

## DFCT: module for ambient temperature regulation of a single zone

DFCT modules allow to regulate, through the **Domino** bus, the ambient temperature of a room of the house. DFCT module integrates the several functions offered by **Domino** system with an easy to use device for the temperature regulation.

DFCT is a specialized module, therefore it allows to decentralize the ambient temperature regulation, thus considerably simplifying the programming of **Domino** system. The user interface can be realized by one or more DFTouch video-terminals (see the related paragraph of this manual). Each DFTouch can manage up to 24 DFCT modules and therefore up to 24 different zones of the house.

As alternative or in addition to DFTouch, all operating parameters of DFCT module can be easily monitored and changed by supervisor, touch screen terminals, via GSM, Internet, Intranet and so on.

As with almost all modules of **Domino** family, the power supply required for the operation of DFCT module is derived from the bus. DFCT module provides two 2-way terminal blocks, one for the connection to the bus and one for the connection to the temperature sensor (provided).

Near to the terminal block for the connection of the temperature sensor, a small push-button allows the address programming and a green LED shows when the module is ready to receive the address itself; the same LED normally flashes every 2 seconds about to signal that the module is properly operating. A small 3-way connector (PRG) allows the connection to the optional tester/programmer.

The small dimensions of DFCT allow the housing of this module directly in the standard rectangular wall box (mod. 503 or similar boxes).

The temperature sensor is very small and can be easily inserted in the panel of the preferred wall box.

**Note:** this data sheet refers to DFCT equipped with firmware 2.0 or higher.

### Address programming

Due to the several available parameters, DFCT module takes, inside the **Domino** bus, two input and 5 output consecutive addresses.

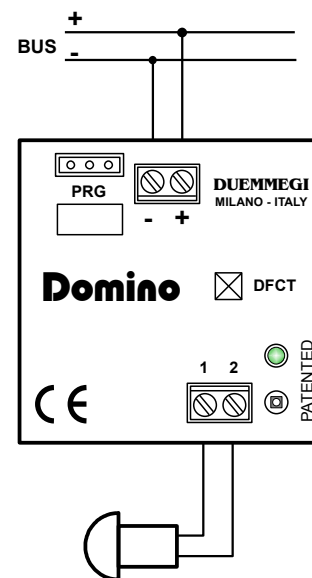
To make operating the module it is however enough to assign a single base address; in other words, assigning an address  $n$  to DFCT module, it will take the input addresses  $n$  and  $n+1$  and the output addresses  $n$ ,  $n+1$ ,  $n+2$ ,  $n+3$  and  $n+4$ .

A white label on the top panel allows the writing of the programmed module base address for an immediate visual identification. For more details about the programming, refer to the related documentation.



### Module connection

DFCT module only need the connection to the temperature sensor and to the bus as shown by the following schematic diagram.



### The temperature regulation

DFCT module features two main regulation modes, one for the Winter season and one for the Summer season. For each one of these two seasons, the regulation takes place controlling the related point of the input section of the module (heat request in Winter and cooling request in Summer).

In addition, DFCT module controls other 3 points of the input section which can be used, if needed, for the management of a 3-speed fancoil.

For each season, DFCT can be set for Automatic and Manual mode.

In Automatic mode, the module allows to specify 3 setpoints: SP1, SP2, SP3. It is advisable to establish that SP3 is always the setpoint with the highest temperature and SP1 the one with the lowest temperature, regardless of the season.

In Manual mode, DFCT allows to specify an additional "manual" setpoint SPM.

## DFCT

### Regulation: Automatic and Manual mode

All setpoints can be set in the range 10.0 to 35.5°C and they can be changed in any moment through DFTouch or, anyway, through the bus. It is also available an OFF position, both in Automatic and in Manual mode; in Winter, the OFF position causes the imposition of the no-frost setpoint, while in Summer it means completely OFF. The no-frost setpoint can be set, during the setting up, in the range 0 to 25.5°C.

DFCT also provides a weekly programmer with half hour resolution; for each day of the week, DFCT module allows to specify the relationship between the time and the desired setpoint. The scheduling is performed in a graphical way by DFTouch, in order to see the whole program of each day with a single look.

### Regulation algorithm

The temperature regulation performed by DFCT module can be chosen, during the setting up, among the ON/OFF type with hysteresis and the time modulation type.

#### **ON/OFF regulation with programmable hysteresis**

In this case the temperature regulation will be executed activating or less the related point of the input section (heat or cooling request depending on the season), comparing the temperature detected by the module with the current setpoint, also taking in account the chosen hysteresis value.

The hysteresis around the setpoint can be defined, with 0.1°C resolution, during the setting up and this step needs the choice of two values, for each season, corresponding to the positive and negative delta in respect to the setpoint.

In Winter, when the ambient temperature exceeds the setpoint summed to the positive delta, the regulation will be switched OFF, and then switched ON again when the temperature goes below the setpoint decreased by the negative delta; in Summer the algorithm is inverted.

The speed of the fancoil is determined according to the difference between the ambient temperature and the setpoint. The switching thresholds between a speed and the other one (that can be different for Winter and Summer) can be defined during the setting up of the module. When the heat request is activated (or cooling, depending on the season), the fancoil is always ON at least at the minimum speed.

#### **Time modulation regulation**

In this case the temperature DFCT module regulates according to a proportional-integral type algorithm with fixed timebase. DFCT module regulates modulating the points "heat" or "cooling request" of the input section (depending on the season) in respect to a fixed time. At the beginning of each regulation cycle, the module evaluates the difference between the ambient temperature and the current setpoint. The ratio (Time\_ON / Time\_OFF) will be then calculated according to the detected difference.

In this case too, the speed of the fancoil is determined according to the difference between the ambient temperature and the setpoint; the switching thresholds of the fancoil can be set for each season.

The switching between Automatic and Manual mode occurs activating the point 14 of the output base address section, or, more easily, by the related icon on DFTouch video-terminal.

In Automatic mode, the temperature regulation (intended as control of the heating/cooling device) occurs according to the scheduler which impose one of the 4 setpoints SP1, SP2, SP3 or OFF.

In Manual mode, the temperature regulation (intended as control of the heating/cooling device) occurs instead by the imposition of one of the setpoints SPM or OFF, regardless of the current time.

The values of all setpoints SP1-2-3-M can be changed in any moment writing to the last 4 output address of DFCT module; this operation can be easily performed by DFTouch video-terminal.

*Note: DFCT does not features an internal timekeeper; therefore, to allow the scheduler operation, a DFCK module or a DFPC controller must be installed on the bus.*

### Fancoil: Automatic and Manual mode

Generally, the speed of the fancoil is decided by DFCT module itself, according to the difference between the ambient temperature and the current setpoint; in this case the fancoil is managed in Automatic mode.

It is however possible to select a different speed replacing that one decided by the system, simply acting on the point 3-4-5-6 of the output base address section.

Each one of these points corresponds to the speed MIN, MED, MAX, OFF; at the activation of a speed other than that one decided by the system, also point 7 of the output base address section will be activated; this point means that the fancoil has been switched to Manual mode. De-activating the point 7 of the output section, the fancoil will be controlled again in Automatic mode by the system.

Of course, the fancoil can be easily controlled by DFTouch video-terminal.

### Information from and to DFCT module

As said before, DFCT module takes, inside the **Domino** system, 2 input addresses and 5 output addresses..

Through the **Domino** bus, it is possible to read some information from the input addresses and to perform some commands writing to the output addresses.

The meaning of the data field of input and output addresses will be here described.

#### **Input section n**

The input address n provides the digital information as described in the following table.

**DFCT**

Point	Description
1	Heat request
2	cooling request
3	Read MIN speed status
4	Read MED speed speed status
5	Read MAX speed speed status
6	Read OFF speed speed status
7	Read MAN speed status
8	Temperature sensor failure
9	Read SP1 status
10	Read SP2 status
11	Read SP3 status
12	Read OFF status
13	Read SPM status
14	Read MAN regulation status
15	Read Summer status
16	Not used

The meaning of these points will be here described.

- **Point 1:** point=1 means that the regulator requires to switch ON the heating device (in Winter).
- **Point 2:** point=1 means that the regulator requires to switch ON the cooling device (in Summer).
- **Points 3..5:** mutually exclusive points; point=1 means that the regulator requires to switch ON the related speed (MIN, MED, MAX). If all points are OFF, then the fancoil is stopped (and in this case the following point 6 will be activated).
- **Point 6:** point=1 means that the fancoil is stopped.
- **Point 7:** point=1 means that the fancoil speed is set to Manual mode.
- **Point 8:** point=1 means temperature sensor failure (opened or in short circuit).
- **Point 9..13:** mutually exclusive points; point=1 means that DFCT is regulating at the related setpoint (SP1, SP2, SP3, OFF or SPM).
- **Point 14:** point=1 means that the DFCT regulation is set to Manual mode; point=0 means that it is set to Automatic mode.
- **Point 15:** point=1 means that DFCT is set to Summer; point=0 means that it is set to Winter.

The points of the base address input section must be used in the programming of the **Domino** system in order to perform the desired actions.

For instance, assuming to have assigned the address 41 to DFCT, the command to the heating device must be implemented, for example directly in an output module, by a simple equation like the following one:

$$O31.1 = I41.1$$

where **O31.1** is the relay output connected to the heating device and **I41.1** is the related point of DFCT.

If the 3-speed fancoil management is required, another output module must be programmed as follows:

$$O50.1 = I41.3 \quad //MIN \text{ speed}$$

$$O50.2 = I41.4 \quad //MED \text{ speed}$$

$$O50.3 = I41.5 \quad //MAX \text{ speed}$$

**Note:** in order to make possible to use in an equation an input with point number greater or equal to 5 (like **I41.5** in the previous example), output modules with firmware version 6.0 or higher must be used.

**Input section n+1**

The input address n+1 reports the information related to the **ambient temperature** detected by the sensor of DFCT (or other temperature module as specified in the configuration panel, see later). The temperature is given in °Kx10; for instance 2980 means:  $(2980 - 2730) / 10 = 25.0^{\circ}\text{C}$ .

**Note:** if the value reported by the module at the address n+1 is 0 (corresponding to  $-273.0^{\circ}\text{C}$ ), then the temperature sensor is unconnected (or broken); if instead the temperature value reported by the module at the address n+1 is 32767 (corresponding to  $3003.7^{\circ}\text{C}$ ), then the temperature sensor is short circuited.

**Output section n**

The output address n provides digital points allowing to set the several operation mode of DFCT module, as described in the following table.

Point	Description
1	Not used
2	Not used
3	Set to MIN speed
4	Set to MED speed
5	Set to MAX speed
6	Set to OFF speed
7	Set speed control to Manual Mode
8	Not used
9	Set to SP1
10	Set to SP2
11	Set to SP3
12	Set to OFF
13	Set to SPM
14	Set regulation to Manual mode
15	Set season to Summer
16	Not used

The meaning of these points will be here described.

- **Point 3..6:** mutually exclusive points, acting on level; setting to ON one of these points, the fancoil will be set to the related speed (MIN, MED, MAX or OFF). If one of these points is active, the automatic control of the fan is suspended. When enabling one of these points, point 7 too will be activated (both on the input and output base address), thus reporting that speed has been forced to manual mode.
- **Point 7:** setting this point to 1, the fancoil speed control will be changed to manual mode, and this means that the speed will not be decided by DFCT module, but by the status of point 3..6 described before. Setting this point to 0, the speed control of the fancoil will return to automatic mode.

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- **Points 9..13:** mutually exclusive points; setting to ON one of these points, DFCT changes the regulation to the related setpoint (SP1, SP2, SP3, OFF, SPM). When the Auto mode is active, the imposition of a setpoint SP1-2-3 and OFF different from that one decided by the scheduler does NOT cause the switching to manual mode, but the new setpoint will be maintained until a different one will be imposed by the scheduler. When activating SPM while DFCT is in Auto mode, the mode will be forced to Man (which means that the scheduler will be disabled).
- **Point 14:** setting this point to 1, the temperature regulation will be changed to manual mode, and this means that setpoint SPM will be imposed; this setpoint can be however changed with one of the others acting on points 9..13 seen before. Setting this point to 0, the regulator returns to Auto mode.
- **Point 15:** setting this point to 1, DFCT will be set to Summer operation; setting it to zero, DFCT will be set to Winter operation.

**Output section n+1**

Set and report the value of **setpoint SP1**, as °Kx10 (e.g. 2980 means (2980-2730)/10= 25.0°C).

**Output section n+2**

Set and report the value of **setpoint SP2**, as °Kx10 (e.g. 2980 means (2980-2730)/10= 25.0°C).

**Output section n+3**

Set and report the value of **setpoint SP3**, as °Kx10 (e.g. 2980 means (2980-2730)/10= 25.0°C).

**Output section n+4**

Set and report the value of **setpoint SPM**, as °Kx10 (e.g. 2980 means (2980-2730)/10= 25.0°C).

**Setting up**

This paragraph describes the parameters setting of DFCT module; this procedure, to be executed during the setting up of the plant, allows to adjust the operation of DFCT module according to the requirements of the application.

To execute the setting of the parameters, BDTools or DCP Ide program is required.

From main menu of the program, select "Programming", "Modules Configuration" and "DFCT"; the window shown in Figure 1 will appear.

On the left top side, the text box Address allows to enter the base address of DFCT module to be configured and/or to be read. Near to address field, it is possible to choose the Mode of regulation (ON/OFF or Modulation).

The section **Season** allows to select Winter or Summer (this choice can be also made by DFTouch too or, anyway, via bus).

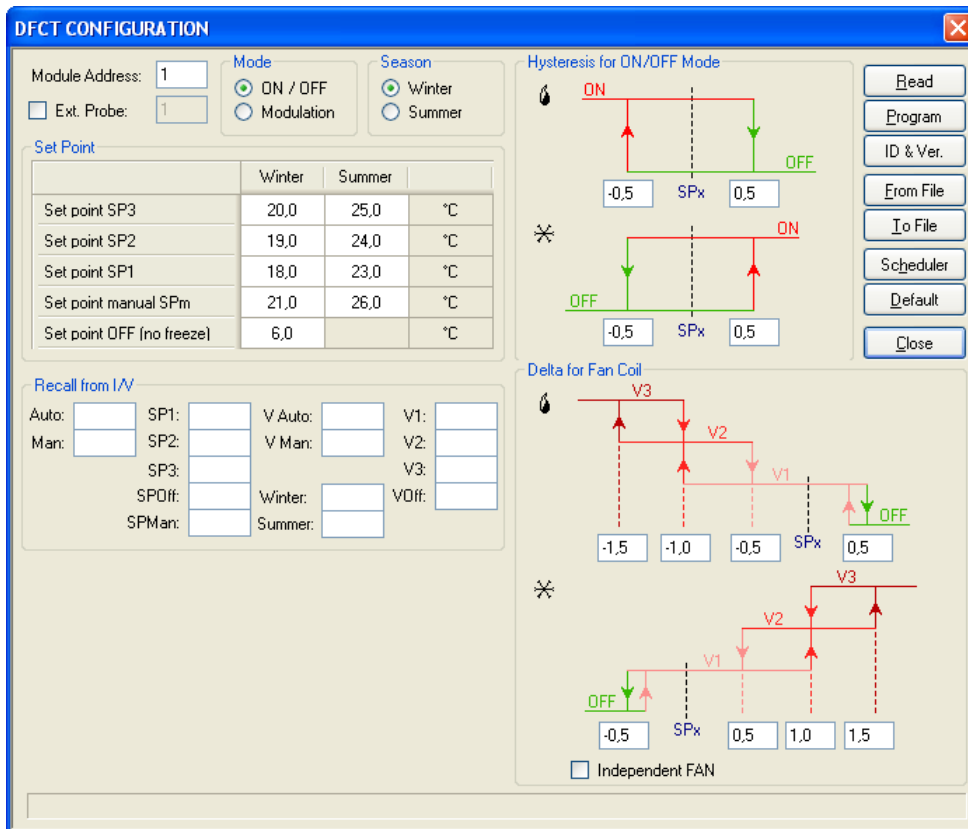


Figure 1: DFCT configuration window

## DFCT

Checking the **Ext. Probe** option, it is possible to use, instead of the temperature probe connected to DFCT, a remote probe connected to another module (e.g. DFTA, DFRHT). In this case, the address of the module detecting the temperature must be entered; this temperature will be shown in the address section of DFCT.

The **Set Points** section in the configuration window lists the several setpoints to be used in Winter and Summer operation. Allowed values are in the range 10.0 to 35.5°C for SP1-2-3-M and 0.0 to 25.5°C for no-frost setpoint. Even if the setpoints can be freely set, it is recommended to choose SP3 always greater than SP2 and SP2 always greater than SP1, regardless of the currently selected season.

The section **Hysteresis for ON/OFF Mode** allows to define, with the help of an effective graphical representation and separately for Winter and Summer, the two values of the temperature delta in respect to the current setpoint (Spx) which the regulator uses to switch ON and OFF the heating or the cooling device. These values must be in the range -12.8 to 12.7°C; moreover, the absolute value of negative delta and positive delta can be different each one to the other.

The section **Delta for fancoil** allows to define, with the help of an effective graphical representation, the several deltas to be used to change from a speed to the other one, separately for Winter and Summer.

Each delta is intended to be in respect to the current setpoint (Spx) and it can be both a positive or negative value. These values must be in the range -12.8 to 12.7°C.

The values of the delta values depend on the specific application, but the default values should be suitable for the majority of the possible cases.

When the fan is in Auto mode, DFCT module keeps the fan at least at the minimum speed if the heat or cooling request is active. If instead the application needs that heat and cooling request does not affect the fan control, then enable the option **Independent FAN**; in this case the fan speed will be controlled by the specified Delta for Fan Coil parameters only.

The section **Recall from I/V** is useful when the settings of DFCT module have to be changed acting on pushbuttons or other similar device connected to **Domino** bus. In other words, this section allows to specify some optional input points (both real and virtual) that, when activated, must recall a well defined setting. In details:

**Auto and Man:** switch DFCT to automatic (scheduler) or manual mode respectively. The inputs controlling these two commands must be momentary type (operation on the edge). When switching to manual mode, the previously activated setpoint will be maintained (while activating the manual mode from output point 14 will cause the switch to SPM).

**SP1, SP2 SP3 SPOff and SPMan:** force the related setpoint. The inputs controlling these commands must be stable (operation on the level): when one of these is active, the scheduler will be ignored until the same point will be deactivated. If more than one of these commands are activated, then the used setpoint will be that one related to the last command activated. Bus commands can set different setpoints and therefore discordance between current setpoint and the status of these inputs may occur.

**V Auto and V Man:** switches the fan speed to automatic or manual mode respectively. The inputs controlling these two commands must be momentary type (operation on the edge). When switching to manual mode, the previously active speed will be maintained.

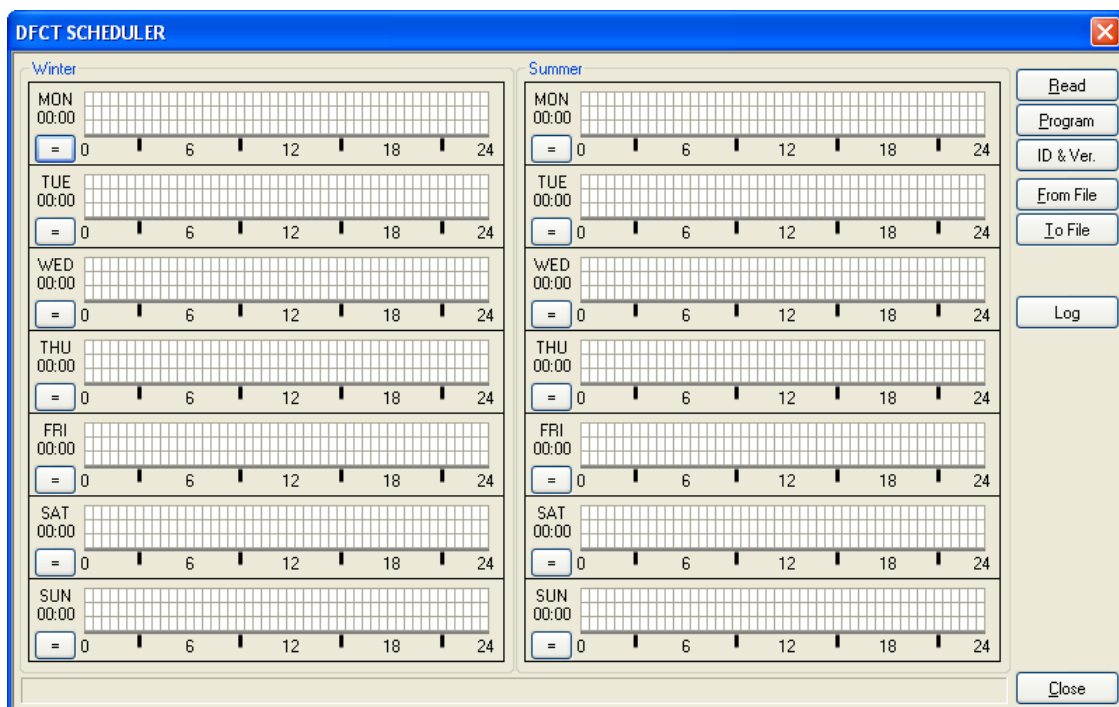


Figure 2: DFCT Scheduler

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**V1 V2 V3** and **VOFF**: force the related speed (Min Med Max and Off respectively). The inputs controlling these commands must be stable (operation on level): when one of these is active, the automatic control of the will be suspended until the same point will be deactivated. If more than one of these commands are activated, then the speed will be that one related to the last command activated. Bus commands can set different speeds and therefore a discordance between current fan speed and status of these inputs may occur.

**Winter** and **Summer**: switch DFCT to Winter or Summer mode respectively. The inputs that control these two commands must be momentary type (operation on the front).

The following figure shows a possible situation when using Recalls from I/V table (when using real inputs, simply change I to V).

The specified inputs may also be complemented by putting an exclamation mark before it (like in the usual **Domino** syntax). In addition, the same input point can be used to perform more actions at the same time (e.g. set regulation to manual, activate SP2 and force fan speed to V2).

An empty field means that for the corresponding function is not provided the remote forcing.

Once entered all wanted parameters, press the button "Program" to send to DFCT module the parameter displayed on the configuration window. The "Read" button executes the reverse operation.

Of course, before to begin the transfer, the communication between BDTTools or DCP Ide program and the user bus interface (e.g. DFRS or DFCP or others) must be enabled.

The "Id & Ver." button asks for the DFCT module firmware version. The "Default" button restores all parameters in the window to the default values.

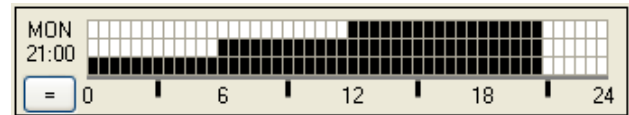
The configuration window allows to save in a file, with .DCT extension, the parameters shown in the configuration window ("To File"). Of course, the reverse operation can be also performed ("From File").

The configuration window also allows to recall the **Scheduler** window (the schedule needs a DFCK module or a DFCP module installed on the bus). The DFCT Scheduler window is shown in Figure 2.

This window is divided in two vertical section, one for Winter season and one for Summer season. For each season it is possible to choose the scheduled times for each day of the week. The result of the scheduled times will be a graph, for each day, similar to that shown on the display of DFTouch.

Moving the mouse cursor on the cells of the grids, the related time will be shown on the left side, with half-hour resolution. Left clicking on the cells, one of the 3 setpoints SP1-2-3 (from bot to top) will be activated; right clicking on the cells, the OFF setpoint will be set.

The following figure shows a programming example: from 0:00 to 6:00 SP1 will be activated, then SP2 will be activated until 12:00, then SP3 until 21:00 and then OFF until 24:00.



The buttons "=" in the DFCT Scheduler window allow to copy the whole program of a day to the next one.

The buttons "Program" and "Read" perform the transfer of the program to the module and vice-versa.

The DFCT Scheduler window too allows to save all shown data in a file with .DCT extension ("To File"); the reverse operation is possible too ("From File").

## DFTouch as interface of DFCT module

The **Domino** DFTouch video-terminal allows to create, in a easy and quick way, the user interface to interact with one or more DFCT modules. Each DFTouch can control up to 24 DFCT (and therefore 24 zones); moreover, the DFCT modules themselves can be controlled from more DFTouch video-terminals, thus allowing a wide margin of choice in designing the thermo-regulation installation.

The user's manual of DFTouch describes the proper instructions to set up these special pages; the configuration will be however reduced to the entering of the name to be assigned to the zone, the base address of DFCT controlling it and the fancoil option.


The following figure shows a typical page on DFTouch controlling a DFCT.

The name of the zone (or room) is shown on the upper center side of the page. The name can be freely defined during the setting up of DFTouch (max 10 characters). The buttons identified by the number 1 in the previous figure allow to scroll one by one, forward and backward, all configured rooms.

The icon showing the heating request or the cooling request changes depending on the current selected season. The figure shows the icon related to the heating request,

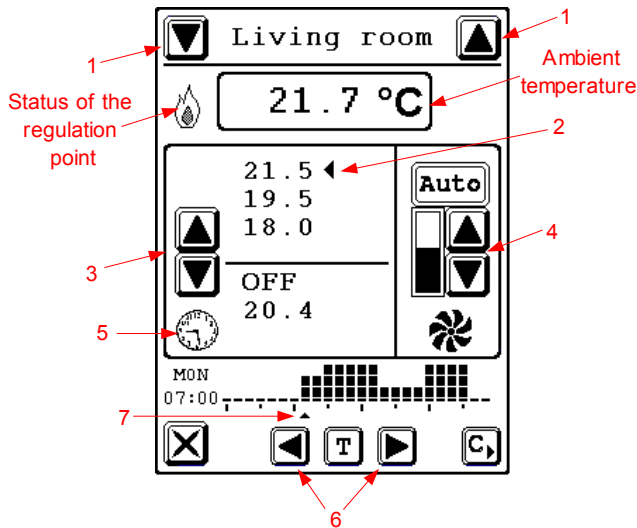
while the icon  is related to the cooling request.

The middle side of the figure is divided in two areas. On the left side, the cursor 2 shows the current setpoint. By means of buttons 3, the selected setpoint can be increased or decreased. The currently selected Automatic or Manual mode

is shown by the icon 5; in Manual mode, the icon  will be shown.

**DFCT**

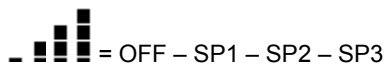
The section related to the fancoil (if enabled) is shown on the middle right side. The label Auto or Man inform about the currently selected mode for the fancoil. The buttons 4 allow to modify the speed of the fancoil. The bargraph on the right side of buttons 4 shows the current speed of the fancoil.



The bottom side of the page on DFTouch shows the scheduler function. By means of buttons 6, it is possible to move the cursor 7 to the left or right side, thus changing the time forward or backward, with half hour resolution.

The currently selected time will be also shown on the left side of the diagram (MON 07:00 in the example shown in the figure).

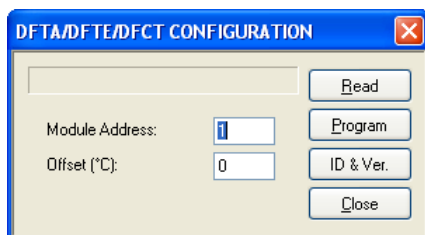
The button **T**, placed between the two buttons 6, allows to choose the desired setpoint at the time pointed by cursor 7. Each little brick in the scheduler diagram means a different setpoint as here explained::



The button **C**, finally, allows to copy the shown program on the next day.

**Correction of temperature offset**

In some situations it could be necessary to adjust the temperature value read by the sensor. Using BDTTools or DCP Ide this can be done; select "Programming", "Modules Configuration" and "DFTA / DFTE / DFCT "; the following window will appear:



Enter the address of the DFCT module to be configured in the first text box; then enter the offset value to be assigned to that module. Allowed values are in the range -12.8 to +12.7 degrees.

Press then the Program button to send the chosen value to the module. The Read button allows to check the current configuration of the module having the address specified in the related text box.

For instance, if the value +0.2 has been entered, then DFCT module will sum the value 0.2 to the temperature as read from the sensor; if this last one measures 25.3°C, then the temperature value sent on the bus will be 25.3 + 0.2 = 25.5°C.

If the offset has been set -0.2, then the temperature value sent on the bus will be 25.3 - 0.2 = 25.1°C.

**Note:** the chosen offset value will be retained in the module memory even if an interruption of the power supply occurs.

**Technical characteristics**

Power supply (bus side)	By specific centralized power supply mod. DFPW2
Temperature sensor	NTC
Temper. measurement range	-10 ÷ +41.1 °C
Temper. measurement resolution	0.1 °C
Linearity	±0.5 °C
MAX error	±0.5 °C
MAX length of cables for the connection to temperature sensor	10 meters, with shielded cable, shield connected to terminal – of the bus
Number of regulated zones	1
Type of regulation	Selectable among ON/OFF with hysteresis and PID
Amount of intervention points (the installation on the bus of a DFCK module or DFCE controller is required DFCE)	48 for each day of the week
Amount of setpoints	5 for Winter and 4 for Summer
Operating temperature	-5 ÷ +50 °C
Storage temperature	-20 ÷ +70 °C
Protection degree	IP20

**Outline dimensions**



**Correct disposal of this product**

(Waste Electrical & Electronic Equipment)  
(Applicable in the European Union and other European countries with separate collection systems). This marking on the product, accessories or literature indicates that the product should not be disposed of with other household waste at the end of their working life. To prevent possible harm to

the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources. Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.

**Installation and use restrictions****Standards and regulations**

The design and the setting up of electrical systems must be performed according to the relevant standards, guidelines, specifications and regulations of the relevant country. The installation, configuration and programming of the devices must be carried out by trained personnel.

The installation and the wiring of the bus line and the related devices must be performed according to the recommendations of the manufacturers (reported on the specific data sheet of the product) and according to the applicable standards.

All the relevant safety regulations, e.g. accident prevention regulations, law on technical work equipment, must also be observed.

**Safety instructions**

Protect the unit against moisture, dirt and any kind of damage during transport, storage and operation. Do not operate the unit outside the specified technical data.

Never open the housing. If not otherwise specified, install in closed housing (e.g. distribution cabinet). Earth the unit at the terminals provided, if existing, for this purpose. Do not obstruct cooling of the units. Keep out of the reach of children.

**Setting up**

The physical address assignment and the setting of parameters (if any) must be performed by the specific softwares provided together the device or by the specific programmer. For the first installation of the device proceed according to the following guidelines:

- Check that any voltage supplying the plant has been removed
- Assign the address to module (if any)
- Install and wire the device according to the schematic diagrams on the specific data sheet of the product
- Only then switch on the 230Vac supplying the bus power supply and the other related circuits

**Applied standards**

This device complies with the essential requirements of the following directives:

2004/108/CE (EMC)  
2006/95/CE (Low Voltage)  
2002/95/CE (RoHS)

**Note**

Technical characteristics and this data sheet are subject to change without notice.