FM 31 A

DIGITAL THERMOSTAT WITH HEAT, COLD AND DEFROST

User Manual

PREVIOUS STATEMENT:
In this manual are contained all the necessary information for a correct installation and the instructions for the use and the maintenance of the product; we recommend, therefore, to read carefully the following instructions. The maximum care has been used in the realisation of this document, anyway OSAKA does not assume any responsibility deriving from the use of itself. The same consideration has to be done for each person or Company involved in the creation of this manual. The herewith issue is an exclusive property of OSAKA. which forbids any reproduction and divulgation, although partial, if not expressly authorised. reserves the right to execute aesthetically and functional modifications, at any moment and without any notice.

1 - INSTRUMENT DESCRIPTION

1.1 - GENERAL DESCRIPTION

FM 31 is a microprocessor digital thermostat, used to control temperature with ON/OFF control and defrost control by stopping compressor mode.
The process temperature can be visualised via two red displays, whereas the state of the compressor is given by a led.
The equipement has a relay output (8A o 16A) and one input for a NTC temperature probe.

1.2 - FRONT PANEL DESCRIPTION

1 - Key Set : It is used to program the Set Point and the functionning parameters.
2 - Key DOWN : It is used to decrease the programming values or to select a parameter.
3 - Key UP/DEFROST : It is used to increase the programming values or to select a parameters and to start manual defrost.
4 - Led OUT/SET : It indicates the state of the output : ON (on), OFF (off) or inhibited (flashing green), and it indicates that we are in the programming mode (fast blinking)

2 - PROGRAMMING

2.1 – PROGRAMMING OF SET POINT

Press the key Set then release it and the display will show **« SP »** and the led OUT/SET will blink rapidly.
Releasing the key, the display will show the programmed Set Point. To modify it, push the keys UP to increase the value and DOWN to decrease it.
To leave the programmation of the Set Point, don't press any key during 5 seconds and the display will show the value of the temperature measured by the probe.

2.2 - PARAMETERS PROGRAMMING

To access the instrument's function parameters, press the key Set and keep it pressed for about 5 seconds, after which the SET led will light up, the display will visualised the code that identifies the first group of parameters ("SP ") and after 4 more seconds, the first parameter ("CA") will be displayed.
You can release the key Set and the set value for "CA" will be displayed. You can modify this value by pressing the UP and DOWN keys.
Once the desired value has been set, press the key Set again: the new value will be memorised and the display will show the label of another parameter. Once again, you can release the key Set and the set value for "CA" will be displayed. You can modify this value by pressing the UP and DOWN keys.
To exit the programming mode, do not press any key for about 20 seconds, or keep the UP or DOWN key pressed until it exits the programming mode.

You should always wait to be out of the programming mode because if the equipment is turned off before, all the data entered during the last programming will be lost.

2.3 - PARAMETER PROTECTION

It is possible to block the access to the programming parameters following this procedure :
Turn the equipment off, press the Set key and keep it pressed while turning the equipement on again.
After 5 seconds, "**uL"** (unlock) will be displayed meaning that you can access parameters.
Pressing the keys Set and Down, **"Lo"** (lock) will be displayed meaning that parameters cannot be accessed.
To get out of this programming mode, release the key Set. The display will go back to normal mode, the rest of the parameters will not be accessible and you will only be able to modify the Set point.
To access parameters once again, you have to repeat the same procedure pressing the key UP to select "uL" and be able to get out of the protection mode.

3 - INFORMATION ON INSTALLATION AND USE

3.1 – PERMITTED USE

The devices are made as measuring and regulating equipment in accordance with EN 61010-1 norm for operation up to an altitude of 2000 mts.
The use of equipment for standard applications not expressly provided in norm cited above, should provide all measurement and adjustments necessary protection.
The equipment must be adequately protected and away from liquids, dust, grease and dirt. They must be accessible only with the use of a right tool and safety system (except the front).
The devices can NOT be used in dangerous environments (flammable or explosive) without adequate protection.
It is recalled that the installer must ensure that the norm for electromagnetic compatibility is respected after implantation in the installation of equipment, eventually using the right filters if is needed.
In case of failure or malfunction of measuring and control equipment that can create dangerous situations or damage to persons, things, animals or products (defrost food or changes in their ideal state), it is recalled that the facility should be equipped with electronic devices or electromechanical safety and warning system.
They should be placed outside the measuring and control equipments, possible protective devices, responding to specific safety requirements that are covered by the norm of the product or suggest the common sense.
For your own safety, is highly recommended fulfilling the instructions provided above.

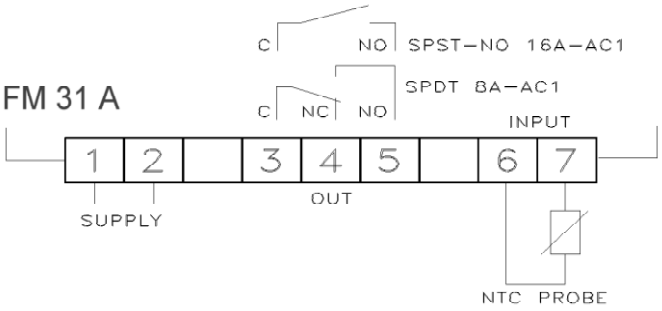
3.2 - MECHANICAL MOUNTING

The instrument, in case 33 x 65 mm, is designed for flush-in panel mounting. Make a hole 25 x 58 mm and insert the instrument, fixing it with the provided special bracket.
We recommend that the gasket is mounted in order to obtain the front protection degree as declared. Avoid placing the instrument in environments with very high humidity levels or dirt that may create condensation or introduction of conductive substances into the instrument.
Ensure adequate ventilation to the instrument and avoid installation in containers that house devices which may overheat or which may cause the instrument to function at a higher temperature than the one permitted and declared.
Connect the instrument as far away as possible from sources of electromagnetic disturbances such as motors, power relays, relays, solenoid valves, etc.

3.3 - ELECTRICAL CONNECTIONS

Carry out the electrical wiring by connecting only one wire to each terminal, according to the following diagram, checking that the power supply is the same as that indicated on the instrument and that the load current absorption is no higher than the maximum electricity current permitted.
As the instrument is built-in equipment with permanent connection inside housing, it is not equipped with either switches or internal devices to protect against overload of current: the installation will include an overload protection and a two-phase circuit-breaker, placed as near as possible to the instrument, and located in a position that can easily be reached by the user and marked as instrument disconnecting device which interrupts the power supply to the equipment.
It is also recommended that the supply of all the electrical circuits connected to the instrument must be protected properly, using devices (ex. fuses) proportionate to the circulating currents.
It is strongly recommended that cables with proper insulation, according to the working voltages and temperatures, be used.
Furthermore, the input cable of the probe has to be kept separate from line voltage wiring. If the input cable of the probe is screened, it has to be connected to the ground with only one side.
Whether the instrument is 12 V version it's recommended to use an external transformer TCTR, or with equivalent features, and to use only one transformer for each instrument because there is no insulation between supply and input.
We recommend that a check should be made, making sure that the parameters are those desired and that the applications function correctly before connecting the outputs to the actuators so as to avoid malfunctioning that may cause irregularities in the plant that could cause damage to people, things or animals.
OSAKA and its legal representatives do not assume any responsibility for any damage to people, things or animals deriving from violation, wrong or improper use or in any case not in compliance with the instrument's features.

3.4 - ELECTRICAL WIRING DIAGRAM



4 - FUNCTIONS

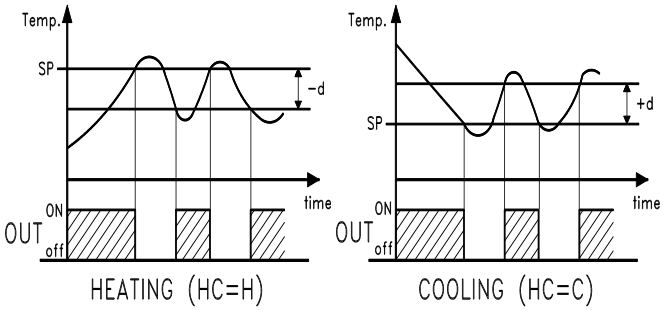
4.1 - MEASURING AND VISUALIZATION

When the equipment is turned on, before showing the measured temperature, the display shows during 5 seconds the measurement unit which can be modified by the par. **"ru"** in °C or °F.
You have to notice that changing this parameter will only modify the visualization on the display and not the Set Point and the parameters. They need to be modified manually (for instance, if the Set Point is 50 °C and you change the measurement unit, the Set Point will be 50ºF).
Moreover, via the par. **"CA",** you can program a shift for the positive or negative output that is added to the value read by the probe.
This parameter can be used for a new regulating of the equipment depending on the needs of its application.

4.2 – TEMPERATURE CONTROL

The equipment has an ON / OFF control and works on the output OUT according to the probe measurement, the Set Point **"SP"**, the differential **"d"** and the operating mode **"HC**".

According to operating mode programmed via the par. "HC", the differential is automatically considered by the controller as negative values for heating control (HC=H) or positive for cooling control (HC=C).



In the event of cell probe error, it is possible to set the instrument so that that the output "Out" continues to work in cycles according to the times programmed in the parameter **"t1"** (activation time) and **"t2"** (deactivation time).

If an error occurs on the probe Pr1 the instrument activates the output for the time, then deactivates it for the time and so on whilst the error remains.

Programming "t1" = 0, the output in probe error condition will remain switched off.

Programming instead "t1" to any value and "t2" = 0, the output in probe error condition will remain switched on.

Remember that the temperature regulation function can be conditioned by "Compressor Protection" function described below.

4.3 – COMPRESSOR PROTECTION FUNCTION AND DELAY AT POWER-ON

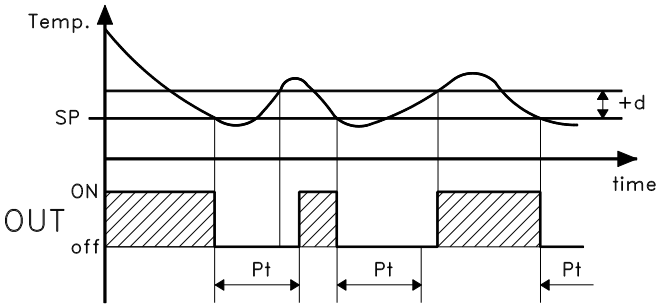
The function "Compressor Protection" carried out by the machine aims to avoid close start ups of the compressor controlled by the instrument in cooling applications. This function remains activated in heating applications ("HC" = H).

This function foresees a time control on the switching on of the "Out" output associated with the temperature regulation request.

The protection consists of preventing the output from being switched on during the time set in the parameter **"Pt"** (expressed in min.) and counted from the last output swich off, and therefore that any activation occurs only after the "Pt" time has finished.

If during the power on delay phase, the regulator request should disappear, due to an inhibition caused by the compressor protection function, the foreseen start up of the output is naturally cancelled.

The function is deactivated by programming "Pt" = 0.



Avoiding the activation of the output can be determined by the switch on delay mode.

It is then possible to stop the activation of the output after turning on the equipment, despite the regulator demand, for the time set via the par. **"od"** and expressed in min.

The function will be deactivated by "od" = 0.

During all the steps of the actuation delay of the output, by stopping the function of "Compressor Protection" or by turning on delay, the led OUT/SET is blinking.

4.4 – DEFROST CONTROL

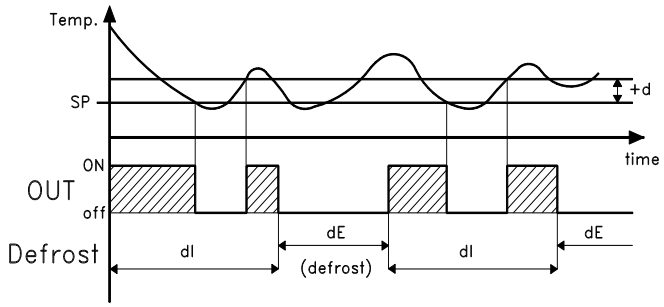
The defrost control mode by compressor stop works depending on the following parameters :

"dI" : Interval between defrosts (in hours).

"dE" : defrost length (in min.)

Each operating hour "dI", the output is deactivated for the length of time "dE".

It operates on the cooling control ("HC"=C), also on the heating control ("HC" =H), and when there is a probe error.



When defrost cycle is in process, **"dF**" is being displayed.

With the par. **"dL"**, it is possible to use the display during defrost. The equipment can display "dF" in alternation with the temperature measured by the probe (dL = oF) or only "dF" (dL = Lb).

In this last event and in cooling control, the equipment will display the temperature measured by the probe at the end of defrost, only if it is lower than the value of [SP+d]. Otherwise, the equipment will display **"Pd"** until the temperature drops below this value.

4.5 - MANUAL DEFROST

To start up a manual defrosting cycle, press the key UP/DEFROST when it is not in programming mode and keep it pressed for about 5 seconds after which the instrument will carry out a defrosting cycle.

Manual or automatic defrost time is always programmed by the par. "dE".

Manual defrost works even with a probe error.

5 - PROGRAMMABLE PARAMETERS

5.1 - PARAMETERS TABLE

Par.		Description	Range	Default.	Note
MEASURE AND VISUALIZATION					
1	**CA**	Calibration	-20...+20 °C/°F	0	
2	**ru**	Measurement unit	°C - °F	°C	
TEMPERATURE CONTROL					
3	**d**	Differential	1 ...20 °C/°F	2	
4	**LS**	Minimum Set	- 40 ... HS °C/°F	-40	
5	**HS**	Maximum Set	LS ... 99 °C/°F	60	
6	**HC**	Output operating mode	H - C	C	
7	**t1**	Output OUT activation time for probe error	0 ... 99 min.	0	
8	**t2**	Output OUT deactivation time for probe error	0 ... 99 min.	0	
COMPRESSOR PROTECTION AND POWER ON DELAY					
9	**Pt**	Compressor protection time	0 ... 99 min.	0	
10	**od**	Delay at power on	0 ... 99 min.	0	

DEFROST CONTROL					
11	**dI**	Defrost interval	0 ... 99 hrs	10	
12	**dE**	Defrost time	0 ... 99 min.	15	
13	**dL**	Display blockage during defrost	oF - Lb	oF	
SET POINT					
14	**SP**	Set Point	LS ... HS °C/°F	0	

5.2 - PARAMETERS DESCRIPTION

MEASUREMENT AND VISUALIZATION PARAMETERS: They are used to determine the visualization conditions for the temperature measured by the probe.

CA - CALIBRATION : Positive or negative offset added to the value read by the probe before the visualization.

ru – MEASUREMENT UNIT : Established by temperature measurement, visualization in degrees Celcius or Fahrenheit. We advise that changing this parameter will modify the display visualization but not the Set and the Set limits programmed via (par. “LS” and “HS”), that have to be modified manually. For instance, if the Set is 50 °C and the unit of measurement is changed, the Set will be 50 °F.

SET POINT LIMITS PARAMETERS : They are used to limit the Set Point programming so that it is impossible to program values that could damage the installation that is being controlled.

LS - MINIMUM SET : Mimimum value programmable as a Set Point.

HS - MAXIMUM SET : Maximum value programmable as a Set Point.

TEMPERATURE CONTROL PARAMETERS: They are for the programming of the temperature ON/OFF control and the control of the output in case of a probe error.

SP - SET POINT : Set Point value.

d - DIFFERENTIAL : Value between the activation and the deactivation in relation to the Set Point of the output OUT.

HC – OUTPUT OPERATING MODE : Works if the output OUT has to control a heating or cooling process (H=Heating, C=Cooling).

t1 – ACTIVATION TIME OD THE OUPUT IN CASE OF A PROBE ERROR :

t2 - DEACTIVATION TIME OD THE OUPUT IN CASE OF A PROBE ERROR :

In case of a probe error, the output OUT will be activated for the time set by the par. “t1” to then remain deactivated for the time set by the par. "t2", and so on. By programming “t1” = 0, ouput in case of error, the probe will always remain switched off. However, by programming “t1” to any value and “t2” = 0, the output in probe error condition will remain switched on.

COMPRESSOR PROTECTION AND POWER ON DELAY PARAMETERS: They are used to introduce delays in the output OUT activation to avoid close startings of the compressor in case of cooling events or each time the equipment is turned on. When the output has to be activated but it is forbidden by its functions, the led OUT/SET is blinking.

Pt –DELAY TIME OF THE COMPRESSOR PROTECTION:
Delay time counted from the output last extinction where the controller keeps the output switched off. The output will be lit up when the temperature controller needs it and that time is over. The function is disconnected by programming "Pt" = 0.

od – DELAY OF THE OUPUT ACTIVATION WHEN POWER ON: Time expressed in mins.

DEFROST CONTROL PARAMETERS: They are used to program the defrost control and the display during defrost.

dI – DEFROST INTERVALS : Time between two automatic and successive defrosts expressed in hours.

dE – DEFROST TIME : It determines the time for each automatic or manual defrost cycle, expressed in mins.

dL – DISPLAY BLOCKAGE DURING DEFROST : It determines the display visualization during defrost. Either the equipment can display the temperature that is being measured by the probe in alternation with the sign "dF" (dL = oF), or the display can remain show the sign "dF" (dL = Lb). In this last event and in cooling applications, the equipment will display once again the temperature measured by the probe at the end of defrost, only if it is below the value [SP+d]. Otherwise, it will display **"Pd"** until the temperature drops below this value.

6 - PROBLEMS, MAINTENANCE AND GUARANTEE

6.1 - ERROR

Error	Reason	Action
- -	The probe can be interrupted or short-cutted or it can measure a value out of the values allowed.	Check that the connection between the probe and the equipment is correct and only then check the probe.

In case of a probe error, the output will operate as we described with the parameters “t1” and “t2”.

6.2 - CLEANING

We recommend cleaning the instrument with a slightly wet cloth using water and not abrasive cleaners or solvents, which may damage the instrument.

6.3 - GUARANTEE AND REPAIRS

This device has a guarantee in form of repair or replacement by manufacturing defects in materials of 12 months from the date of purchase.

OSAKA SOLUTIONS automatically void this guarantee and is not liable for any damages deriving from:

- Use, installation, or use and handling undue, others than those described above and, in particular, differs from the safety requirements established by the regulations.
- Use in applications, machines or electrical panels that do not provide adequate protection against liquids, dust, grease and electric shocks to the installation conditions made.
- The inexperienced handling, and / or alteration of the product.
- The installation / use in applications, machines or electrical panels do not comply with the valid norm.

In case of defective product under warranty or out of that period, it should contact the post sales service to perform the necessary steps. Request document repair "RMA" (by mail or fax) and complete it, is necessary send the RMA and the device to SAT OSAKA by method prepaid.

7 – TECHNICAL DATA

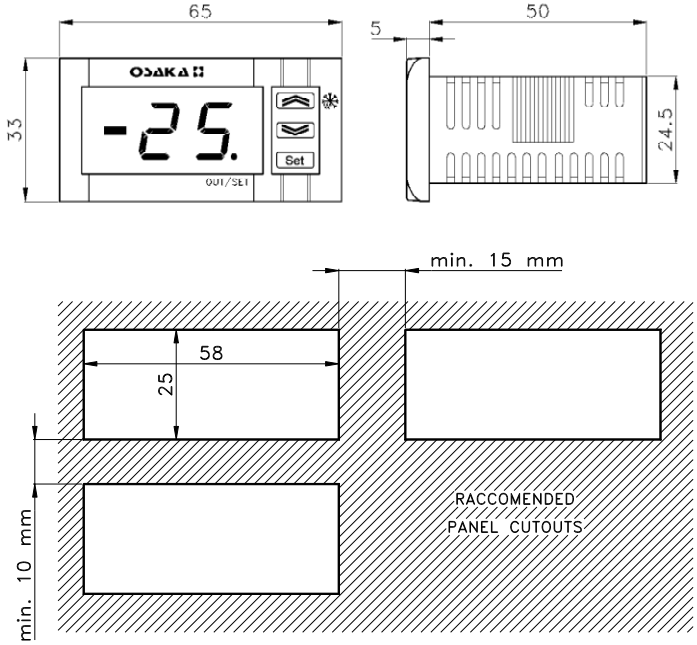
7.1 – ELECTRICAL DATA

Power supply : 12 VAC/VDC, 24, 110, 230 VAC+/- 10%
AC frequency : 50/60 Hz
Consumption : 2 VA approx.
Input : For temperature probe NTC (103AT-2 10 K.... at 25 °C
Ouput : A relay SPDT 8A-AC1 (3A-AC3) 250 VAC or SPST-NO 16A-AC1 (6A-AC3) 250 VAC
Life span of a relay:100000 oper. (relays 8A); 30000 oper. (relays 16A)
Installation category: II

Protection class for electrical discharges : Front panel Classe II
Insulation : Reinforced between parts with low power (power supply 110 or 230 V and output with relay) and front panel ; and the parts with very low power (input) ; Reinforced between power supply and output with relay; No insulation between power supply of 12 V and the input.

7.2 – MECHANICAL DATA
Housing : Self-extinguishing plastic UL 94 VO
Dimensions : 33 x 65 mm, prof. 50 mm
Weight : 105 gr approx.
Mounting : Flush in panel (thickness max. 5 mm) in 25 x 58 mm hole
Connections : 2,5 mm^2 screw terminals block
Degree of front panel protection : IP 65 mounted in panel with gasket
Pollution situation: 2
Operating temperature: 0 ... 55 °C
Operating humidity: 30 ... 95 RH% without condensation
Storage temperature: -10 ... +60 °C

7.3 – MECHANICAL DIMENSIONS, PANEL CUT-OUT AND MOUNTING [mm]



7.4 – FUNCTIONAL DATA
Temperature Control: ON/OFF mode
Defrost control: interval cycles for compressor stops
Measurement range: -40 ...60°C / -30...99 °F
Display resolution: 1 °
Overall accuracy: +/- 1 % fs
Sampling rate: 1 per second
Display: Red h 14 mm, 2 Digits with sign ”-”
Compliance: ECC directive EMC 89/336 (EN 50081-1, EN 50082-1), ECC Directive BT 73/23 et 93/68 (EN 61010-1).

7.5 - EQUIPMENT ORDERING CODE
FM 31 a b cc
a : POWER SUPPLY
F = 12 VAC/VDC
A = 24 VAC
C = 110 VAC
D = 230 VAC
b : RELAY
L = SPDT 8A-AC1
H = SPST-NO 16A-AC1
cc : SPECIAL CODES