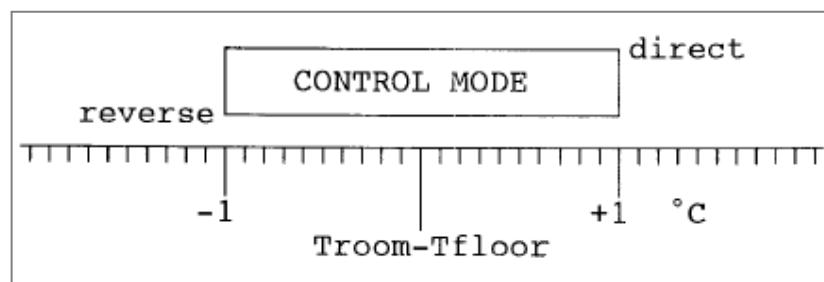
Section Two - Principal of Operation

2.0 Temperature Control

The room temperature is compared with the set-point temperature; if the room temperature is 0.5°C higher than the set point cooling is needed. Cooling is possible when the temperature under the floor is lower than the room temperature; this is called the **direct control mode**. In this case the damper is opened by gear motor activation. The damper is closed when the room temperature falls to 0.5°C below the set point.

However if the room temperature is 0.5°C lower than the set point, heating is needed. If the temperature under the raised floor is higher than the set point, heating is possible and this is called the **reverse mode**. In this case the damper is opened by gear motor activation. The damper is closed when the room temperature rises to 0.5°C above the set point. The information if warm or cold air is available (reverse or direct mode) can be obtained automatically from the sensor positioned in the under floor air intake of the TUX.

- If room temperature is 1°C higher than the temperature under the floor, the direct mode is selected.
- If room temperature is 1°C below the supply air temperature, the reverse mode is selected.



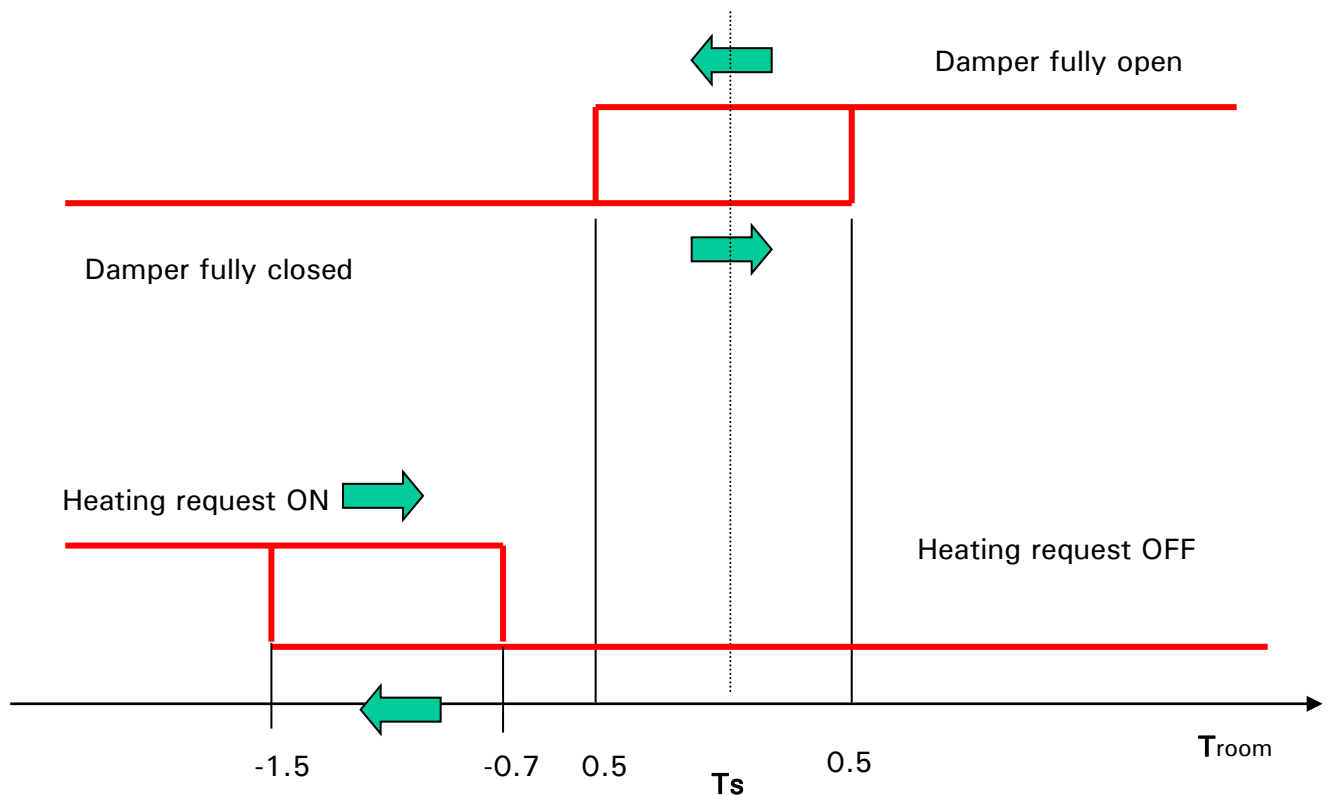
2.1 Direct Mode

In this mode there is one step of cooling and one step of heating possible.

When the temperature reaches 0.5°C higher than the set point, the damper is energized and cooled air enters the room from the raised floor. The damper is closed when the temperature has fallen to 0.5°C below the set point.

When in cooling mode, the room temperature in an area served by a TUx falls to 0.5°C below the set point, the damper closes. When the room temperature falls to 1.5°C below the setpoint, and the electric heater is activated. The electrical heater is deactivated when the temperature reaches 0.7°C below the set point.

Figure One - Temperature control direct mode for FAT (T_s =Set Point)



2.2 Reverse Mode

In this case two steps of heating are provided.

➤ *First heating step*

If the room temperature is less than 0.5°C below the set point the controller energizes the damper to open, and warm air enters the room. The damper is closed when the temperature has reached 0.5°C above the set point.

➤ *Second heating step*

When a heater is installed on the TUx, it is turned on when the room temperature falls to 1.5°C below the set point. When the temperature has reached 0.7°C below the set point, the electric heater is switched off. In this operation the damper remains open to allow warm supply air to assist the heating process.

Figure Two – Temperature control in reverse mode

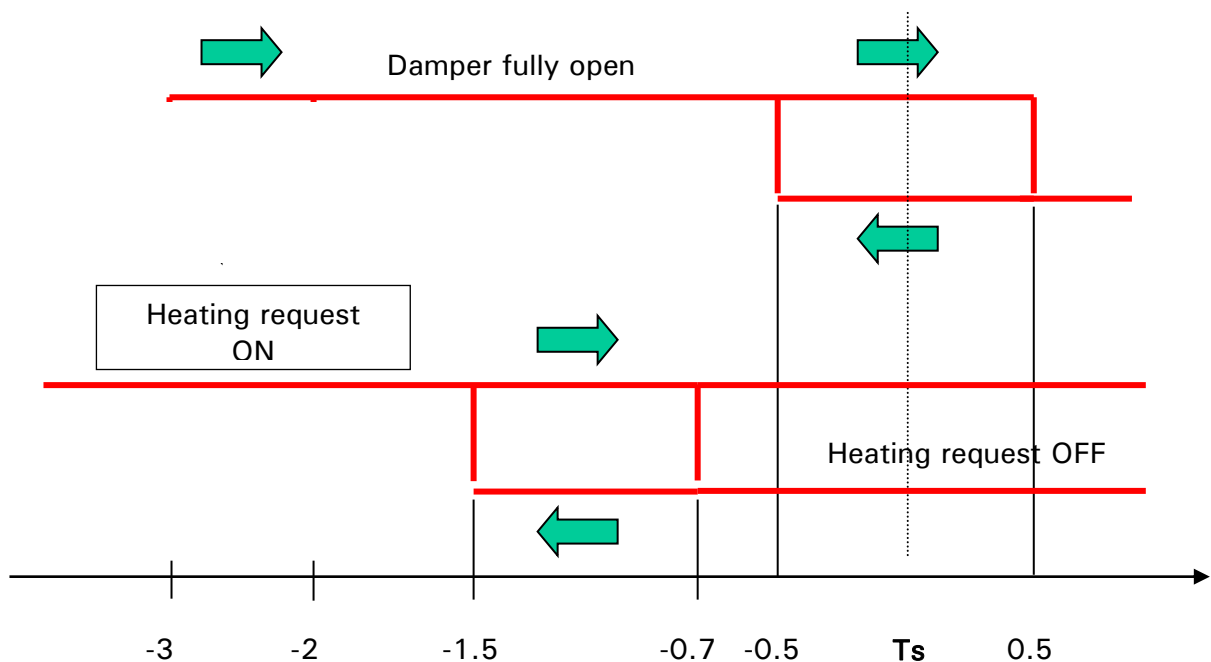
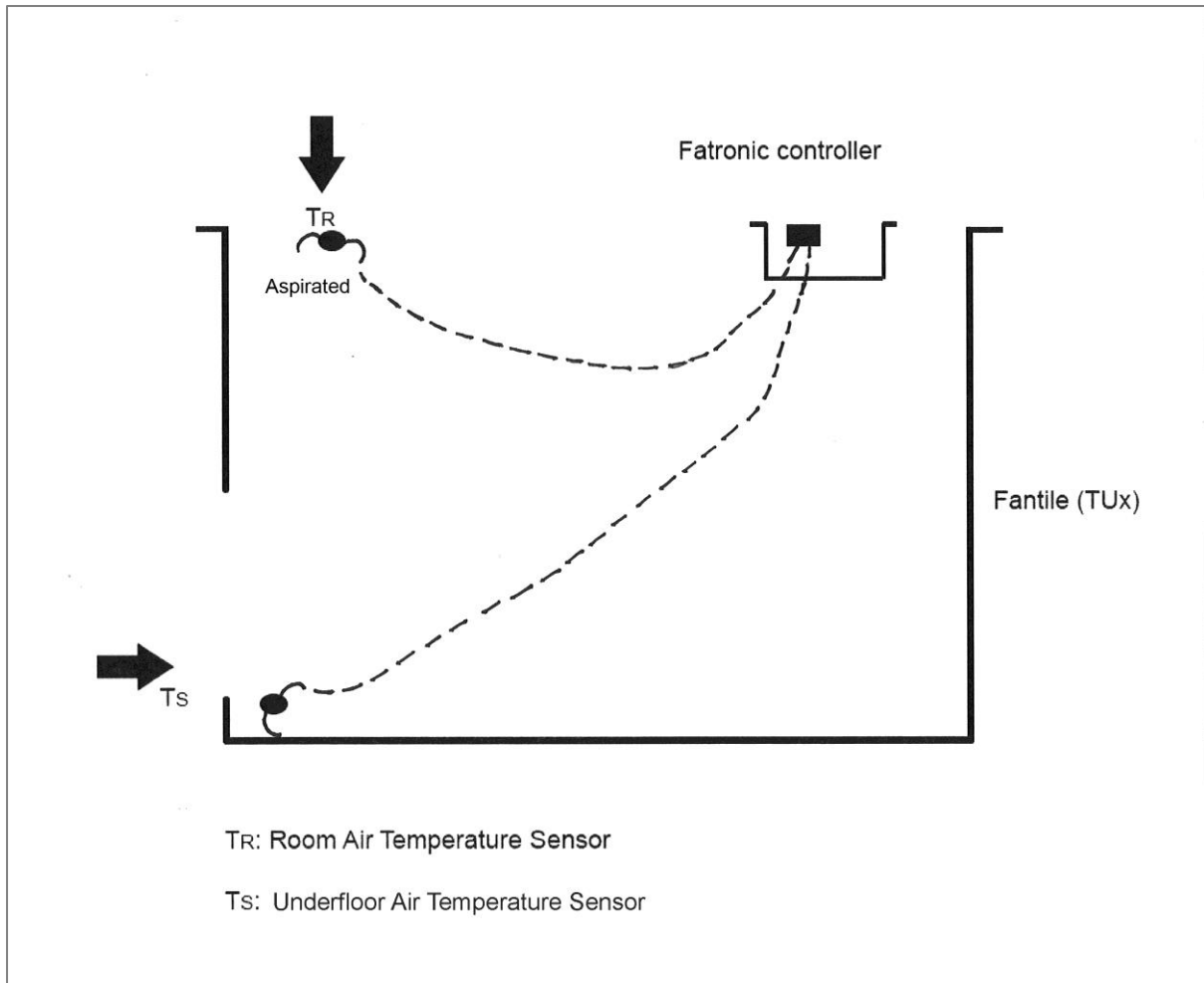


Figure Three - Temperature Sensor Location



2.3 Fan speed

The end-user can adjust the fan speed according to personal needs. Different operating modes can be selected at the controller. See section 3.11 how to select different fan speed settings.

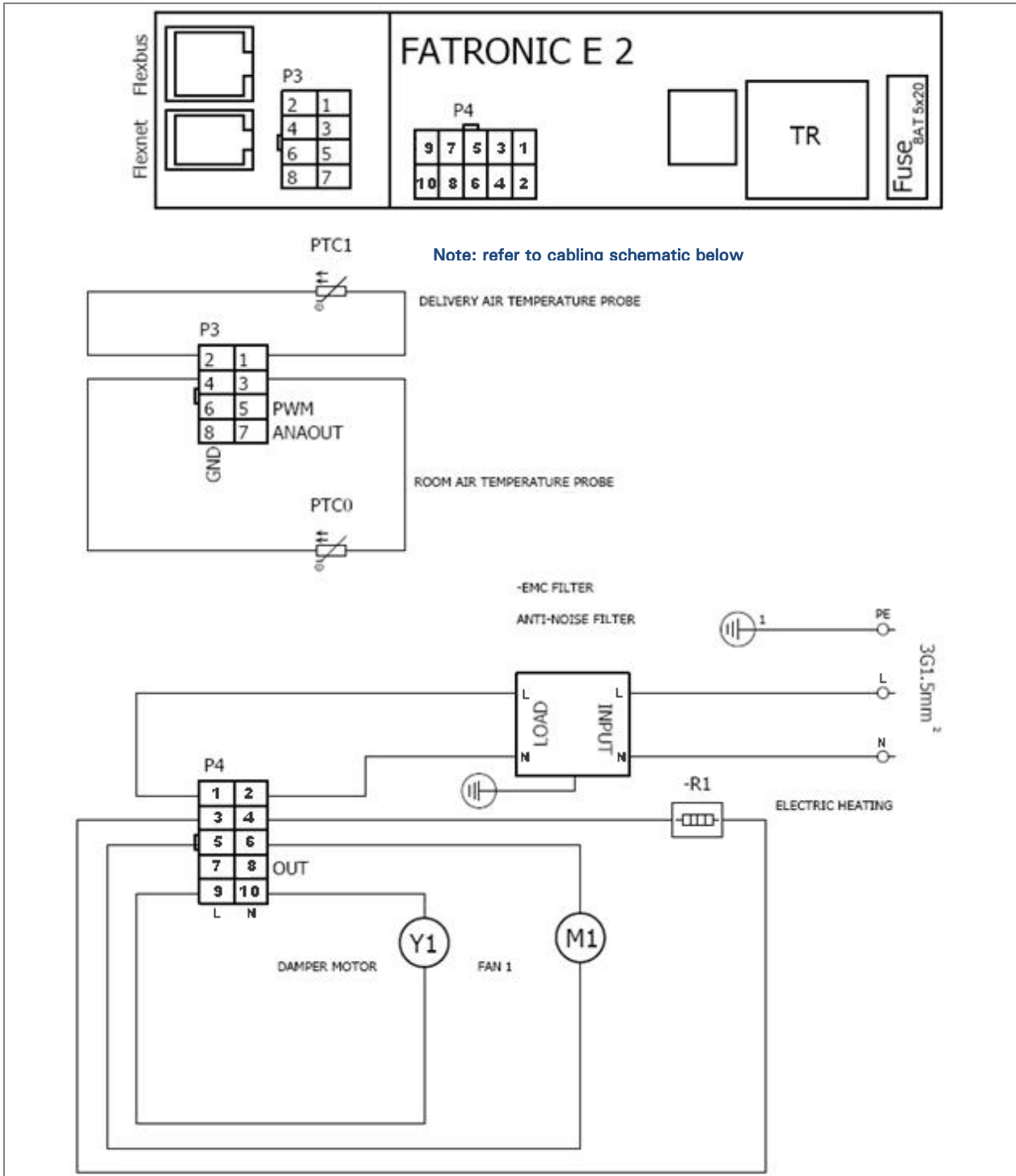
“Y” *At startup the device will start with the last speed set by the user.* By selecting the memorised mode the fan, at start-up operates at the speed it had at the moment it was switched off.

“D” *At startup the device will start with speed programmed by parameter “d”.* When switched on in the default mode, it operates at a fixed speed during the operating hours. This can then be varied by the user but it will default to this setting provided that power has been cleared and restored.

- “N”** *Always same fan speed:* In the prohibited mode the facility to vary the fan speed using the push buttons is disabled: the speed will be fixed at the value set at the time of the selection of this mode.
- “A”** *Automatic speed selection:* After startup the Fan speed is adjusted automatically based on the room temperature: by selecting the auto mode the fan-speed will automatically change on the basis of the deviation between set-point and room temperature in steps from low to high speed.

Section Three – Technical

3.0 Fatronic Hardware



3.1 AC Voltage input:

The Fatronic control is designed to operate with a single-phase power supply as follows:

- Voltage range : 200V -10% to 250V $+6\%$
- Frequency range : 45 to 65Hz

The overall **maximum** current absorption is up to **8A**.

3.2 Damper Output

Damper Output is able to supply the Main Voltage (230V ac) by an On/Off TRIAC for loads up to **1A** in steady-state.

3.3 Fan Speed Outputs - AC Fans

FAN1 Output is able to directly drive an inductive load with a minimum $\cos(\phi)=0.85$.

Regulation is achieved by a phase cutting control, delivering a voltage to the Fan in the range of 130-220Vac. Maximum current foreseen for this output is 1A in steady-state.

FAN2 Output (Auxiliary Fan output) is able to supply the Main Voltage (230V ac) by a On/Off TRIAC for loads up to **1A** in steady-state.

3.3.1 Fan Speed Outputs – EC Fans

When operating with EC Fans the Fatronic controller is set up at commissioning to generate a 0-10v signal to the EC fan control.

Additionally the Fatronic controller permits adjustment of the min. and max. values. E.g. Max (0 - 10v) – Adjust (1.5 - 7v) example.

3.4 Heater Output

Heater output is able to supply the main voltage (230Vac) by a relay for pure ohmic loads (only resistor heaters) up to **1000W** in steady-state.

3.5 Fuse

Fuse is 5mm*20 type 8A.

*****CAUTION*****

When using the control in the application ensure the overall current is not higher than 8A foreseen in worst case working. Overall current = Heater ON + Both Fans ON + Damper Activated

3.6 PTC Temperature Inputs

There are different types and lengths available: please refer to spare parts list on the Flexface application manual. PTC Sensors are temperature-sensors, changing the resistance according to the temperature (positive temperature coefficient). The connection is 2 poles.

The length of the cable for the sensor ranges up to 10 metres.

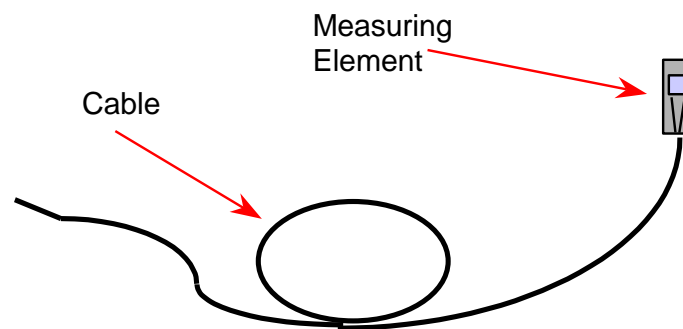
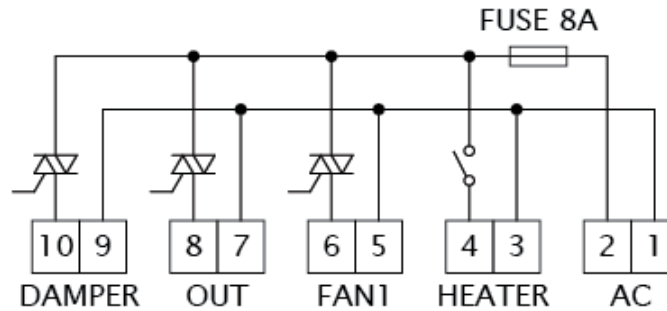


Figure Four – PTC Sensor

3.7 Output Schematic



3.8 Hardware Technical Specification

FATRONIC E TECHNICAL SPECIFICATION:		
	Power Supply (V a.c.)	200÷250Vac – 50/60Hz Upper limit +6%, lower limit –10%
	Type of operation	Type 1.C Software category A
	isolation	Over voltage category III pollution degree 2 surge voltage 2,5kV
1, 2	Power connection	type Y attachment wire connection AWG 18-20
3, 4	Power Digital Out Main Volt output (Relay)	1 Normally used for Heater It applies main voltage output Maximum load (1.0kW, pure resistive) Type of switching: micro-disconnection
5, 6	Power Digital Out Main Volt output (TRIAC)	3 Max current foreseen per output: 1.0A steady state 8.0A FLC (10 cycles 50Hz)
7, 8	NOT USED	240V output
9, 10	Damper Motor Supply	On/Off 240V output
	Analogue In (PTC Kty 81-210)	2
	Flexbus connection (RJ45)	1 x HB Slave Not optocoupled
	Flexnet connection (RJ9)	1 x RS485 Not optocoupled
	Storage Temperature range	-10 (dry conditions) to +65°C
	Operating Temperature range	0 (dry conditions) to +55°C

3.9 Installation

The Fatronic is installed on a 2mm thick metal panel. (see technical appendix for mechanical dimensions). The unit is a “push-fit” and may be removed using the specific tool supplied.

*****Warnings for Installation*****

Avoid mounting the control in environments with the following characteristics:

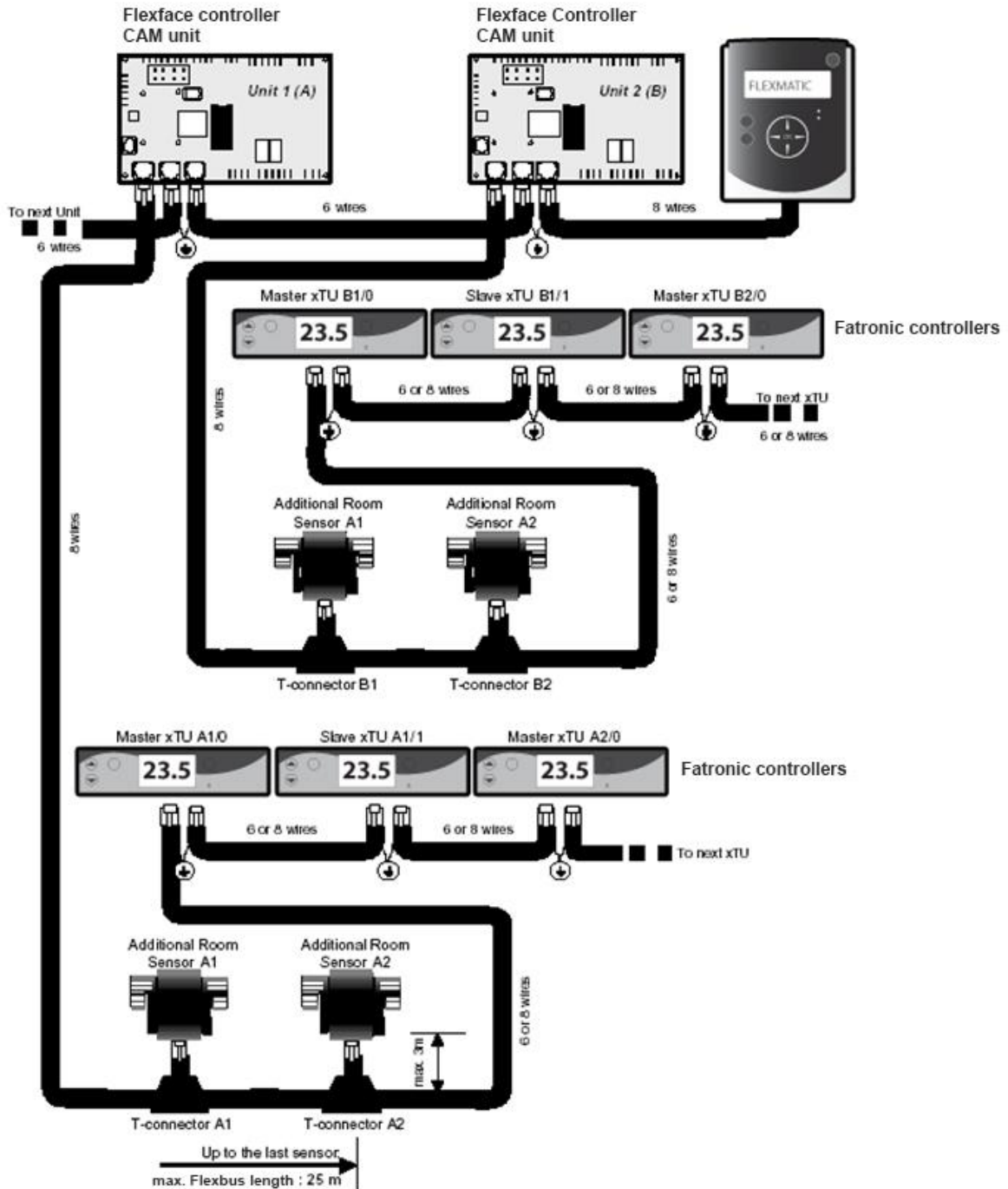
- Relative humidity above 90%
- Strong vibrations or knocks
- Exposure to continuous streams of water
- Exposure to aggressive and polluting agents (e.g.: sulphurous and ammonia gases, saline mists, smoke) which may cause corrosion and/or oxidation
- High levels of magnetic and/or radio-frequency interference (thus avoid installation near transmitting antennas)
- Exposure to direct sunlight and atmospheric agents in general
- Large and rapid fluctuations in ambient temperature
- Environments where explosives or mixes of inflammable gases are present
- Excessive exposure to dust (formation of corrosive patina with possible oxidation and reduction of insulation)

When connecting the control the following cautions should be noted:

- 1) Voltages different from the power ratings will seriously damage the system.
- 2) Use cable-ends which are suitable for the terminals being used. Once completed the fitting operation lightly pull the cables to check that they are properly inserted.
- 3) The sensor and digital input signal cables should be separated as much as possible from the inductive load and power cables to avoid electromagnetic disturbance. Do not use the same cable channels (including those for the electrical cables) for power cables and sensor cables. Avoid installing the sensor cables in the immediate vicinity of power devices (contactors, thermo-magnetic protection devices or similar).
- 4) Reduce the path of the sensor cables as much as possible and avoid any winding of cables which may enclose power devices.
- 5) Avoid touching or nearly-touching electronic components mounted on the boards to avoid electrostatic discharges (extremely damaging) from the operator to the components.

3.10 Flexbus LAN

The Fatronic can be connected into a Flexbus LAN to achieve communication and synchronization with the central unit according to the following layout:



Connection Guidelines:

- The length of Flexbus, connecting the Flexfaces, must not exceed 300 metres in total.
- The length of Flexbus, connecting the Sensors and the TUx, must not exceed 300 metres in total.
- The sensors must be connected at first to the Flexface (max. distance 25 metres to the Flexface), TUx “behind” the sensors, using “T” connectors.
- All bus-cables from the central unit must be screened and connected to earth.
- In total 24 Master TUx are addressable, including Slave TUx the number must not exceed 32 TUx in total, connected to one Flexface.
- The bus-cable must be wired from the first unit to the last unit in a chain arrangement including Master and Slave units.
- “Star” or “Ring” connections are not permitted.
- The maximum length of the Flexbus cable is 300 metres, counting all connection cables together. The single distances are not important, so long as the total length of all cables together does not exceed 300 metres. Beyond this length data may be slowed or disrupted.

3.11 Flexbus Cables and other Connection Cables

The connections between various Flexfaces, Flexmatic display and sensors are carried out with cables having a different number of wires and different connectors.

Please note that an incorrect connection could cause serious problems to the electronic devices (Flexface and Flexmatic); for this reason we strongly recommend that only high quality products or those supplied by AET are used.

Figure Five - Eight-wires; eight poles connector FLEXBUS cable, for Flexmatic or Humitemp connections

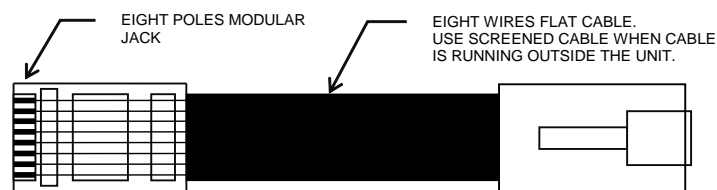


Figure Six - Six-wires (Pin 1 and 8 not connected) FLEXBUS cable, for Microface and TUx connections

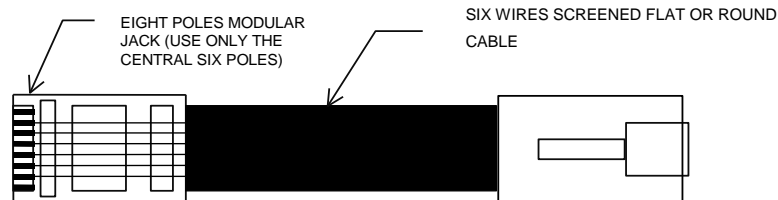
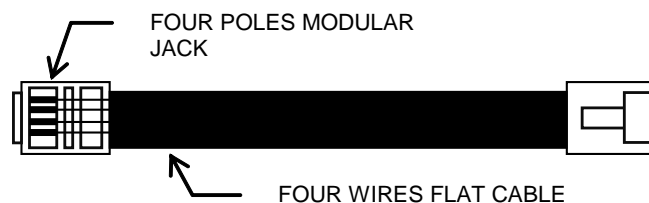
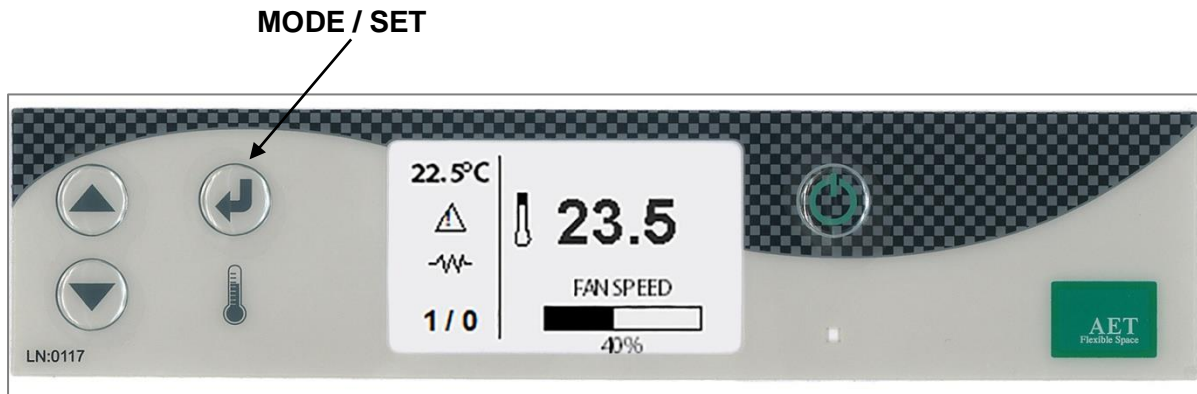


Figure Seven - 4 wires flat cable for RS485 communication, four poles connectors

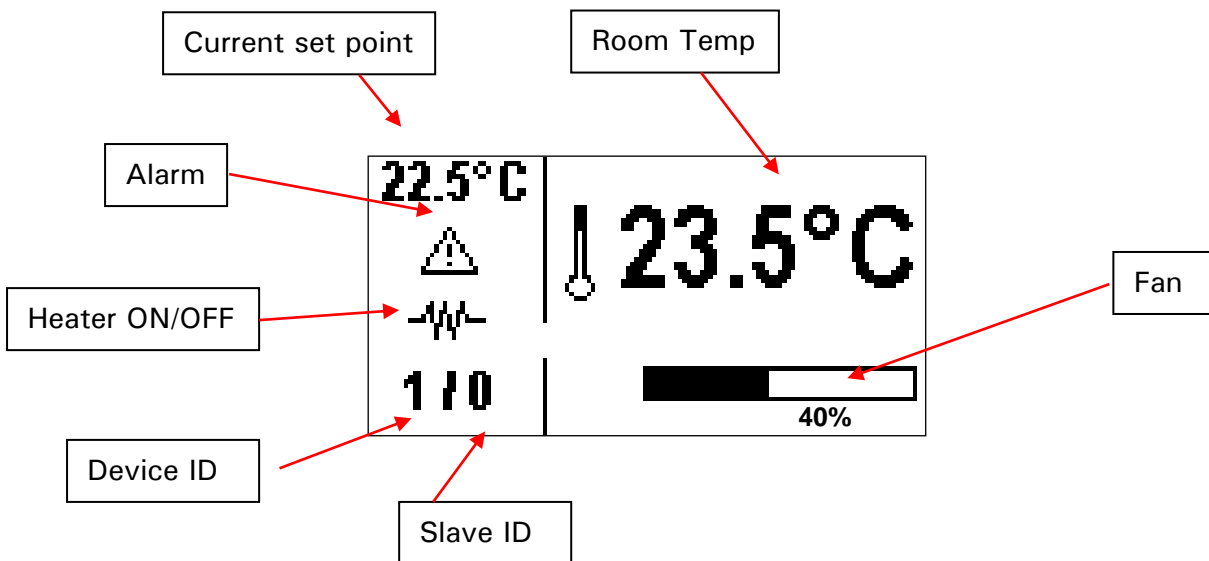


3.12 LCD Display Control (128x64)

The LCD control has a 128x64 graphical display with timed back light. Three push buttons (“Set”, “Up” and “Down”) will permit the user to configure the device, and a fourth permits Power On/Off function.



3.13 Normal Indication



- Pressing the “Up” and “Down” button will change the Fan speed.
- Pressing “MODE” button ONCE, the user will have the possibility to change the set-point by pressing the “UP” and “DOWN” buttons. Information will be stored in the non-volatile memory of the control immediately after the modification.
- Pressing the “POWER” button or after 5 seconds of non-activity, the control will return in the Normal indication mode with the last modification stored.
- Pressing “MODE” twice will put the control in the “Program” mode.

Power On/Off

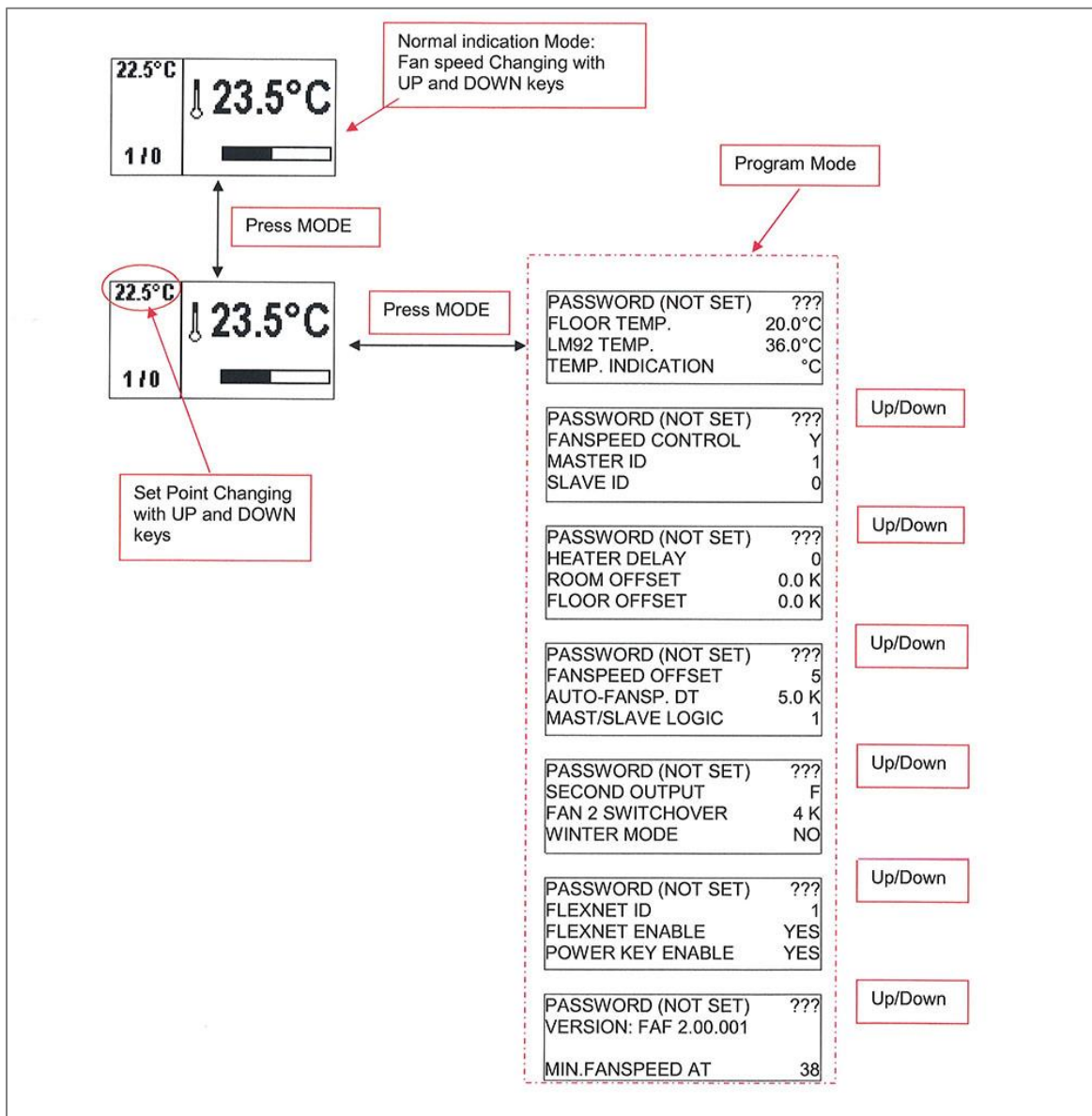
Pressing the POWER key for several seconds in normal indication/operation will switch off the control. Standby LED will switch ON and no unit operation will be possible.

Once in the standby condition users can switch on the control by pressing the POWER key, provided that the unit is enabled from its CAM unit. The On/Off function can be enabled and disabled by a special parameter present inside the control.

3.14 Program Mode

From the "Normal indication", the Program Mode can be entered by pressing the mode button twice.

The following diagram shows how to navigate in the program sub-menus;



- Pressing the MODE button once, starting from the “Normal indication”, a user will be able to adjust the set point.
- By pressing the UP and DOWN key from the Normal Indication Mode, the user can change the fan speed setting.
- The user can enter the “program mode” by the pressing the “MODE” key twice starting from “normal indication mode”. Once in the Program mode, the user can navigate the submenu by pressing “UP” and “DOWN” key, provided they insert the pass code.
- To modify the parameters chosen, the user has to press the “MODE” button. Modification of the parameter will be done by pressing the “UP” and “DOWN” button. Pressuring of the “MODE” key will confirm the modification and will return to the Program mode submenu level.
- All the parameters, except for the set-point, are passcode protected.

PASSWORD (NOT SET)	Password to be set to allow parameter changes
FLOOR TEMP.	Underfloor temperature showing
LM 92 TEMP.	Internal control temperature
TEMP. INDICATION	See parameter (1)

PASSWORD (NOT SET)	Password to be set to allow parameter changes
FANSPEED CONTROL	See parameter (2)
MASTER ID	See parameter (6)
SLAVE ID	See parameter (7)

PASSWORD (NOT SET)	Password to be set to allow parameter changes
HEATER DELAY	See parameter (5)
ROOM OFFSET	See parameter (8)
FLOOR OFFSET	See parameter (9)

PASSWORD (NOT SET)	Password to be set to allow parameter changes
FANSPEED OFFSET	See parameter (A)
AUTO-FANSP.DT	See parameter (B)
MAST/SLAVE LOGIC	See parameter (C)

PASSWORD (NOT SET)	Password to be set to allow parameter changes
SECOND OUTPUT	See parameter (D)
FAN 2 SWITCHOVER	See parameter (E)
WINTER MODE	Indication if the control is in Direct (NO) or Reverse (YES)

PASSWORD (NOT SET)	Password to be set to allow parameter changes
FLEXNET ID	Flexnet address in the RS485 network
FLEXNET ENABLE	Flexnet communication enabling
POWER KEY ENABLE	Switching On/Off by the Standby key enabling

3.15 Parameter List

On the control it is possible to set different parameters for different operation modes; the user can choose the parameter number and the value of the parameter can be set.

DESCRIPTION	VALUES
Indication units	°C or °F
Fan speed control	Y or N or D or A
Master ID nr.	From 1 to 24
Slave ID nr.	From 0 to 7
Heater delay	From 0 to 32
Room sensor offset	From -5.0 to +20.4 °C
Floor sensor offset	From -5.0 to +20.4 °C
Fan speed offset	From 0 to 9
Automatic Fan speed Delta	From 0 to 5 K
Master/Slave logic	0 or 1
2 nd Output enable	F or 3P
2 nd Fan Switchover	From 0 to 20 K
Winter Mode	Yes or No
Flexnet ID	From 1 to 24
Flexnet Enable	Yes or No
Power key enable	Yes or No
Version	XX.YY.ZZZ
Contrast	Bright or Dark
Minimum Fan speed	From 10 to 50 %
Analogue output 0% =	1.0V
Analogue output 100% =	5.0V
Advanced protocol	Yes or No

COMMENTS:**INDICATION UNITS:**

°C: Selects the indication of set point and room temperature in degrees Celsius; resolution is 1.0°C.

°F: Selects the indication of set point and room temperature in degrees Fahrenheit; resolution is 1.0°F

FANSPEED CONTROL:

Y: Fan speed is memorized and at system ON the fan speed will be as at power OFF.

D: Assuming that power to Fantile has been cut at system ON the fan speed will revert to commissioned setting.

N: No fan speed variations are possible; the fan speed up/down keys are ignored.

A: Automatic mode for fan speed, (See section 2.3).

HEATER DELAY:

In order to avoid electrical heating during start-up of the Flexible Space system, a programmable delay can be introduced between power-up and heater ON. Time is parameter value multiplied by 10min. If 32 is selected the heater is disabled and will not operate.

MASTER IDENTIFICATION NUMBER:

Indicates the group to which the unit belongs. For stand-alone applications 0 can be used. Up to 24 Masters may be addressed within a single zone.

Typically a zone will be configured with 20-24 Master Fantiles. 1/0 2/0 - - - 24/0.

SLAVE IDENTIFICATION NUMBER:

Indicates the function of the unit within the group; 0 Means that the control is a master, 1, 2 indicate that the control is a Slave (1, 2 respectively). Each Master may be connected to up to 7 Slaves.

In individual areas a user may choose to make up to 7 Slave units from 1 Master.

1/0 2/0 2/1 3/0 3/1 3/2 3/3 3/4 4/0 5/0 6/0

In this example Master Fantile 2/0 has 1 Slave and Master Fantile 3 has 4 Slaves

ROOM SENSOR OFFSET:

Allows calibration of the sensor, offset shall be visualized in *DEGREES not in numbers*, and range that can be stored is from -5.0°C to +20.4°C [-128 to 127]

FLOOR SENSOR OFFSET:

(As above)

FANSPEED OFFSET:

With this parameter the fan speed corresponding to each dot can be increased or decreased. 0 means that the fan speed is decreased by 5 steps (nearly 2 dots). 9 means that the speed is increased by 4 steps.

AUTOMATIC FANSPEED TEMPERATURE DIFFERENTIAL SETUP:

This parameter will decide how the automatic fan speed shall work according to the difference between the SetPoint and the Current Room temperature calculated in absolute way (DeltaT).

Formula to be applied is the following:

$$F_s = F_s^{MAX} - (F_s^{MAX} - F_s^{\min}) \frac{\Delta T_{SP} - \Delta T}{\Delta T_{SP} - 0.5}$$

Where:

F_s : Actual calculated Fan Speed

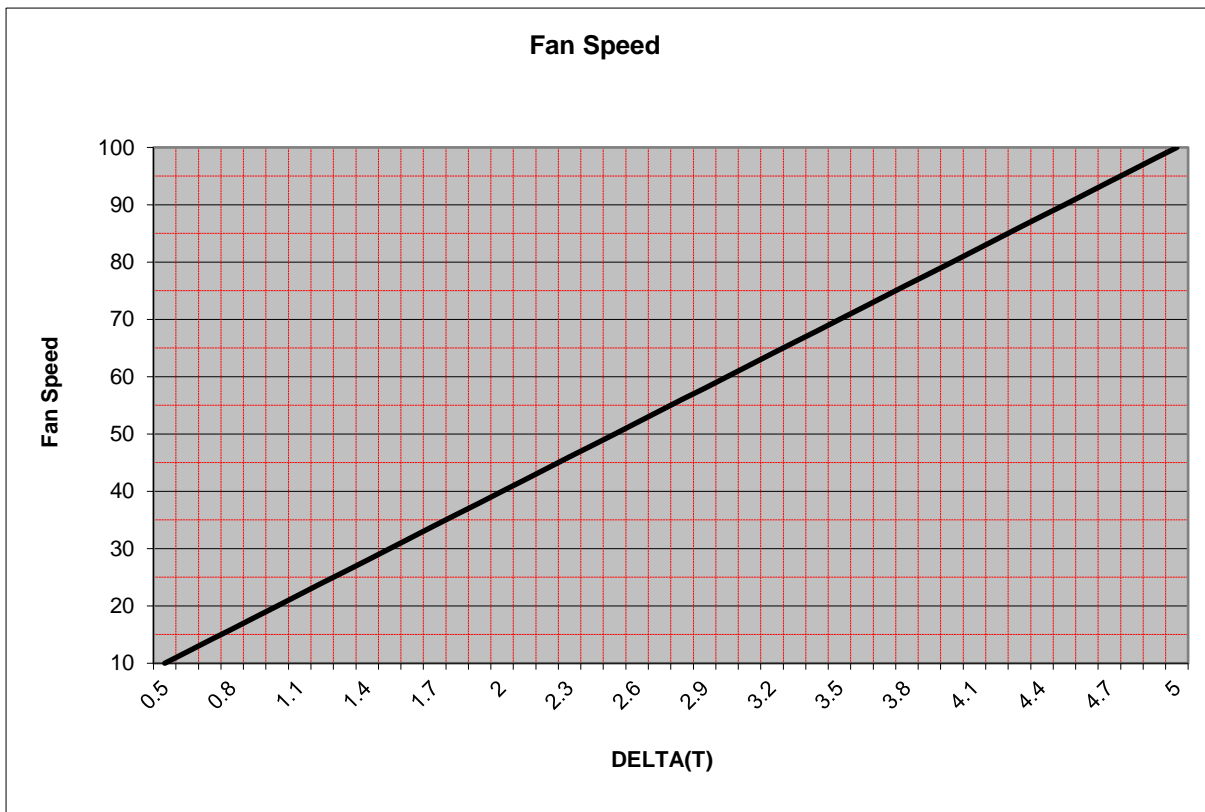
F_s^{MAX} : Maximum Fan speed (100%)

F_s^{\min} : Minimum fan speed (38%)

ΔT : Difference between the Set Point and the Room Temperature in absolute value.

ΔT_{SP} : Parameter to be set.

The graph below refers to the Parameter set to 5:



2nd OUTPUT ENABLE:

This parameter shall be set once to enable the second “TRIAC out” on the control. Possibilities are:

- 1) **F**: Fan speed step: In case room temperature exceeds temperature set in parameter E the output will be activated. The other fan output will work according to parameter set in F.

- 2) **3P**: 3-Point actuator: This second output would be used to work in conjunction with the damper output and used to drive a 3-Point damper actuator at 230V ac. (110V ac in USA). In this case the further output will activate the CLOSE command. The other damper output will retain the OPEN command. Free-cooling position with intermediate regulation has to be defined and will be not implemented in this software revision.

2nd FAN SWITCHOVER:

This parameter will define the switch-over temperature offset related to the set point for the 2nd Fan speed step as per previous parameter. Once the temperature set in this parameter + 1°C is reached the output will be activated. The output will be switched off once the temperature set in the parameter – 1°C is reached, (2°C dead-band zone).

MINIMUM FANSPEED: Lowest limited Fanspeed value used when a heater is employed to avoid overheating.

3.16 Default Values

If no valid values for set points or program number are stored in the memory, the following default parameters will be used;

Set point temperature	22.0°C
Indication	°C
Fan speed	Last value [Y]
Electrical heater delay	40 min.
Master Identification Number	1
Slave Identification Number	0
Room sensor offset	0.0°C
Floor sensor offset	0.0°C
Motor speed offset	5
DeltaT	5
Master/Slave logic	1
2 nd output enable	Fan
2 nd Fan switchover	4.0K
Power Key Enabled	Yes
Minimum Fanspeed	38 %

3.17 Parameters / Operator Interface

User can set the fan speed, the set point and can choose between the direct or reversed mode when both the second sensor and the centralized command are not installed.

- ON/OFF: with this switch power to the unit is switched ON or OFF. When unit is switched ON fan motor and all controls are activated.
- FANSPEED: The fan speed shall be increased or decreased respectively by the local control; there will be a total of 10 different speeds achieved by varying the voltage applied to the fan motor.
- SETPOINT: In case of network working the desired room temperature shall be selected from the CAM-C or CAM-V unit that schedules the floor supply temp and the local set point can be selected by the user in the range of +/-5°C respect to what is given from the CAM unit.

3.18 Master Slave Concept

MASTER/SLAVE Logic:

With this parameter set to 0:

Slave will switch OFF when the related Master is switched OFF

With this parameter set to 1:

Slave will continue to work in stand-alone condition with the last settings stored (last data sent from the Master before switching OFF).

*****CAUTION*****

It should be noted that, in case this parameter has been set to 0 with device programmed as slave without the master, the control will switch OFF without being possible to restore it ON unless the communication with the related master in the same network will be restored, or changing of the Flexbus address by the Flexmatic terminal. Caution should be applied when setting this parameter.

When several TUX units in one room are installed, regulation can be controlled from one unit only (Master) and the other units (Slaves) follow exactly the Master damper, and the electrical heater action. Additionally depending on what is selected the fan speed on the Slave can be adjusted independent of the Master.

On the Slave the keys for changeover, local heating and set point local regulations are inoperative.

The Fan speed mode with the Master/Slave configuration that can be foreseen can be set as follows:

- a) Follow the Master, except for the Fan speed.
The Slave Fan Speed can be adjusted independently from the master.
Set parameter "Fanspeed control" to "Y" in the Master and "Y" in the Slave

- b) Follow the Master, also for the Fan speed.
Slave follows the Master Fan speed.
Set parameter "Fanspeed control" to "Y" in the Master and "N" in the Slave

- c) Follow the Master, also for the Fan speed (Default Mode).

Slave follows the Master Fan speed and Slave follows the Default Master Fan speed after a master stand-by or ON/Off condition.

Set parameter “Fanspeed control” to “D” in the Master and “N” in the Slave

3.19 Legacy issue:

To keep compatibility with the Fatronic controls present in the field, the parameters have been numbered in the same way as in the old versions. Old parameters 3 and 4 will be ignored with this new control. Parameters shall be managed as in the old control, but visualized on the screen according to the specification written above.

3.20 Alarms

The program monitors the functioning of the sensors. If an error occurs the Fantile unit is switched OFF and the damper is closed. The following alarm conditions can occur:

- **AL1** - Temperature read from room sensor is outside the range; in this case the heater is switched OFF.

- **AL2** - Temperature read from supply air sensor is outside the range; also here the heater is switched OFF.

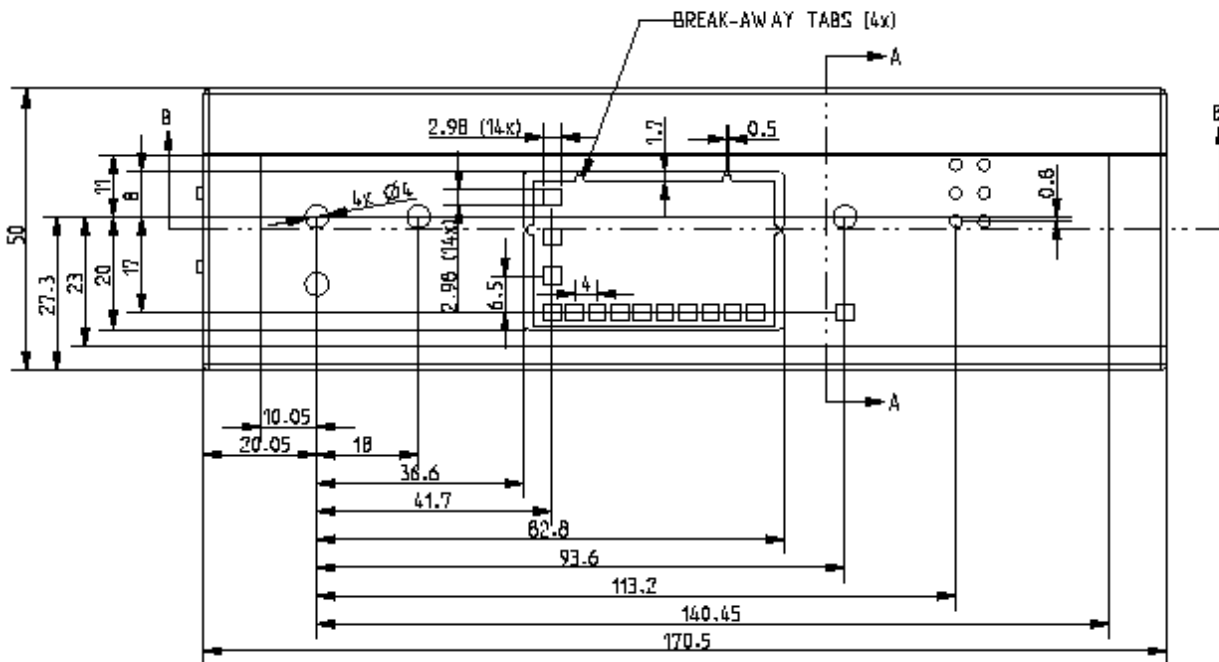
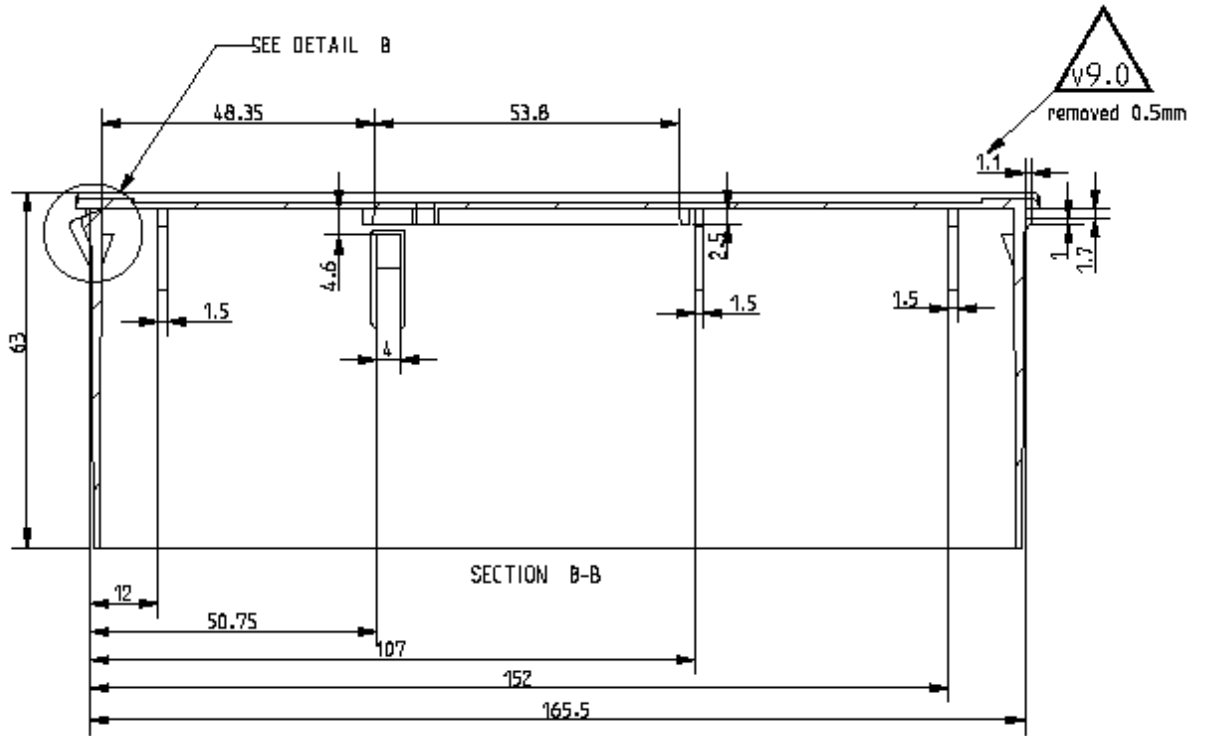
If during power ON a wrong supply air temperature is read, the control switches automatically to manual changeover.

- **AL3** - If the control is set to SLAVE and there is no communication with its Master, the device will continue to run according to parameter C setting.

Alarms will appear on the main display screen.

Section Four - Appendix

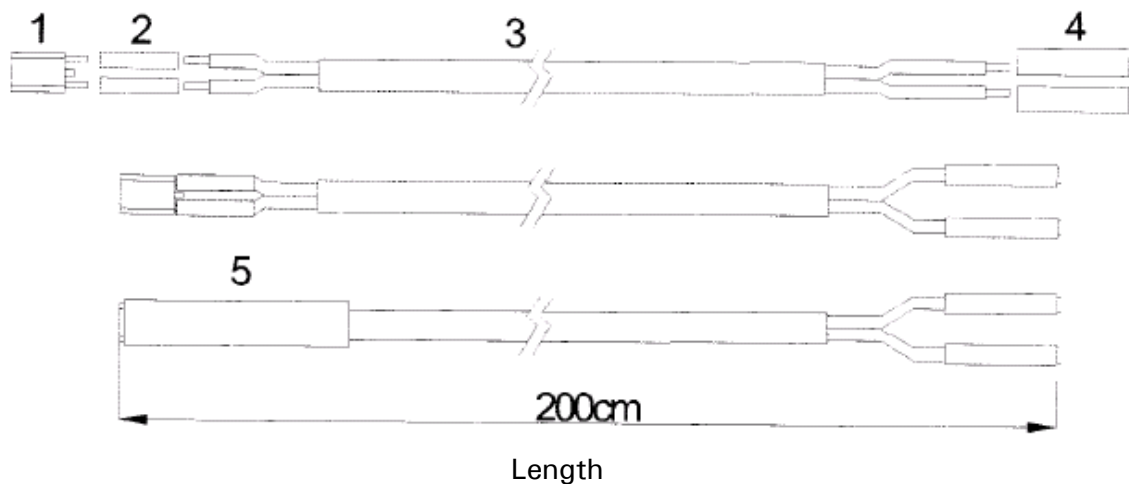
4.1 Mechanical Dimensions



4.2 Labeling

Mat.UL V-2	FATRONIC E2	WARNING COMPONENTS INSIDE THE CONTROL HAVE NEVER TO BE REMOVED OR REPLACED WARRANTY EXPIRES	Hardware Rev. 1.2 3559421237
Product Code	3559421237 MAIN AC: 230Vac - 50/60Hz/8A RELAY: 230Vac 1000W TRACs: 230Vac 1A		
Destination	AIR CONDITIONING		

4.3 Probes Specification



- 1) Temperature Sensor Philips KTY81-210
- 2) Heat shrinkable sleeve
- 3) Multi-conductor cable restraining flame propagation, with high flexibility at low temperature too. (see specifications below)
- 4) Crimp-contact Tyco 1586315-1 or 794956-1 or similar to be put into 8 pole housing 794954-8 (or similar)
- 5) Length from 300 to 2 000 mm

Terminal metallic tube (optional)

Material: Aisi304 – Stainless Steel

Length: 30mm
 Diameter: 6mm
 Connection to cable: None
 Temperature range: from -25C to +125C

The cable shall be of the following type:
 FRO2R AWG18-22, Multi-conductor cable restraining flame propagation, with high flexibility at low temperature too maximum external diameter of 5,30mm.

4.4 Applicable Standards

Standard Norms		Cable Characteristics
CEI 20-29-IEC 228	➔	Conductor Specifications
UNEL 0722-VDE 0293 – IEC 227-1	➔	Colour Coding
CEI 20 – 20 – IEC 227-	➔	Technical Characteristics
CEI 20-11	➔	Physical Characteristics
CEI 20-22 11 – IEC332	➔	No Flame Propagation

4.5 Electrical Specifications

ELECTRICAL SPECIFICATIONS (at 20°C)		
	UM	0,75
MAX RES. CONDUCTORS	Ohm/km	26,00
MIN R. MAX INSULATING	Ohm/km	200
SECTION	mm ²	0,75
VOLTAGE RATING	V	300/500
VOLTAGE TEST	V	2000

4.6 Construction Specifications

CONSTRUCTION SPECIFICATIONS		
	UM	0,75
DIELECTRIC		PVCAF 1,90
EXTERNAL JACKET		PVCAF
EXTERNAL COLOR		GREY RAL 7035
WORKING TEMP.	°C	-10/+80

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