

ModCL: Module for the regulation of the ambient temperature

ModCL is a smart module that has been specially developed for the management of the ambient temperature, both for domestic appliance and for offices in building automation. ModCL module interfaces, through MCP XT controller, to the well tested **CONTATTO** world and it is goes to integrate the many features offered by the system with an easy to use temperature regulation device.

ModCL is a specialized module, therefore it allows to decentralize the management of the ambient temperature regulation, thus simplifying a lot the programming of **CONTATTO** MCP XT controller. The user interface of the module features a graphic back lighted LCD display and 6 pushbuttons; the back lighting switches on automatically when pushing a button and it switches off 30 seconds after the last button pushing.

The remote control of ModCL module via the **CONTATTO** bus is not a problem: quite all operating parameters can be easily monitored and changed by supervisors, touch screen terminals, via GSM, Internet, Intranet and so on.

A remote sensor connected to another module (e.g. ModNTC), can be used for the regulation instead of the integrated probe; in this way it is possible to place the ModCL module in another place than the regulated one, even if this is very far from it.

In addition to the regulated ambient temperature, ModCL module can display up to 4 different temperatures sensed by other modules (e.g. ModNTC), allowing to report the temperature of external zones, other rooms and so on. A name can be freely assigned to each one of these zones, allowing an easy identification of them on the display.

ModCL is a compact module, developed to be housed in mod. 504 standard wall box; this solution allows the user to choose among a big variety of frames according to his taste.

Address programming

ModCL module take 1 input and 1 output address that are equal each one to the other, so only a base address is needed. This must be assigned by the FXPRO programmer through the proper programming cable inserted in the connector named PRG on the back side of module.

Two labels on the back panel allow to make note of assigned addresses for an immediate visual identification.

Wiring

ModCL module needs to be connected only to the 4-wire **CONTATTO** bus as reported on the labels near to the bus terminal block on the back side of the module.

The temperature regulation

ModCL module can manage two main regulation modes, one for Winter and one for Summer season. For each season, ModCL provides Automatic and Manual mode.

In Auto mode, the module allows to specify 3 setpoints: SP1, SP2 and SP3 (from the less to the more comfortable one). For instance, a good idea may be to assume this points as follows:



- SP3: "Comfort" setpoint
- SP2: "Night" setpoint
- SP1: "Absent" setpoint






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

The range for all setpoints is 10.0 to 35.5°C and can be changed in any moment by the keyboard of the module or via the bus.

Moreover, an OFF position is available both for Auto and Manual mode; for winter season, the OFF position causes the regulation at the no-frost setpoint (for summer season it means completely off). The no-frost setpoint can be set, during the setting up, in the range 0 to 25.5°C.

ModCL can be set, during the setting up, to control a single point (e.g. heater or cooler) or to control a 3-speed fan coil (in addition to the main enable to heater and cooler devices). The module allows to control separate enable outputs depending on the current season (winter or summer).




The display always shows, in the main window, the value of the currently applied setpoint. It also shows the currently selected Auto  or Manual  mode, the current day of the week and time and the status of the regulation outputs as here bottom explained:

- in single point mode, the display shows the status of the regulation output by the icon  or the icon  (a flame in winter mode and an ice crystal in summer mode).
- in fan coil mode the display shows, near to the  or  icon, the status of the 3 "speed points" (see in the next) by a 3-bar graph , that reports what speed is currently activated (if any).

ModCL also features a weekly scheduler with half-hour resolution; for each day of the week, ModCL allows to specify the relationship between the time and the desired setpoint. The programming of the scheduler is made in a graphical way directly by the keyboard of the module, in order to view the whole program for the day simply taking a look to the display.

Auto and Manual operation



The switching from Auto to Manual mode occurs by the


button  from the main screen. In Auto mode (icon ) ModCL follows the scheduling program (it regulates at one of the 3 setpoints "Auto" + OFF), while in Manual mode (icon ) it regulates at SPM or it can be set to OFF (no-frost in winter mode).

The regulation setpoints in Auto and Manual mode can be changed in any moment as described in the following.

Auto mode



The temperature regulation (intended as control of the heating/cooling element) occurs according to the scheduling program which imposes one of the 4 setpoints (SP1, SP2, SP3 or OFF).


Pushing on buttons  and  from the main screen, it is possible to increase and decrease the value of the current setpoint (no-frost setpoint excluded); the modified value will not be stored, in order to reload the original value at the next occurrence of the same SPx in the scheduling program (this function is useful to temporarily change the current setpoint according to the requirement of the moment).

Pushing on button  from the main screen, it is possible to switch from a setpoint to the next one (in the sequence OFF, SP1, SP2, SP3, OFF, SP1,..... and so on).

Manual Mode

The temperature regulation (intended as control of the heating/cooling element) occurs by the imposition of SPM or OFF setpoint, regardless of the time.

Pushing on buttons  and  from the main screen, it is possible to increase and decrease the value of the Manual setpoint SPM (which will be stored in order to have the same value at the next switching from Auto to Manual mode).

Pushing on button  from the main screen, it is possible to switch between the setpoint SPM and OFF.

Note: the fancoil speed will be always decided by the system; in other words, the user cannot change in any way the speed of the fancoil.

Available information on the CONTATTO bus

As said before, ModCL module takes, inside the CONTATTO system, one input and one output address, both 4-channel / 16-bit type. The meaning of the available point/value is here described.

Input channels

Input section				
Point	CH1	CH2	CH3	CH4
1	MIN Speed			
2	MED Speed			
3	MAX Speed			
4	Heat request			
5	Cool request			
6	Probe failure			
7	-			
8	-			
9	-	Room Temperature (°Kx10)	-	-
10	Read SP3 status			
11	Read SP2 status			
12	Read SP1 status			
13	Read OFF status			
14	Read SPM status			
15	Read MAN status			
16	Read Summer status			

Description of input channels

CH1 input

- **Point 1..3:** mutually exclusive points; a point=1 means that regulator needs to switch ON the related speed (if ModCL has been set for fan-coil operation). If all points are 0, the fan must be OFF.
- **Point 4:** point=1 means that regulator needs to switch ON the heating device (in winter mode).
- **Point 5:** point=1 means that regulator needs to switch ON the cooling device (in summer mode).
- **Point 6:** point=1 means failure of the temperature probe (e.g. open or short circuit).
- **Point 7..9:** not used at this moment.
- **Point 10..14:** mutually exclusive points; point=1 means that ModCL is currently regulating at the related setpoint (SP3, SP2, SP1, OFF or SPM).
- **Point 15:** point=1 means that ModCL is currently set in Manual mode; point=0 means that is currently set in Auto mode.
- **Point 16:** point=1 means that ModCL is currently set for summer mode; point=0 means that is currently set for winter mode.

CH2 input

- **Point 1..16:** value of the room temperature, in °Kx10 (e.g. 2980 means (2980-2730)/10= 25.0°C).

CH3 & CH4 input

- Not used.

The input points of CH1 must be used in MCP XT program to perform the wanted operations. For example, assuming that address 100 has been assigned to ModCL module, the command to the heating device must be implemented by a simple equation like the following:

O31.1 = I100:1.4

where **O31.1** is the relay output connected to the heating device and **I100:1.4** is the related point of ModCL.

In the same way, called **O10.1**, **O10.2** and **O10.3** the outputs connected to the fan coil, the following equation must be included in MCP XT:

O10.1 = I100:1.1

O10.2 = I100:1.2

O10.3 = I100:1.3

Output channels

Output section				
Point	CH1	CH2	CH3	CH4
1				
2				
3				
4				
5	Set and read the value of SPM (°Cx10)			
6				
7				
8				
9		Set and read the value of SP3 (°Kx10)	Set and read the value of SP2 (°Kx10)	Set and read the value of SP1 (°Kx10)
10	Set SP3			
11	Set SP2			
12	Set SP1			
13	Set OFF			
14	Set SPM			
15	Set MAN			
16	Set Summer			

Description of output channels

CH1 output

- **Point 1..9:** Read and Write field. This must be interpreted as analog value which sets and reads a value corresponding to the manual setpoint; this value is in °Cx10 (e.g to set 25.2°C, the value to be sent must be 252).
- **Point 10..12:** Write only points. These points are relevant in Auto mode only. Point=1 switches ModCL to the related setpoint (SP3, SP2, SP1); when keeping activated one or more of these points, the scheduler will be disabled (in this way is possible to change and hold a setpoint regardless of the scheduling program). To make a momentary change of the setpoint, simply generate a pulse on one of points 10..12. It is always possible to change the current setpoint number from the keyboard of ModCL even if one or more of points 10..12 are activated. See also Note 1.
- **Point 13:** Write only point. This point is relevant both in Auto and in Manual mode. Point=1 switch ModCL to OFF; in Auto mode, keeping this point activated, the scheduler will be disabled (in this way is possible to force the OFF condition regardless of the scheduling program). To force a momentary OFF condition (in Auto mode), simply generate a pulse on point 13. It is always possible to change the current mode from the keyboard of ModCL even if point 13 is activated but this point will not be aligned to the new status.
- **Point 14:** Write only points. This point is relevant in Manual mode only. Point=1 switch ModCL to SPM setpoint. It is always possible to switch to OFF from the keyboard of ModCL even if the point 14 is activated but this point will not be aligned to the new status.
- **Point 15:** Read and Write point. Point=1 sets ModCL in Manual mode, point=0 sets it in Auto mode; the reading of this point informs about the current mode (as for point 15 of the CH1 input). See also Note 2.
- **Point 16:** Read and Write point. Point=1 sets ModCL for Summer mode, point=0 sets it for Winter mode; the reading of this point informs about the current mode (as for points 16 of the CH1 input). See also Note 2.

CH2 output

- **Point 1..16:** Read and Write field. It sets and reads the value corresponding to setpoint SP3, in °Kx10 (e.g. 2980 means (2980-2730)/10= 25.0°C).

CH3 output

- **Point 1..16:** Read and Write field. It sets and reads the value corresponding to setpoint SP2, in °Kx10 (e.g. 2980 means (2980-2730)/10= 25.0°C).

CH4 output

- **Point 1..16:** Read and Write field. It sets and reads the value corresponding to setpoint SP1, in °Kx10 (e.g. 2980 means (2980-2730)/10= 25.0°C).

Since some parameters of ModCL can be changed both from the bus and from its keyboard, it is mandatory to include in MCP XT program an appropriate **FIELDtoRAM** directive. In this way, when changing a parameter from ModCL keyboard, the related data in MCP XT RAM will be aligned accordingly.

Without this configuration directive, the alignment direction will be, by default, from the RAM of MCP XT to ModCL and, as consequence, it will not be possible to change the value of the setpoints, the Manual/Auto mode and the Summer/ Winter season from ModCL keyboard.

Assuming that address 100 has been assigned to ModCL module, then the configuration directive must be:

FIELDtoRAM = (AO100:1..AO100:4)

Note 1: in Auto mode, keeping activated one of the output points 10..12, the regulator will switch to the related setpoint regardless of the scheduling program.

ModCL module keeps this new setpoint until the related output point remains activated. When the output point will be de-activated, the setpoint becomes that decided by the scheduling program, but only if the currently scheduled setpoint is different from that which was active before the forcing of the output point.

Keeping activated an output point which forces a setpoint different from the scheduled one, it is anyway possible to change the setpoint from the keyboard of ModCL (but the output points 10..12 do not change their status, because these are write only points).

Note 2: changing to Manual mode through the bus and keeping activated the output point 15, when changing again to Auto mode from the keyboard of ModCL the output point 15 will be aligned accordingly. The same rule applies to output point 16 (Winter/Summer mode).

Regulation algorithm

The temperature regulation performed by ModCL module is based on a proportional-Integral algorithm with 10 minutes timebase. ModCL module regulates the temperature by modulating the points "heat request" or "cool request" (depending on the season) on a fixed period. At the beginning of each regulation cycle, the module evaluates the difference between the ambient temperature and the current set point SPx. The ratio (Time_ON / Time_OFF) will be then adjusted according to this difference.

The control of the 3 speeds for fan coil mode is instead implemented by configurable thresholds, considered as temperature drop ("delta") in respect to the current setpoint (see the paragraph "Setting up").

Setting up

This paragraph describes the setting up of the module; this step allows to adapt the operation of ModCL module according to the application requirements.

An easy to use program is available, free of charge, for the setting up of the module; this program is named CLTools and it is distributed together MCP IDE package (rel. 1.0.4 or higher) from MCP XT. The setting up is made through the **CONTATTO** bus.

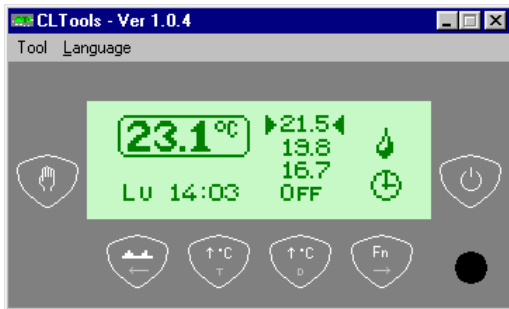
ModCL


Note: ModCL can operate only in systems where MCP XT controller is installed; the setting up and the programming of MCP XT requires the program MCP IDE.

All ModCL modules installed in the application must be declared in the MCP XT configuration, specifying the addresses as in the following example:

```
MODCL = ( I100, O100 )
MODCL = ( I101, O101 )
MODCL = ( I102, O102 )
... ..
```

After having transferred a program to MCP XT containing at least the addresses of installed ModCL modules, the second step is the configuration of the operating parameters. As said before, to execute this operation, the CLTools program is required. From the menu of MCP Visio select Configuration and then ModCL. The following window will appear:



From this window select Tool and then ModCL Configuration or, as option, left click with the mouse on the button  .

The configuration window will be shown as in Fig.1. In this window many parameters can be set as required; some radio buttons on the top side allow to set:

- **Season:** Winter or Summer; it can be changed also by the ModCL keyboard
- **Mode:** Automatic or Manual mode; it can be changed also by the ModCL keyboard
- **Type:** Single point (for simple heater or cooler) or Fan Coil; this cannot be changed by the ModCL keyboard
- **Language:** to specify the language to be used for the day of the week on the display; it can be changed also by the ModCL keyboard
- **Probe:** ModCL allows to use, for the regulation, the built-in temperature probe or a remote probe connected to another module (e.g. ModNTC); when choosing the Remote option, the address and the channel of the module where the remote probe is connected has to be specified; this parameter cannot be changed by the ModCL keyboard

The **Set Points** section in the configuration window lists the several setpoints to be used in winter and in summer mode. Allowed range are 10.0 to 35.5°C for SP1-2-3-M and 0.0 to 25.5°C for the no-frost setpoint. Even if the setpoints can be freely defined, we suggest to assume SP3 as the more comfortable setpoint and SP1 as the less comfortable one, regardless of the currently selected season.

All setpoints, excluding the no-frost one, can be changed also by the ModCL keyboard.

The **Visualization** section allows to specify, if required, the name (8 characters max) and the Address/Channel of up to 4 additional temperature probes; the names and the temperature values will be shown on the proper page of ModCL (only if an address other than zero was specified for that zone).

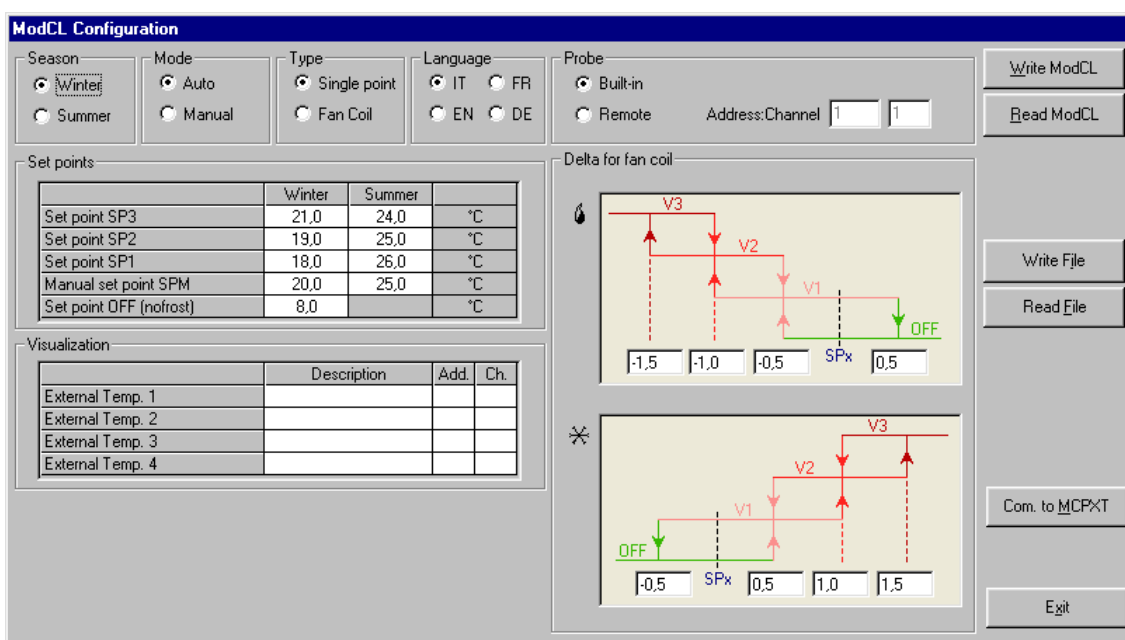


Fig. 1

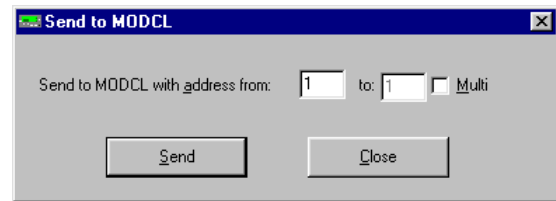
The following figure shows this section filled with some possible parameters:

Visualization			
	Description	Add.	Ch.
External Temp. 1	External	10	1
External Temp. 2	Bedroom	10	2
External Temp. 3	Cellar	18	1
External Temp. 4	Garage	25	4

The **Delta for fan coil** section allows to define, with the help of an easy graphical representation, the several delta to be used for switching from a speed to the other one, both for winter and summer mode. The delta values are intended in respect to the current setpoint (SPx) and they can be positive or negative numbers (in this last case it is possible, for instance, to switch off the heater before to reach the setpoint, thus avoiding temperature overshoots).

The values of delta parameters depend on the particular application, but the default values may be suitable for most of them.

Once all wanted parameters have been entered in the CLTools program, press the button "Write ModCL" to send to the module the information shown in the "ModCL Configuration" window. The following message will be shown:



Specify the address of the ModCL to be programmed or, activating the "Multi" option, specify a starting and an ending address; in this case the program will transfer the setting to all ModCL modules found in that address range.

The button "Read ModCL" executes the inverse operation. Of course, before the transferring, the communication with MCP XT must be enabled by the button "Com. to MCPXT".

The CLTools program allows to save in a file, having .CL extension, the data shown in the ModCL configuration window ("Write File"). It is also possible the opposite operation ("Read File").

The CLTools program also allows the setting of scheduling times. From the main CLTools window select Tool and then ModCL Scheduler or, as option, left click with the mouse on

the button .

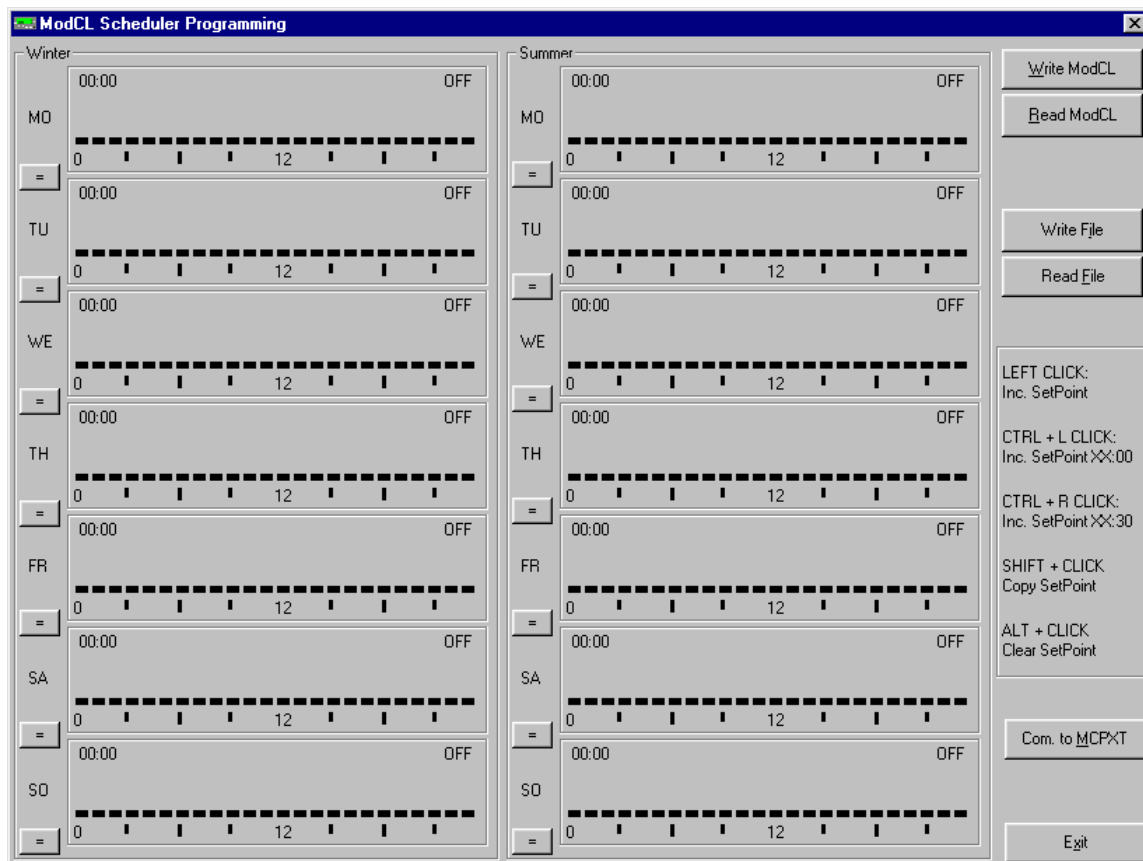


Fig.2

ModCL

The scheduler window will be shown as in Fig.2. This window is divided in 2 vertical sections, one for winter and one for summer season. Each season allows the programming of scheduling time for the seven days of the week. The result of the programming will be a graph, for each day, similar to that shown on the display of ModCL module.

Some comments on the right side of the Scheduler window explain how to change the programming; these commands are here resumed:

- Left click: increase setpoint at the mouse position
- Ctrl + left click: increase setpoint for time XX:00 (thus at time XX o'clock)
- Ctrl + right click: increase setpoint for time XX:30 (thus at time half past XX)
- Shift + left (or right) click: copy setpoint of the previous time-step to the current mouse position
- Alt + left (or right) click: clear setpoint (OFF) at the current mouse position

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

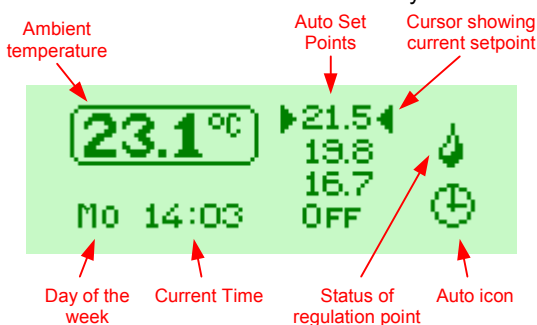
The buttons "Write ModCL" and "Read ModCL" transfer the scheduling program from the window to the module and from the module to the window.

Also from the Scheduler window it is possible to save in a file, having .CL extension, all the data shown in the CLTools windows ("Write File"). It is also possible the opposite operation ("Read File").

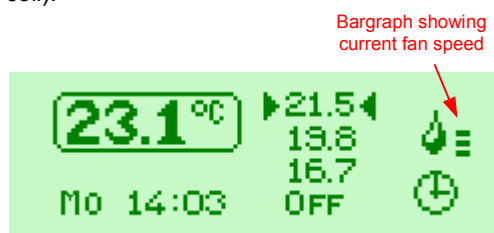
Keyboard operation

The keyboard of ModCL allows full control of all its functions and settings. ModCL module, depending on the selected function, shows the following screens:

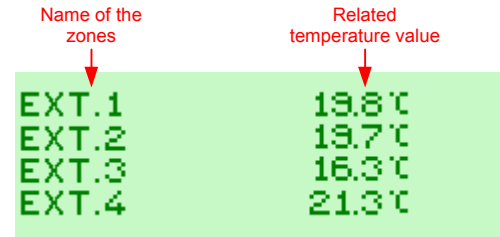
- **Main screen:** this is the screen normally shown



The icon showing the status of the regulation point changes depending on the season and operation mode (single point or fan coil).



- **External temperature screen:** this is an optional screen, shown only if external zones have been defined



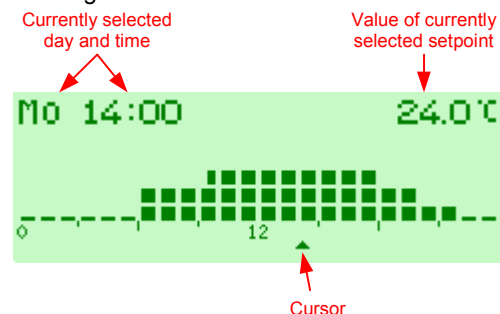
The name of the zones can be fully defined during setting up (8 characters MAX).

- **ON/OFF Times screen:** this is a screen showing the amount, in the format hh:mm:ss, of time T_{ON} and of time T_{OFF} of "heat request" or "cool request" point (depending on current season). These times give an indication of the climatic system efficiency (see also paragraph "Regulation algorithm").



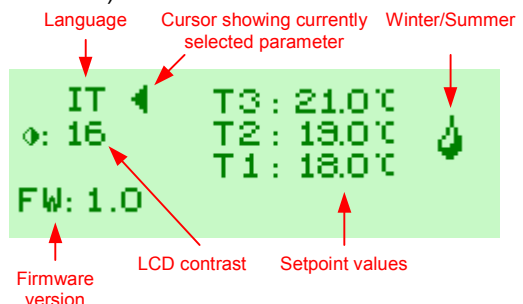
These times can be zeroed pushing the button

- **Scheduler screen:** allows programming and edit of scheduling times



When moving left or right the cursor, the currently selected day and time and the value of currently selected setpoint change accordingly.

- **Settings screen:** this allows to change some operating parameters (language, LCD contrast, setpoint values and season)



The keyboard of ModCL module allows moving from one screen to the others as shown in the menu tree in Fig.3.

Notes:

When the back-lighting is off, the first pushing on any button of ModCL module will cause the switching on of the back-lighting and no more actions.

The current day of the week and time is read from the bus (MCP XT cyclically sends the time information on the bus); ModCL module has not a built-in timekeeper. It is not possible to change date and time of MCP XT from ModCL module.

Upgradability

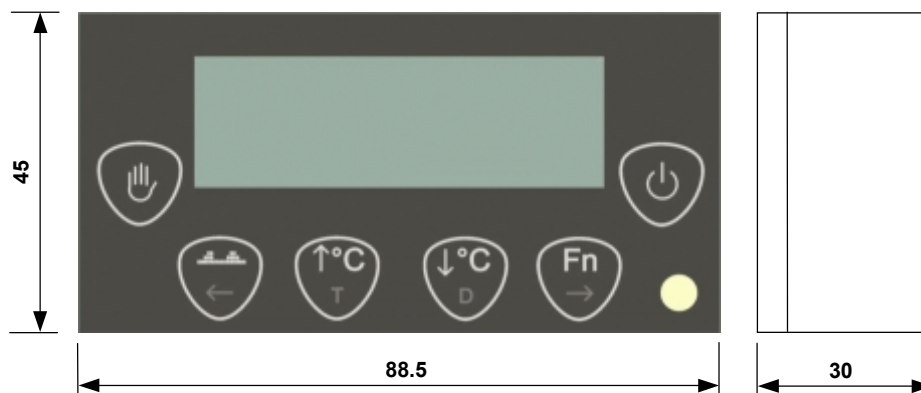
The firmware of ModCL module can be easily upgraded through the bus. This feature allows to have the module always updated with last modifications or new features.



Technical characteristics

Supply voltage	24V \pm 25% SELV
MAX current consumption	50mA
Built-in temperature probe:	
Type	NTC
Range	0.0 ÷ 40.0°C
Resolution	0.1 °C
Max error	\pm 0.5 °C
Linearity	\pm 0.5 °C
Display	LCD graphic with automatic back-lighting
Display contrast	Adjustable by panel
Controlled device	Single point Heater & Cooler or 3-speed fan coil
Regulation algorithm	PI type on fixed timebase. Fan speed control by configurable delta values
Amount of setpoints for winter	3 in Auto mode and 1 in Manual mode + OFF. No frost feature in winter mode
Amount of setpoints for summer	3 in Auto mode and 1 in Manual mode + OFF.
Setpoints range:	
SP1-SP2- SP3- SPM	+10 ÷ +35.5 °C
No-frost	0.0 ÷ +25.5 °C
Scheduler	Weekly, separate programs for Winter and Summer, half-hour resolution
Operating temperature	-10 ÷ +50 °C
Storage temperature	-30 ÷ +85 °C
Protection degree	IP20

Outline dimensions



Menu tree

Screen	Button	Function	Screen	Button	Function	Screen	Button	Function	Screen	Button	Function						
MAIN		Auto ↔ Man						Go to external temperatures screen (if any), otherwise go to settings screen									
		Increase current set point value (temporarily)															
		Decrease current set point value (temporarily)															
		In Auto: select SPx. In Man: Toggle ON/OFF															
			External Temperatures		Return to MAIN							TON/OFF		Return to MAIN	Screen		Reset times
					Go to TON/OFF screen									Go to settings screen	Settings		Return to MAIN
																	Move to the next parameter
																	Move to the previous
																	Increase current parameter
																	Decrease current parameter
				Scheduler								Move cursor to right					
												Move cursor to left					
					Choose set point for that time (scroll between OFF-SP1-SP2-SP3)												
					Move to next day of the week												
				+	Copy current setpoint to right												
				+	Copy current setpoint to left												
					Copy the program of the currently shown day to the next day												