TCO 30

MICROPROCESSOR-BASED DIGITAL ELECTRONIC OVENS CONTROLLER

OPERATING INSTRUCTIONS
16/03 - Code: ISTR_M_TCO30_E_03_--

FOREWORD

This manual contains the information necessary for the product to be installed correctly and also instructions for its maintenance and use; we therefore recommend that the utmost attention is paid to the following instructions and to save it.

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1 - INSTRUMENT DESCRIPTION

1.1 - GENERAL DESCRIPTION

Model TCO30 is a microprocessor-based digital controller designed to command ovens, particularly those used in bakeries.

The instrument's main feature is the possibility to have separate control over the temperature and heating powers for the TOP and FLOOR of the oven, as well as commanding the oven's lighting, extractor, the steamer and the steam injector.

The instrument can store up to 8 different cooking programmes and a maximum of 7 relay outputs, up to 4 inputs for thermocouples (J or K) or thermoresistances (Pt100) and 3 configurable digital inputs.

An internal clock makes it possible to programme the oven to switch on automatically at the desired time, set cooking time and, if desired, the automatic switching off of the oven.

The instrument also offers the possibility of having an RS485 serial communication interface with MODBUS-RTU communication protocol.

Other important functions present include: output power limitation, automatic steam injection control, temperature alarms, steamer temperature adjustment, automatic enabling of extractor fan once cooking is terminated and configurable auxiliary output.

1.2 - FRONT PANEL DESCRIPTION
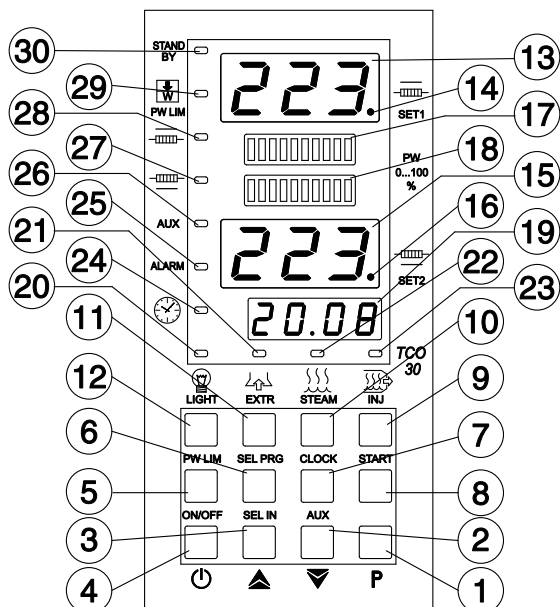
1 - P Key: Used for accessing function parameter programming and for confirming selections.

2 - DOWN (and AUX) Key: Used to decrease the values to be set and for parameter selection. If held down, it also makes it possible to pass to the previous programme level to exit programming mode. When not in programming mode and if suitably programmed, it allows control of the AUX output.

3 - UP (and SEL IN) Key: Used to increase the values to be set and for parameter selection. If held down, it also makes it possible to pass to the previous programme level to exit programming mode. When not in programming mode, allows display of steam and auxiliary probe temperatures.

4 - ON/OFF Key: Used to switch the control device on (RUN mode) or off (STAND-BY mode).

5 - PW LIM Key: Used to enable/disable the power limiter.

6 - SEL PRG Key: Used to access programme selection

7 - CLOCK Key: Used to access switching on time, cooking time and current time programming.

8 - START Key: Used to start/stop the cooking time or switching on time counter.

9 - INJ Key: Used to start/stop vapour injection.

10 - STEAM Key: Used to switch on/off steamer heating.

11 - EXTR Key: Used to switch on/off the extractor fan output.

12 - LIGHT Key: Used to switch on/off oven lighting output.

13 - DISPLAY 1: Normally displays the temperature measured by the oven's TOP probe.

14 - LED SET1: (flashing) indicates the TOP temperature setting mode.

15 - DISPLAY 2: Normally displays the temperature measured by the oven's FLOOR probe.

16 - LED SET2: (flashing) indicates the FLOOR temperature setting mode.

17 - LED 1 BAR: Indicates the heating power of the TOP of the oven.

18 - LED 1 BAR: Indicates the heating power of the FLOOR of the oven.

19 – CLOCK DISPLAY: Normally displays the current time or the cooking time when the timer is started.

20 - LIGHT Led: Indicates the status of the oven lighting output.

21 - EXTR Led: indicates the status of the extractor fan output.

22 - STEAM Led: Indicates the status of the steamer heating regulator. When the Led flashes, it indicates that the injection function is off as the temperature is not yet high enough (par. "SEt").

23 - INJ Led: Indicates the status of steam injection. When the Led flashes it indicates a pause between automatic injections.

24 - CLOCK Led: Indicates the start-up of a counter (automatic switching on or cooking time).

25 - ALARM Led: Indicates active (on), non-active (off) or muted (flashing) alarm status.

26 - AUX Led: Indicates the status of the auxiliary output AUX.

27 - TOP Led: Indicates the status of the output for heating the TOP of the oven.

28 - FLOOR Led: Indicates the status of the output for heating the FLOOR of the oven.

29 - PW LIM Led: Indicates that the power limit function is on.

30 - STAND-BY Led: Indicates that the control device is in STAND-BY mode.

2 - PROGRAMMING

2.1 - RUN/STAND-BY

The unit has an ON/OFF key, which when held down for 2 seconds, switches the instrument on (and therefore starts regulation running). Once the machine is running, if the same key is held down for two seconds, it will switch off.

Once the system is connected to the power supply, it can assume two different modes:

- ON (RUN): meaning that the control device activates all the control functions. The panel therefore shows all the displays and all the leds to be active, with the exception of the Stand-by Led (off).

- OFF (STAND-BY): meaning that the control device does not activate any control function, with the exception of the light command. The display is therefore off, with the exception of the Stand-by led, which is lit.

If the automatic switch on timer is present, in the OFF status it is possible to set the time at which the oven should switch on and then start the timer.

If the timer is started, in the OFF mode, the time display and CLOCK led (see switching on timer) on the display will be lit.

In the event of a blackout, the instrument stores the control device status, in order to return to the same status once the energy supply is restored.

2.2 – SELECTING STORED PROGRAMMES

The instrument can store up to 8 different cooking programmes, thus making it possible to rapidly recall preset parameters for different types of cooking.

When the SEL PRG key is pressed, the upper display will show the programme currently being performed ("**P1**", "**P2**" etc.). The UP and DOWN arrows can be used to select another one.

After 5 seconds of key inactivity, the display will return to the normal operating mode and the selected programme will start.

When one enters programming mode, the Set and parameters shown are those of the current programme.

N.B.: Certain parameters (such as those for calibration, probe selection, etc.) are common to all programmes and are indicated in the parameter table by the caption "com".

2.3 - FAST PROGRAMMING OF SET POINTS AND POWERS

With the instrument switched on, press the P key and then release, the SET1 Led will flash and the upper display will show the TOP temperature set-point set.

In order to modify the value, use the UP key to increase and the DOWN key to decrease.

These keys change one digit at a time, but if held down for more than one second the value changes rapidly and after two seconds the speed will increase further, until the desired value is reached.

When in the SET1 setting mode, by pressing the P key once again and then releasing it, the SET 2 Led will flash and the lower display will show the FLOOR temperature set-point set, which can be modified using the UP and DOWN keys as described above.

At this point, when the P key is pressed and then released, the TOP power bar will flash and can then be modified using the UP and DOWN keys.

Finally, by pressing and then releasing the P key once again, the FLOOR power bar will flash and can then be modified as described above.

The set and power setting mode is exited automatically when no key is pressed for 5 seconds, after which the displays will revert to showing the values measured by the probes.

2.4 – SETTING THE TIME AND DAY
The unit has an internal clock, which must therefore be set to the correct time and day as described below:

Press the CLOCK key and hold down for 5 seconds, after which the upper display will show "**CL**" and the clock display will show the current time.

By pressing the "UP" and "DOWN" keys, it can therefore be altered in order to set the correct time.

By pressing the CLOCK key once again, within 5 seconds, the upper display will "**dy**" and the clock display will show the current day of the week (1=Sunday... 7=Saturday).

By pressing the "UP" or "DOWN" keys when the day is displayed, it is possible to modify it in order to set the current day.

To exit the clock setting mode, do not press any key for 5 seconds, the instrument will automatically return to the normal display mode.

2.5 – SETTING THE COOKING TIME
The cooking timer can only be programmed and enabled when the instrument is in the ON status.

In order to programme the time, press and release the CLOCK key. The CLOCK led will flash and the clock display will show the last cooking time set, in an hh.mm form.

The UP and DOWN keys can be used to set the desired time.

Press the START key to start the counter running.

The cooking time count is then indicated by the CLOCK led lighting up, the flashing of the hh.mm separation led and the countdown on the clock display that in this mode changes to show the decreasing count (and no longer the current time).

Once the cooking time has expired, the control device will activate the buzzer for the time set under the "**bt**" parameter (which can be set in seconds).

To mute the buzzer ahead of time, press any key.

In order to deactivate the cooking timer ahead of time, press the START key and the display will revert to showing the current time.

The "**cEF**" parameter can be used to establish whether at the end of cooking, the control device switches off automatically ("cEF" = On) or whether it remains switched on ("cEF"=OFF).

2.6 – SETTING THE AUTOMATIC SWITCH ON TIME
The switching on timer can only be programmed and activated when the control device is in Stand-by.

To programme the time, press and then release the CLOCK key, the upper display will show "**On**" and the clock display will show the last switching on time set.

Use the UP and DOWN keys to set the desired switching on time.

At this point, by pressing the CLOCK key the upper display will show "**dy**", the clock display will show the day subsequent to the current one and the Up and DOWN keys can be used to change it.

By pressing the CLOCK key once again, the upper display will show "**Ct**" (Cooking Time) and the clock display "**0.00**".

To start the cooking timer running when the oven is switched on, set the desired cooking time using the UP and DOWN keys, otherwise, by leaving the cooking timer at 0.00, it can be started manually only.

Once the desired values have been set, to activate automatic switching on, press the START key for approximately 1 s

The switch on delay time counter will be indicated by the lighting of the CLOCK led and the flashing of the hh.mm separation led. At the programmed time, the control device will switch on automatically.

To deactivate the switching on timer, press the START key for 1 second or switch the instrument on ahead of time.

If you wish the oven to switch on and switch off automatically, in this mode the cooking time must also be programmed once the "cEF" parameter has been programmed as = on.

2.7 – PARAMETER PROGRAMMING
By pressing the "P" key and holding it down for approximately 5 seconds, one accesses the programming menu.

The UP and DOWN keys can be used to scroll the selections:

OPr	allows access to the operative parameter menu but can contain all the desired parameters (see par. 2.8)
CnF	allows access to the configuration parameter menu that contains all the instrument's parameters and is protected by a password

Once the desired option has been selected, press the P key to confirm.

To access the "**OPr**" menu, select "OPr" and then the P key.

The display will now show the code that identifies the first group of parameters ("ⁿ**SP**") and the UP and DOWN keys can be used to select the group of parameters to be edited.

Once the desired group of parameters has been selected, press the P key, the display will show the code that identifies the first parameter of the group selected.

Once again using the UP and DOWN keys, it is possible to select the desired parameter and, by pressing the P key, the display will show, alternately, the parameter code and its setting, which can be altered with the UP or DOWN keys.

Once the desired value has been set, press the P key again: the new value will be stored and the display will show the code of the parameter selected.

The UP and DOWN keys can be used to select another parameter (if present) and modify it as described.

In order to go back to select another group of parameters, hold down the UP or the DOWN key for approximately 2 seconds, after which the display will revert to showing the code of the group of parameters.

Release the key pressed and use the UP and DOWN keys to select another group (if present).

To exit the programming mode, do not press any key for approximately 20 seconds, or hold down the UP or DOWN key until exiting the programming mode.

In order to access the "**CnF**" menu, select "CnF" and press the P key. An access password will now be requested.

When it appears, use the UP and DOWN keys to set the number given on the last page of this manual and then press the "P" key.

If an incorrect password is set, the instrument will return to the regulation status in which it was previously.

If the password is correct, the display will show the code that identifies the first group of parameters ("ⁿ**SP**") and the UP and DOWN keys will be used to select the group of parameters that one intends to edit.

The procedure for programming and exiting programming of the "ConF" menu are the same as those described for the "OPEr" menu.

2.8 – PARAMETER PROGRAMMING LEVELS
The "OPr" menu usually contains the parameters for setting the Set points and output powers, however, at this level, it is possible to make all the parameters desired appear or disappear by following the procedure described below:

Access the "CnF" menu and select the parameter that you wish to make or not make programmable in the "OPr" menu.

Once the parameter has been selected, if the SET1 Led is off it means that the parameter can only be programmed in the "CnF" menu, if, on the other hand, it is lit, the parameter can also be programmed in the "OPr" menu.

Press the ON/OFF key to modify the visibility of the parameter: the SET1 led will change status, thus indicating the parameter's level of accessibility (on = "OPr" and "CnF"; off = "CnF" menu only).

3 - INFORMATION ON INSTALLATION AND USE

3.1 - PERMITTED USE

The instrument has been projected and manufactured as a measuring and control device to be used according to EN61010-1 for altitude operation below the 2000 m on the sea level.

The use of the instrument for applications not expressly permitted by the above mentioned rule must adopt all the necessary protective measures.

The instrument MUST NOT be used in dangerous environments (flammable or explosive) without adequate protection.

The installer must ensure that EMC rules are respected, also after the instrument installation, if necessary using proper filters.

Whenever a failure or a malfunction of the device may cause dangerous situations for persons, thing or animals, please remember that the plant has to be equipped with additional devices which will guarantee safety.

3.2 – MECHANICAL MOUNTING

The instrument, in case DIN 72 x 144 mm, is designed for flush-in panel mounting.

Make a hole 139 x 68 mm mm and insert the instrument, fixing it with the provided special brackets.

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 CONNECTION

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 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 all the electrical circuits connected to the instrument must be protect 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.

We recommend that a check should be made that the parameters are those desired and that the application functions 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.

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3.4 - ELECTRICAL WIRING DIAGRAM
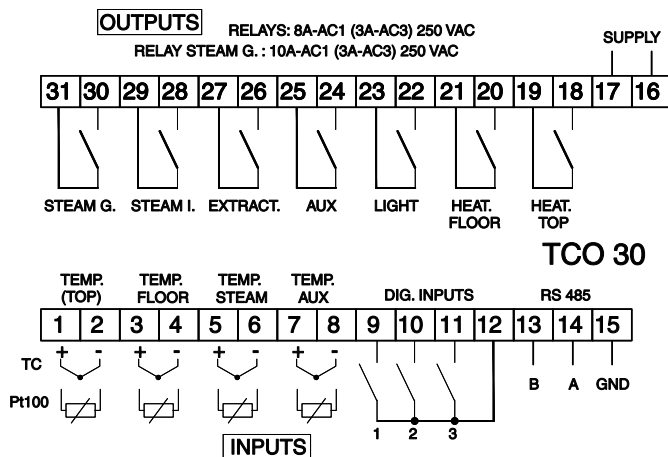
4 - FUNCTIONS

4.1 - MEASURING AND VISUALIZATION

All the measurement parameters are contained in the "ᴵIn" group**.**
The instrument has a maximum of 4 temperature probe inputs:
1 (t) – TOP probe;
2 (F) – FLOOR probe;
3 (S) – STEAM probe *(Optional);*
4 (A) – Auxiliary AUX probe (AUX) *(Optional).*

If the model in question has inputs for thermocouples by means of the "**SEn**" parameter, it is possible to select the type of probe to use, which can be for thermocouples J (J) or K (CrA).

The unit of temperature measurement is established by the "**uni**" parameter and can be set to either °C or °F.

It should be noted that when this parameter is changed, it only changes the display, not the Set Point and the parameters, which must be modified manually (for example if the Set Point was 50°C and the unit of measurement is changed, the set point will change to 50°F).

The "**OSt**", "**OSF**", "**OSS**", "**OSA**" parameters can be used to set a positive or negative offset that is added to the value read by the relative probe before displaying, to which the regulation function is also connected. The displays normally show the temperatures measured by the other probes (if present and enabled with the "**EFP**", "**ESP**", "**EAP**" parameters) by pressing and releasing the SEL IN (DOWN) key.

The upper display will alternately show "**SP**" and the temperature measured by the steamer probe, by pressing the SEL IN key again within 5 seconds, the display will show "**AP**" and the temperature measured by the AUX probe. After 5 seconds of inactivity, the display will return to its normal function.

4.2 – TEMPERATURE AND POWER REGULATOR

The temperature controller is of the ON/OFF kind and activates the power regulator according to the Set Point and the relative differential.

With the TCO 30, is possible to have split temperature control for the TOP and FLOOR or, alternatively, a single control for the entire oven.

If the split control is needed, the TOP and FLOOR probes must be connected and the enable floor probe parameter set as "EFP" = ON; for single probe temperature control, only the TOP probe needs to be connected and the parameter floor probe set to "EFP" = OFF.

All controller parameters are contained in the "ᴵrG" group**.**

SINGLE PROBE CONTROL

The controller with one probe operates in heating mode on both the HEAT TOP and HEAT FLOOR outputs, according to the SET1 "**SP1**", of the differential "**HS1**" and the "**OP1**", "**OP2**", "**tCP**" parameters that will be described below.

The controller unusual feature consists in the fact that it can control the power on the two outputs following a time cycle that can be set to the "**tCP**" parameter.

The control powers for the top and floor are displayed on two bargraphs and can be set with "OP1" and "OP2" parameters (or as described in paragraph 2.3) in the range 0… 100% and 10% definition.

The instrument also has a "PSP" parameter that can be used to manage the setting of the two powers as:

=0 – Independent;

=1 – Dependent: if one increases, the other decreases so that if the heating power of the ceiling and of the floor are equal, the sum of the powers is always 50% of the whole;

=2 – Dependent: if one of the powers decreases, this causes the automatic switch to 100% of the other, so that, if the top and floor powers are the same, the sum of the powers is always between 50 and 100% of the total.

Therefore, if the temperature controller foresees the enabling of the outputs, the power limiter will be off and the power set for the outputs is 100%, both the HEAT TOP and HEAT FLOOR outputs will always be lit.

If, on the other hand, in the same conditions, powers different from 100% are set starting from the cycle time count:

The TOP output remains on for the time: [tCP x OP1/100]
and off for the time: [tCP - (tCP x OP1/100)]
The FLOOR output remains off for the time: [tCP - (tCP x OP2/100)]
and on for the time: [tCP x OP2/100]

For example, with the parameters set in this way:
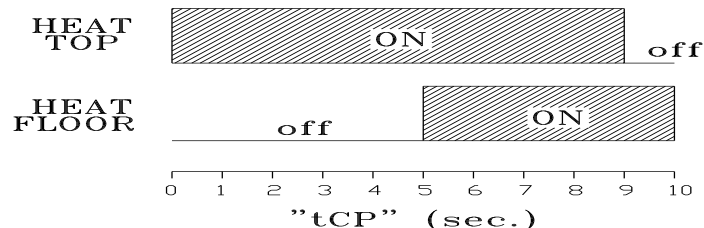
"tCP" = 10 s   "OP1" = 90%   "OP2" = 50%

the following function is obtained:

HEAT TOP on   = 10 x 90/100   = 9 s
HEAT TOP off   = 10 - (10 x 90/100)   = 1 s
HEAT FLOOR on   = 10 x 50/100   = 5 s
HEAT FLOOR off   = 10 - (10 x 50/100)   = 5 s

"tCP" (sec.)

Should the power limiter be activated, by pressing the PW. LIM key, the relative led will light and the controller will ensure that the outputs are never simultaneously on (therefore if the two resistances are equal, the maximum power absorbed is 50%).

This occurs in any case when, without the limiter being on, the sum of the two powers is less than 100%.

Therefore, the function with the power limiter on, starting from the count of the cycle time is as follows:

1) The TOP output remains on for the time:
[tCP/2 x OP1/100]

2) Both outputs remain off for the time:
[(tCP/2 - (tCP /2 x OP1/100)) +(tCP/2 - (tCP/2 - (tCP/2 x OP2/100))]

3) The FLOOR output switches on for the time:
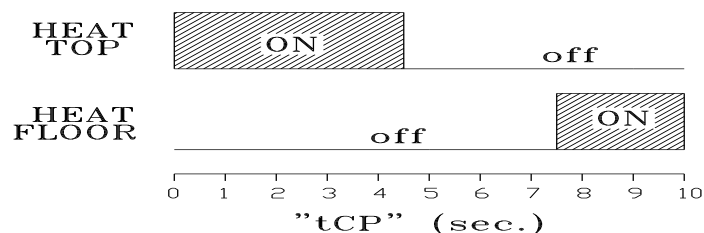[tCP/2 x OP2/100]

and so on.

For example, with the parameters thus set:

"tCP" = 10 s   "OP1" = 90%   "OP2" = 50%
HEAT TOP on   = 10/2 x 90/100   = 4.5 s
HEAT TOP and FLOOR off
= 10/2 - (10/2 x 90/100) + 10/2 - (10/2 x 50/100)   = 3 s
HEAT FLOOR on   = 10/2 x 50/100   = 2.5 s

"tCP" (sec.)

It goes without say that when the Set temperature is reached both outputs switch off.

2 PROBE CONTROL

With two probes the regulator operates in heat mode on both the HEAT TOP and HEAT FLOOR outputs, according to SET1 "SP1" and SET2 "SP2", differentials "HS1" and "HS2", and the "OP1", "OP2", "tCP" parameters.

As for single probe control, it is possible to control the power on the two (top and floor) resistance control outputs according to the cycle time "tCP".

Operation is identical to single-probe control, with the difference that the power regulator, and consequentially the two outputs are deactivated by both Sets rather than just one.

Therefore, if both the TOP and FLOOR temperature regulators foresee the activation of the outputs, the power limiter is off and the power set for the outputs is 100%, both outputs are always on.

If, in the same conditions, powers differing from 100% are set starting from the cycle time count, the outputs are activated as seen previously for single-probe control.

Should the power limiter be activated, the controller ensures that the outputs are never switched on simultaneously, as seen previously.

On reaching the temperature of both regulators, obviously both outputs are switched off.

On the other hand, should one of the two regulators need its output to be switched off, the power limiter is temporarily switched off and therefore access to the other regulator can always remain switched on (obviously if the power set for it is 100%).

Limiter function is automatically restored when both regulator outputs must be switched on.

4.3 – TEMPERATURE ALARMS

The instrument is fitted with an over-temperature alarm function that indicates oven temperature abnormalities, by means of an internal buzzer, a luminous signal (ALARM led) and, optionally, an output (AUX if present and suitably programmed).

All temperature alarm parameters are contained in the "^{I}AL" group.

Temperature alarms can be set as absolutes or relative to the regulation set.

The alarm function parameters are:

A1t Probe 1 (TOP) alarm function mode as absolute or relative
A1L Set probe 1 (TOP) minimum alarm;
A1H Set probe 1 (TOP) maximum alarm;
HA1 Probe 1 (TOP) alarms differential;
A1d Probe 1 (TOP) alarms delay;
A2t Probe 2 (FLOOR) alarm function mode as absolute or relative;
A2L Set probe 2 (FLOOR) minimum alarm;
A2H Set probe 2 (FLOOR) maximum alarm;
HA2 Probe 2 (FLOOR) alarms differential;
A2d Probe 2 (FLOOR) alarms delay.

The alarms are always operative, if the maximum alarm is not desired, simply set it to 999 and if the minimum alarm is not desired set it to –99.

There is also an enabling delay when the instrument is switched on, which can be set under the "POd" parameter and is only operative when the machine is switched on and the temperature is in alarm conditions and is cancelled when the temperature returns to non-alarm conditions.

Alarm activation takes place when disabling expires in the following conditions, according to the type of alarm programmed:

(NB: in the following examples, the number of the alarm is generally indicated with n).

"Ant" = Ab – ABSOLUTE ALARMS: The alarm is activated when the value measured drops below the alarm threshold set under parameter "AnL" or rises above the alarm threshold set under the "AnH" parameter.
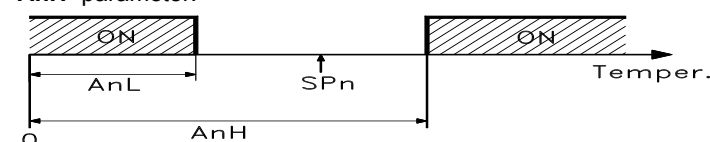
"**Ant**" = dE − RELATIVE ALARM: the alarm is activated when the value measured drops below the [SPn - AnL] value, or when it rises above the [SPn + AnH] value.

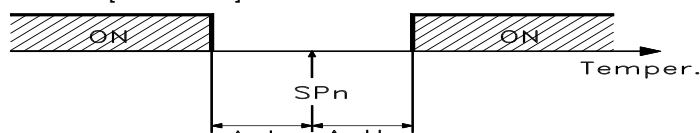When an alarm is active, the ALARM led lights, a buzzer is activated, the AUX output is activated if configured as an alarm and the displays will show the alarm code alternated with the temperate measured (the upper display for the alarms relating to the TOP probe and the lower display for the alarms relating to the FLOOR probe.

When activated, the buzzer can be muted by pressing any key. Even when the buzzer is muted, the instrument indicates the alarm with the flashing of the AL led and the display shows:

A1L   In the case of a probe 1 (TOP) minimum alarm;
A1H   In the case of a probe 1 (TOP) maximum alarm;
A2L   In the case of a probe 2 (FLOOR) minimum alarm;
A2H   In the case of a probe 2 (FLOOR) maximum alarm.

In order to provide an external tone command (should the internal one be weak), it is possible to use the AUX output as a mutable alarm output (see AUX output operation).

Alarm operation is also influenced by the alarm differentials (par. "**HA1**" and "**HA2**"), which operate as follows.

In the case of a minimum alarm, the alarm will activate when the temperature value drops below the "**AnL**" alarm threshold value and will deactivate when it rises above the ["AnL" + "Han"] value; in the case of a maximum alarm, the alarm will activate when the temperature value rises above the "**AnH**" alarm threshold and will deactivate when it drops below the ["AnH" - "Han"] value.

Minimum Alarm   Maximum Alarm
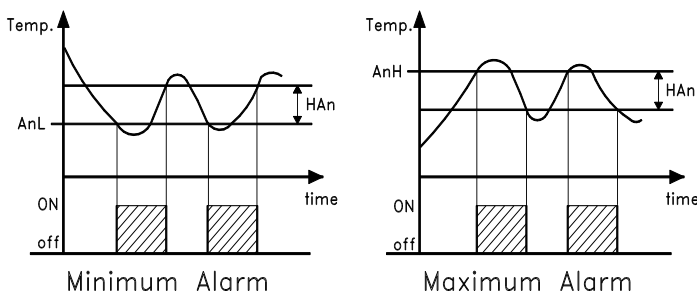
4.4 – OVEN LIGHT CONTROL

The LIGHT key can be used to activate/deactivate the LIGHT output, the activation of the output is therefore indicated by the LIGHT led.

When the controller is switched off, the output is in any case switched off, but in standby mode the output can be switched on or off. In normal switching on conditions or after a power cut, the output returns to the state in which it was left.

4.5 – STEAMER AND STEAM INJECTION CONTROL

All the steam control parameters are contained in the "]**St**" group.

When the instrument is in the ON status, it is possible to activate/deactivate the steamer regulator using the STEAM key.

Activation is therefore indicated by the STEAM led.

Switching off of the regulator prevents the steam injection control from functioning.

Output function can differ, according to the presence of the STEAM temperature probe.

If the instrument is not fitted with a probe for the steamer (or the probe is disabled using the "ESP" = OFF parameter), the STEAM G output can be enabled/disabled directly using the STEAM key.

If the instrument is fitted with a steamer probe and the steamer probe is enabled ("ESP" = ON), the STEAM key can be used to activate/deactivate the steamer regulator.

Switching on the output is therefore subordinate to the ON/OFF regulator, which acts in heat mode according to the temperature measured by the steamer probe, the steamer temperature set "**SPS**" and the relative differential "**HSS**".

If the probe is used and the measurement is lower than that programmed under the "SEt" parameter, it will prevent the function of the steam injection control.

If the controller is switched off, when it is switched back on, the steamer control function reverts to the status in which it was left.

In order to indicate all the possible conditions, the STEAM led will operate as follows:
- OFF: steamer deactivated
- ON: steamer function activated and (when the steamer probe is present) temperature above "**SEt**" and therefore injection possible.
- Flashing: steamer function on, but temperature below "**SEt**" and therefore injection off (only when the steamer probe is present).

As mentioned previously, steam injection can only be activated if the steamer control is activated and, if the instrument is fitted with the steamer probe, the measurement of the latter is higher than that set under the "**SEt**" parameter.

Once these conditions have been satisfied, the STEAM INJ. output is therefore activated manually by pressing the INJ. key and remains active, even when the key is released, for the time set under the "**SIt**" parameter.

The "**SIF**" parameter can be used to establish whether, when the "**SIt**" time expires, the injection output switches off even if the key is still pressed down (SIF = OFF, pulse function) and therefore one must release the key and then press it in order to obtain a new injection, or if the output remains in any case activated until the key is released (SIF = On, permanent function).

The injection command is also subordinate to a block time between two subsequent steam injections so that the steamer can return to its temperature.

When the injection output is switched off, the time counter set under the "**SId**" parameter starts, during which injection commands are not performed.

The steam injection can also be obtained automatically using the "**SIc**", "**SIi**" and "**SIt**" parameters.

The "SIi" > 0 and "SIt" >0 parameters enable automatic injection.

The "SIc" = 0 parameter establishes the continuous automatic cycle whereas > 0 establishes the automatic injection cycle time.

One can therefore obtain:
1) Manual steam injection once only when one presses the INJ key ("SIi" = 0, "SIc"=0).
2) Continuous automatic steam injection with injection time = "SIt" and pause = "SIi" starting from when the key is pressed.
   The injection cycle only terminates when one presses the INJ key or when the steamer or the instrument itself is switched off.
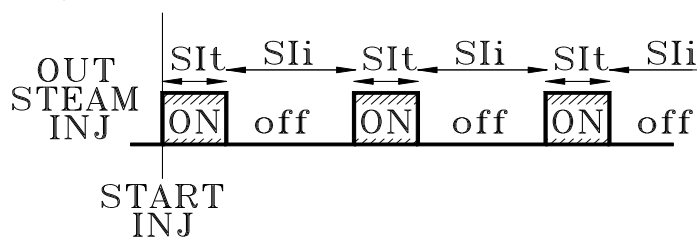
3) A cycle of automatic steam injections for the time "SIc" with injection time = "SIt" and pause = "SIi", starting from when the key is pressed.
   At the end of "SIc" time (or if the INJ. key is pressed again before the end of the time or if the steamer or the instrument is switched off) the cycle of injections terminates.
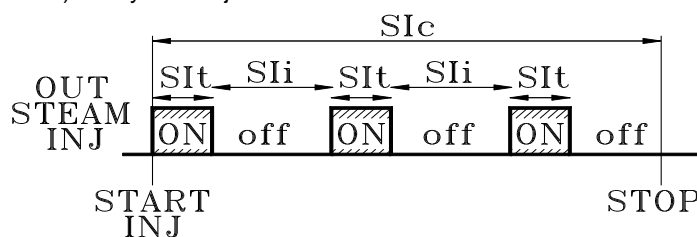
In order to indicate all the possible conditions, the STEAM INJ led operates as follows:
- OFF: injection not active
- ON: injection in progress
- Flashing: automatic injection in progress in the pause status ("SIi" time)

4.6 – EXTRACTOR CONTROL

When the instrument is in the ON status, the EXTR. Key can be used to enable/disable the EXTR. output.

Output activation is therefore indicated by the EXTR. led.

The extractor is normally intended as the oven's suction fan, however the user could command any other function (revolving plate, second light, etc.).

If the controller is switched off (or in the event of a blackout), when it is switched back on again, the output reverts to the status in which it was left.

All the extractor parameters are contained in the "ⁱES" group.

The "ESd" parameter can be used to decide whether the output is commanded by means of the key (=OFF) only or whether the output must be also be switched off when steam injection occurs, in order to prevent the steam injected being extracted (=On).

In this case, the output (if on) switches off when steam injection starts and remains switched off for the entire duration of injection and even after it finishes for a certain time (in s) that can be set under the "Edt" parameter.

Moreover, using the "EAS" = On parameter, it is possible for the extractor output to be activated (if it is not already) automatically, when cooking is terminated, otherwise it will only be commanded manually (= OFF)

In order to facilitate the command of the single extractor on an oven where there are a number or appliances, a relay switch-type operation mode is provided, by which it is possible to command a single extractor from any one of the instruments installed.

In order to obtain this operation, the "Ecn" parameter can be used to establish the operation of the EXTR output in relation to the key as bistable (= OFF) or as monostable (= On).

Therefore, if one wishes to command a single extractor from more than one instrument, it is possible to do so:
- By connecting the relay output EXTR of the first instrument so that it commands the extractor;
- By programming the first instrument with "ECn" = OFF and all the others =On;
- By connecting the EXTR relay outputs of all the others in parallel and therefore to a digital input of the first one, which must have programmed the operation = 2 (see digital input operation).

## 4.7 – AUXILIARY OUTPUT AND AUXILIARY CONTROLLER (AUX)

The instrument can also be fitted with a settable auxiliary output (AUX).

All the AUX output control parameters are contained in the "ⁱAO" group.

The "AOF" parameter can therefore be used to set the output function mode as follows:
=0   No function;
=1   Output ON: the output switches on/off in correspondence with the switching on/off of the instrument;
=2   Auxiliary temperature controller: the use of the AUX probe is essential for this function.

The regulator operates according to the measurement of the auxiliary probe, the auxiliary regulator set "SPA", the relative differential "HAS" and function mode "ArF" (Heat = H; Cool=C).

HEATING (ArF=H)   COOLING (ArF=C)
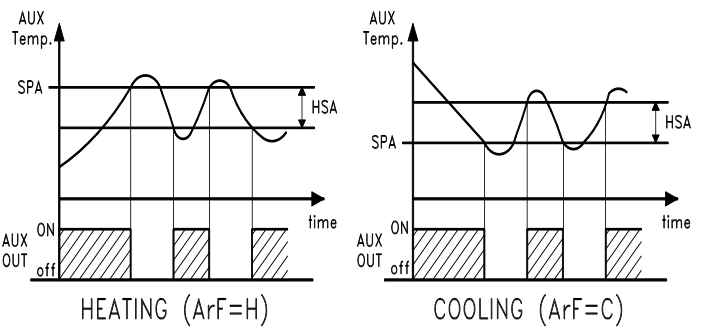
The auxiliary regulator can be used for many applications such as temperature controls in other areas of the oven or inside the product.

=3   End of cooking signal: the output is enabled when cooking ends and, if desired, also ahead of the time that can be set under the "AOt" parameter. If the parameter is = 0 it obviously activates exactly at the end of cooking.

The function can be used to command an external end of cooking signal or to command various devices, such as, for example, the actuators that open the oven's unloading hatches.

Once the output has been activated, it can be deactivated by pressing the AUX (DOWN) key.

=4   Activation using the AUX(DOWN) key or digital input: the output is activated by pressing the DOWN/AUX key (or by activating a suitably programmed digital input).

These commands have a bistable function, which means that at the first command the AUX output is activated whereas on the second it is deactivated.

In this mode, the AUX output can also be switched off automatically after a certain time that can be set under the "AOt" parameter.

With "AOt" = 0 the output is only activated and deactivated manually, using the DOWN/AUX key or the digital input.

=5   Mutable alarm: the AUX output is activated together with the buzzer when alarm conditions exist and, like the buzzer, it can be muted by pressing any key.

=6   Non-mutable alarm: the AUX output is activated when alarm conditions exist and remains activated for as long as such conditions persist.

4.8 – DIGITAL INPUTS

The instrument has three settable digital inputs for free voltage contacts.

All the digital input setting parameters are inserted in the "ⁱIn" group.

The function logic of the digital inputs is established by the parameters "i1L", "i2L", "i3L", which can be programmed as follows:
=On   Contact normally open: the programmed function occurs on the closure of the contact connected to the input.
=OFF Contact normally closed: the programmed function occurs on the opening of the contact connected to the digital input.

The action of the digital inputs can be delayed using the following parameters:

"i1d", "i2d", "B", which can be programmed in seconds.

With regards to operation, the digital input acts according to the "i1F", "i2F", and "i3F" parameters, which can be programmed as:
=0   Not operative
=1   External alarm signal: on input intervention, the alarm is activated and the upper display alternately shows "AIn" (where n is the number of the digital input) and the temperature measured.
=2   Remote control of auxiliary output AUX: the digital input is used to command the auxiliary output AUX as described in operation mode "AOF" = 4 of the auxiliary output
=3   Steam injection remote control: the digital input operates as the instrument's INJ key.
=4   Steam injection block: the intervention of the digital input causes steam injection blockage. The function can be useful if

the instrument does not have the steamer probe and one wishes to block injection by means of a steamer thermostat.

=5 Pulse command for switching on the extractor output for multiple command. This can be used to facilitate the command of the single extractor when more than one appliance is fitted to an oven. If one desires to command a single extractor from a number of instruments, it is possible to do so by programming the former with "ECn"=OFF and all the others with "ECn" =On, connecting the EXTR relay output of the former in such a way that it commands the extractor, connecting the EXTR relay outputs of all the others in parallel and therefore at the digital input of the former, which will have suitably programmed the digital input with this operation mode.
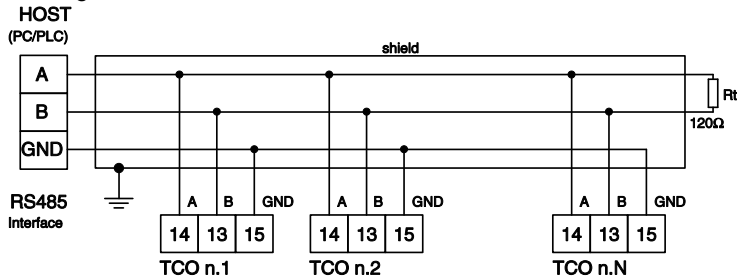
4.9 - RS 485 SERIAL INTERFACE

The instrument can be equipped with a RS 485 serial communication interface, by means of which it is possible to connect the regulator with a net to which other instruments (regulators of PLC) are connected, all depending typically on a personal computer used as plant supervisor. Using a personal computer it is possible to acquire all the function information and to program all the instrument's configuration parameters. The software protocol adopted for TCO is a MODBUS RTU type, widely used in several PLC and supervision programs available on the market (TCO series protocol manual is available on request).

The interface circuit allows the connection of up to 32 instruments on the same line.

To maintain the line in rest conditions a 120 Ohm resistance (Rt) must be connected to the end of the line.

The instrument is equipped with two terminals called A and B which have to be connected with all the namesake terminals of the net. For the wiring operation they must be interlaced with a double cable (telephonic type) and all the GND terminals must be connected to the ground. Nevertheless, particularly when the net results very long or noised and being present potential differences between the GND terminals, it is advisable to adopt a screened cable wired as in the drawing.

If the instrument is equipped with a serial interface, the parameters to be programmed are the following, all present in the parameters group "ˡSE":

"**Add**": Address of the station. Set a different number for each station, from 1 to 255.

"**bau**": Transmission speed (baud-rate), programmable from 2400 to 38400 baud. 1 =2400 baud, 2 =4800 baud, 3 =9600 baud,

4= 19200 baud , 5 =38400 baud. All the stations have to have the same transmission speed.

"**PAC**": Programming access. If programmed as "LoC" this means that the instrument is only programmable from the keyboard, if programmed as "Lor" it is programmable both from the keyboards and serial line.

If an attempt is made to enter the programming from the keyboard whilst a communication through the serial port is in progress the instrument will visualise **"bSy"** to indicate the busy state.

4.10 - PARAMETERS CONFIGURATION BY "A-01"

The instrument is equipped with a connector that allows the transfer from and toward the instrument of the functioning parameters through the device **A-01** with **5 poles** connector.

This device is mainly useable for the serial programming of the instruments which need to have the same parameters configuration or to keep a copy of the programming of an instrument and allow its rapid retransmission.

To use the device A-01 it is necessary that the instrument is supplied.
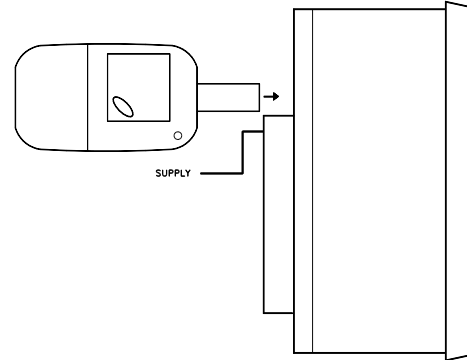
P.A.: For the instruments equipped with RS485 serial communication, is mandatory that the parameter "**PAC**" is programmed as Lor.

To transfer the configuration of an instrument into the device **(UPLOAD)** it is necessary to proceed in the following way:

1) Position both dip switch of A-01 in the **OFF** mode.
2) Connect the device to the instrument TCO plugging the special connector.
3) Verify that the instrument is supplied
4) Observe the indication led on the device A-01: if it results green this means that a configuration is already loaded on the device while if it results green blinking or red blinking this means that it has not been loaded any valid configuration on the device.
5) Press the button placed on the device.
6) Observe the indication led: after having pressed the button, the led becomes red and therefore, at the end of the data transfer, it becomes green.
7) Now it is possible to disconnect the device.

To transfer the configuration loaded on the device onto an instrument of the same family **(DOWNLOAD)**, it is necessary to proceed in the following way:

1) Position both dip switch of A-01 in the **ON** mode.
2) Connect the device to an instrument TCO having the same features of the one from which has been downloaded the desired configuration, plugging the special connector.
3) Verify that the instrument is supplied.
4) Observe the indication led on the device A-01: it has to result green, because if the led results green blinking or red blinking, this means that on the device it has not been downloaded any valid configuration and therefore it's useless to continue.
5) If the les results green, press the button placed on the device.
6) Observe the indication led: after having pressed the button, the led becomes red and therefore, at the end of the data transfer, it becomes green.
7) Now it is possible to disconnect the device.

For additional info, please have a look at the A-01 instruction manual.

5 - PROGRAMMABLE PARAMETERS

Here following are described all the parameters available on the instrument. Some of them could be not present or because they are depending on the type of instrument or because they are automatically disabled as unnecessary.

5.1 - PARAMETERS TABLE

"]SP" Group (Set Point parameters)

	Par.	Description	Range	Def.	Note
1	**SP1**	TOP Set Point	SPL ÷ SPH	0	
2	**SP2**	FLOOR Set Point	SPL ÷ SPH	0	
3	**SPL** (com)	Minimum Set Point	-99 ÷ SPH	0	
4	**SPH** (com)	Maximum Set Point	SPL ÷ 999	999	

"]rG" Group (temperature regulation and power control parameters)

	Par.	Description	Range	Def.	Note
5	**OP1**	TOP power	0 ÷ 100%	50	
6	**OP2**	FLOOR power	0 ÷ 100%	50	
7	**tCP**	Power control Cycle time	1 ÷ 999 s	30	
8	**PSP**	Power setting mode	1 - 2 - 3	1	
9	**HS1**	Regulator differential 1 (TOP)	1 ÷ 999	2	
10	**HS2**	Regulator differential 2 (FLOOR)	1 ÷ 999	2	

"]CL" Group (clock parameters)

	Par.	Description	Range	Def.	Note
11	**ct**	Cooking time	0.01÷ 23.59 hrs. - min.	1.00	
12	**On**	Automatic switch on time	0.00÷ 23.59 hrs. - min.	0.00	
13	**bt**	Buzzer activation time	1 ÷ 999 s	30	
14	**cEF**	Automatic switch off at end of cooking	On - OFF	OFF	

"]In" Group (measurement inputs parameters)

	Par.	Description	Range	Def.	Note
15	**EFP** (com)	Floor probe presence (FLOOR)	On - OFF	On	
16	**ESP** (com)	Steamer probe presence (STEAM)	On - OFF	On	
17	**EAP** (com)	Auxiliary probe presence (AUX)	On - OFF	On	
18	**OSt** (com)	Top probe calibration (TOP)	-99 ÷ 999	0	
19	**OSF** (com)	Floor probe calibration (FLOOR)	-99 ÷ 999	0	
20	**OSS** (com)	Steam Probe calibration (STEAM)	-99 ÷ 999	0	
21	**OSA** (com)	Auxiliary probe calibration (AUX)	-99 ÷ 999	0	
22	**Uni** (com)	Unit of measurement	°C/°F	°C	
23	**SEn** (com)	Type of probe in input	J / CrA	J	
24	**i1F** (com)	Function Digital input 1	0-1-2-3-4-5	0	
25	**i1L** (com)	Logic function digital input 1	On - OFF	On	
26	**i1d** (com)	Delay digital input 1	0 ÷ 999 s	0	
27	**i2F** (com)	Function Digital Input 2	0-1-2-3-4-5	0	
28	**i2L** (com)	Logic function digital input 2	On - OFF	On	
29	**i2d** (com)	Delay digital input 2	0 ÷ 999 s	0	
30	**i3F** (com)	Function digital input 3	0-1-2-3-4-5	0	
31	**i3L** (com)	Logic function digital input 3	On - OFF	On	
32	**i3d** (com)	Delay digital input 3	0 ÷ 999 s	0	

"]AL" Group (alarm parameters)

	Par.	Description	Range	Def.	Note
33	**A1t** (com)	Alarm type AL1	Ab / dE	Ab	
34	**A1L** (com)	Lower threshold alarm 1	-99 ÷ 999	-99	
35	**A1H** (com)	Upper threshold alarm 1	-99 ÷ 999	999	
36	**HA1** (com)	Hysteresis alarm 1	1 ÷ 999	1	
37	**A1d** (com)	Delay activation of alarm 1	0 ÷ 999 s	0	
38	**A2t** (com)	Alarm type AL2	Ab / dE	Ab	
39	**A2L** (com)	Lower threshold alarm 2	-99 ÷ 999	-99	
40	**A2H** (com)	Upper threshold alarm 2	-99 ÷ 999	999	
41	**HA2** (com)	Hysteresis alarm 2	1 ÷ 999	1	
42	**A2d** (com)	Delay activation of alarm 2	0 ÷ 999 s	0	
43	**Pod** (com)	Disabling alarms on switching on	0 ÷ 999 min	0	

"]St" Group (steam control parameters)

	Par.	Description	Range	Def.	Note
44	**SPS**	Steamer control Set Point	-99 ÷ 999	130	
45	**HSS** (com)	Steamer control hysteresis	1 ÷ 999	2	
46	**SEt** (com)	Steam injection block temperature	-99 ÷ 999	110	
47	**SIF** (com)	Permanent steam injection command function	On - OFF	OFF	
48	**SIt**	Steam injection duration	1 ÷ 999 s	10	
49	**Sid** (com)	Time between 2 steam injections	1 ÷ 999 s	30	
50	**SIi**	Interval between automatic steam injections	0 ÷ 999 min	0	
51	**SIc**	Duration of automatic steam injection cycles	0 ÷ 999 min	0	

"]ES" Group (extractor control parameters)

	Par.	Description	Range	Def.	Note
52	**ESd**	Disabling of extractor during steam injection	On - OFF	OFF	
53	**Edt**	Extractor disabling time after end of steam injection	1 ÷ 999 s	1	
54	**EAS**	Automatic switching on of extractor at cooking end	On - OFF	OFF	
55	**Ecn** (com)	Function of the monostable extractor output command	On - OFF	OFF	

"AO" Group (AUX output parameters)

Par.		Description	Range	Def.	Note
56	**AOF** (com)	AUX output function	0-1-2-3-4-5-6	0	
57	**AOt**	AUX output time	0 ÷ 999 min	0	
58	**SPA**	Auxiliary regulator Set Point	-99 ÷ 999	0	
59	**HSA** (com)	Auxiliary regulator differential	1 ÷ 999	2	
60	**ArF** (com)	Auxiliary regulator function mode	H - C	H	

"SE" Group (serial communication parameters)

Par.		Description	Range	Def.	Note
61	**Add** (com)	Controller Serial comm.s address	1… 255	1	
62	**bau** (com)	Serial port baud rate	1-2-3-4-5	3	
63	**PAC** (com)	Programming access through serial port	LoC / Lor	Lor	

5.2 - PARAMETERS DESCRIPTION

"SP" GROUP (SET POINT PARAMETERS):
For setting the regulation set and Set function modes
SP1 SET POINT TOP: Top regulation Set Point value
SP2 SET POINT 2: Floor regulation Set Point Value
SPL SET POINT MINIMUM: Minimum value that can be set as Set Point.
SPH SET POINT MAXIMUM: Maximum value that can be set as Set Point.

"rG" GROUP (REGULATION PARAMETERS): Contains all the regulation function and output power control parameters
OP1 POWER TOP: output power value for TOP heat.
OP2 POWER FLOOR: output power value for FLOOR heat.
TCP POWER CONTROL CYCLE TIME: cycle time for calculating output powers expressed in s
PSP POWER SETTING MODE: allows the management of the two powers as:
  =0 independent
  =1 dependent in such a way that an increase in one causes an automatic reduction in the other so that, if the TOP and FLOOR powers are identical, the sum of the powers will always be 50% of the total.
  =2 dependent so that the decrease in one power causes the automatic switch to 100% of the other, so that, if the top and floor powers are the same, the sum of the powers is always between 50 and 100% of the total.
HS1 REGULATOR 1 HYSTERESIS (TOP): Semiband relating to the TOP Set Point that establishes the regulation activation and deactivation values.
HS2 REGULATOR 2 HYSTERESIS (FLOOR): Semiband relating to the FLOOR set point that establishes the regulation activation and deactivation values.

"In" Group (INPUTS PARAMETERS): These make it possible to establish the characteristics of the measurements and function modes of the digital inputs
EFP FLOOR PROBE PRESENCE: Makes it possible to enable (ON) or disable (OFF) the floor probe if it is not used. If the probe is disabled, regulation operates on both the HEAT TOP and HEAT FLOOR outputs, on the basis of the measurement and sets relative to the TOP only.
ESP STEAM PROBE PRESENCE: makes it possible to enable (ON) or disable (OFF) the steam probe if it is not used. If the probe is disabled, the STEAM output obviously cannot be thermostated and the steam injection block function is deactivated according to the steamer temperature.
EAP AUX PROBE PRESENCE: makes it possible to enable (ON) or disable (OFF) the auxiliary probe if it is not used. If the probe is disabled, the auxiliary regulator function cannot be used.
Ost TOP PROBE CALIBRATION: Positive or negative offset that is added to the value read on the TOP probe.
OSF FLOOR PROBE CALIBRATION: Positive or negative offset that is added to the value read on the floor probe.
OSS STEAM PROBE CALIBRATION: Positive or negative offset that is added to the value read on the steamer probe.
OSA AUX PROBE CALIBRATION: Positive or negative offset that is added to the value read on the auxiliary probe.
Uni UNIT OF MEASUREMENT OF TEMPERATURE: establishes the display of temperatures in centigrade (°C) or Fahrenheit (°F).
Sen INPUT PROBE: If the instrument provides the input for thermocouples, this makes it possible to select the type of input probe as type J (J) or type K (CrA).
i1F DIGITAL INPUT 1 FUNCTION: establishes which function digital input 1 must perform.
  =0 No function (not operative)
  =1 External alarm signal: on input intervention, the alarm is activated and the upper display alternately shows "AL1" and the temperature measured.
  =2 Auxiliary output (AUX) remote control: the digital input is used for the command of the auxiliary output AUX as described in the "AOF" = 4 operating mode of the auxiliary output.
  =3 Steam injection remote control: the digital input operates as the instrument's INJ key.
  =4 Steam injection block: digital input intervention causes the blockage of the steam injection. The function can be useful if the instrument does not have a probe for the steamer and one desires to block injection through a steamer thermostat.
  =5 Pulse command for switching on the extractor output for multiple command. This can be used to facilitate the command of the single extractor when there is more than one appliance on an oven. If one desires to command a single extractor from more than one instrument, it is possible to do so by programming the first one with "ECn"=OFF and all the others with "ECn" =On, by connecting the EXTR relay output of the first instrument in order that it commands the extractor, by connecting the EXTR relay outputs of all the others in parallel and therefore to the digital input of the first, which will suitably programme the digital input with this function mode.
i1L DIGITAL INPUT 1 FUNCTION LOGIC: establishes whether the digital input 1 causes the activation of the programme function on its closure (on) or opening (oF).
i1d DELAY DIGITAL INPUT 1: delay of activation of the function performed by digital input 1, expressed in seconds.
i2F DIGITAL INPUT 2 FUNCTION: same as "i1F" but refers to digital input 2.
i2L DIGITAL INPUT 2 FUNCTION LOGIC: same as "i1L" but refers to digital input 2.
i2d DELAY DIGITAL INPUT 2: same as "i1d" but referred to digital input 2.
i3F DIGITAL INPUT 3 FUNCTION: same as "i1F" but refers to digital input 3.
i3L DIGITAL INPUT 3 FUNCTION LOGIC: same as "i1L" but refers to digital input 3.
i3d DIGITAL INPUT 3 DELAY: same as "i1d" but refers to digital input 3.

"AL" GROUP (TEMPERATURE ALARMS PARAMETERS):
Make it possible to set temperature alarm operation

A1t ALARM 1 TYPE (TOP): allows the selection of the alarm 1 type relative to top temperature by means of 2 possible selections:
- =Ab ABSOLUTE ALARM: the alarm is activated when the top temperature value drops below the alarm threshold set in the "A1L" parameter or rises above the alarm threshold set in the "A1H" parameter.
- =De RELATIVE ALARM: The alarm is activated when the top temperature threshold drops below the value [SP1 - A1L] or when the process value rises above the value [SP1 + A1H]

A1L LOWER ALARM 1 THRESHOLD (TOP): Top temperature alarm intervention threshold as minimum alarm.

A1H UPPER ALARM 1 THRESHOLD (TOP): Top temperature alarm intervention threshold as maximum alarm.

HA1 ALARM 1 HYSTERESIS (TOP): Asymmetric Semiband relative to the "A1L" and "A1H" alarm thresholds that establish the top temperature alarm deactivation value.

A1d ALARM 1 ACTIVATION DELAY (TOP): Allows to select a delay in the activation of the top temperature alarm (in s).

A2t TYPE 2 ALARM (FLOOR): Same as "A1t" but referred to the floor temperature alarm.

A2L LOWER ALARM 2 THRESHOLD (FLOOR): Same as "A1L" but referred to the floor temperature alarm.

A2H UPPER ALARM 2 THRESHOLD (FLOOR): Same as "A1H" but referred to the floor temperature alarm.

HA2 ALARM 2 HYSTERESIS (FLOOR): Same as "HA1" but referred to the floor temperature alarm.

A2d ALARM 2 ACTIVATION DELAY (FLOOR): Same as "A1d" but referred to the floor temperature alarm.

Pod TEMPERATURE ALARM DISABLE ON SWITCHING ON: Duration of temperature alarm exclusion from when the instrument is switched on, expressed in hours.

"St" Group (STEAM CONTROL PARAMETERS): These make it possible to set the operation of the STEAM G and STEAM I outputs that can be used to control the steamer and steam injection

SPS SET POINT STEAMER REGULATOR: Steamer control Set Point. Can only be used if the instrument is equipped with a steamer probe. On reaching the temperature set, the STEAM G output is deactivated.

HSS STEAMER REGULATOR HYSTERESIS: Semiband for the steamer Set Point that establishes the STEAM G output activation and deactivation values.

Set STEAM INJECTION EXCLUSION TEMPERATURE: Relative value at the steamer probe, below which steam injection is disabled. When steam injection is disabled, the STEAM led flashes.

SIF PERMANENT STEAM INJECTION COMMAND OPERATION: For establishing whether when the steam injection time "SIt" expires the injection output switches off even if the key is still held down (= OFF) and therefore it is necessary to release the key and press it again in order to obtain a new injection or whether the output remains activated until the key is released (= On).

Sit STEAM INJECTION TIME: STEAM INJ output activation time when a manual or automatic steam injection command is given (in s).

Sid EXCLUSION TIME BETWEEN TWO SUBSEQUENT STEAM INJECTIONS: Time, counted from the switching off of the STEAM INJ output, in which the steam injection is blocked so that the steamer can return to its normal temperature. During this time (in s) no injection commands will be performed.

Sii AUTOMATIC STEAM INJECTION INTERVAL: Pause time (in min.) when automatic steam injection is enabled. Set = 0 automatic injection disabled. During this time the INJ output flashes.

Sit AUTOMATIC STEAM INJECTION CYCLE TIME: for setting the duration of the automatic steam injection cycle. If set = 0 the automatic cycle is automatic, whereas if set > 0 at the end of the time set the programmed injection cycle terminates automatically.

"ES" Group (EXTRACTOR CONTROL PARAMETERS):
For setting the operation of the EXTR output that can be used for extractor control

ESd EXTRACTOR DISABLING DURING STEAM INJECTION: For automatically deactivating the EXTR. output, if activated, when there is a steam injection (=on), otherwise the EXTR. output functions independently of steam injection (=OFF).

Edt EXTRACTOR DISABLING TIME AFTER END OF STEAM INJECTION: If the "ESd" parameter = On, the EXTR. output (if on) switches off when steam injection is started up and remains off for the entire duration of the injection and even after for the time set for this parameter (in s)

EAS AUTOMATIC EXTRACTOR SWITCH ON AT END OF COOKING: For automatic switching on of the EXTR. output at the end of cooking (=On), otherwise the output can only be commanded manually (=OFF).

Ecn MONOSTABLE EXTRACTOR OUTPUT COMMAND FUNCTION: Parameter used to set EXTR output function in relation to the relative key as bistable (=OFF) or monostable (ON). In practice, bistable operation means that the first time the EXTR. key is pressed the output activates and remains activated, whereas the second time deactivates it. Monostable operation means that the output is activated only when the key is pressed.

"AO" Group (AUXILIARY OUTPUT PARAMETERS):
For setting the AUX output

AOF AUX OUTPUT OPERATION: parameter used to set the output operation mode as:
- =0 No function
- =1 ON output: the output switches on/off according to instrument status.
- =2 Auxiliary temperature control: the use of the AUX probe is essential for this function. The control functions according to the measurement of the auxiliary probe, the auxiliary controller set "SPA", the relative differential "HAS" and the function mode "ArF".
- =3 End of cooking signal: the output activates at the end of cooking and, if necessary, even ahead of the time that can be set under the "AOt" parameter.
  If the parameter = 0, it obviously activates at exactly the same time that cooking finishes.
- =4 Activation from the AUX (DOWN) key or digital input: the output is activated when the DOWN/AUX key is pressed or by activating a suitably programmed digital input. In this mode, the AUX output can also be switched off automatically after a certain interval that can be set under the "AOt" parameter. When "AOt" = 0 the output is activated and deactivated only manually using the DOWN/AUX key or the digital input.
- =5 Mutable alarm: the AUX output is activated in correspondence with the buzzer, when alarm conditions exist and in the same way as the buzzer, it can be muted by pressing any key.
- =6 Non-mutable alarm: the AUX output is activated when alarm conditions occur and remains activated for as long as these conditions exist.

Aot AUX OUTPUT TIME: Time, expressed in min., whose function depends on the AUX output function programmed (see "AOF").

SPA SET POINT AUXILIARY OUTPUT: SET value of the auxiliary regulator, when the auxiliary output is used as a regulator ("AOF" = 2).

HAS AUXILIARY REGULATOR DIFFERENTIAL: auxiliary controller Set Point semiband that establishes the activation and deactivation values of the AUX output when it is used as a regulator ("AOF" = 2).

ArF AUX REGULATOR FUNCTION MODE: establishes whether the auxiliary controller must perform an inverse action, such as,

for example, a heat process (= H), or a direct action, for example, a cooling process (=C).

"¹SE" Group (PARAMETERS RELATIVE TO THE SERIAL COMMUNICATION):

If the instrument is equipped with RS485 serial communication these parameters allow device configuration for communication

Add STATION ADDRESS IN CASE OF SERIAL COMMUNICATION: This is used to set the instrument address in the communication net. Programme a different number for each station, from 1 to 255.

Bau TRANSMISSION SPEED (BAUD RATE): Set the data transmission speed of the network to which the instrument is connected. The possible selections are 1 (2400 baud), 2 (4800 baud), 3 (9600 baud), 4 (19200 baud) , 5 (38400 baud). All stations must have the same transmission speed.

PACS ACCESS TO PROGRAMMING THROUGH SERIAL PORT: Programming access. If programmed as "LoC" this means that the instrument can only be programmed from the keyboard, if programmed as "Lor" it can be programmed from both the keyboards and serial line.

6 - PROBLEMS, MAINTENANCE AND WARRANTY

6.1 - ERROR SIGNALLING

Error	Reason	Action
E1, E2, E3, E4	Probe error	Verify the correct connection between probe and instrument and then verify the correct functioning of the probe
u1, u2, u3, u4	The measured variable is under the probe's limits (under-range)	
o1, o2, o3, o4	The measured variable is over the probe's limits (over-range)	
ErE	Possible anomaly of the EEPROM memory	Push key "P"

In probe error conditions, the instrument provides to disable the control outputs and activate the alarms.

6.2 - CLEANING

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

6.3 - WARRANTY AND REPAIRS

The instrument is under warranty against manufacturing flaws or faulty material, that are found within 12 months from delivery date. The warranty is limited to repairs or to the replacement of the instrument.

The eventual opening of the housing, the violation of the instrument or the improper use and installation of the product will bring about the immediate withdrawal of the warranty's effects.

In the event of a faulty instrument, either within the period of warranty, or further to its expiry, please contact our sales department to obtain authorisation for sending the instrument to our company.

The faulty product must be shipped to Ascon Tecnologic with a detailed description of the faults found, without any fees or charge for Ascon Tecnologic , except in the event of alternative agreements.

7 - TECHNICAL DATA

7.1 - ELECTRICAL DATA

Power supply: 24, 115, 230 VAC ±10%;

Frequency AC: 50/60 Hz;

Power consumption: 9 VA approx.;

Input/s: up to 4 inputs for temperature probes tc J (2 wires). 3 digital inputs for free voltage contacts;

Output/s: Up to 7 outputs. STEAM output SPST-NO (16 A-AC1, 6 A-AC 250 VAC), the others outputs SPST-NO (8 A-AC1, 3 A-AC3/250 VAC);

Electrical life for relay outputs: 100000 operations;

Installation category: II;

Measurement category: I;

Protection class against electric shock: Class II for Front panel;

Insulation: Reinforced insulation between the low voltage section (supply, relay outputs) and the front panel; Reinforced insulation between the low voltage section (supply, relay outputs) and the extra low voltage section (inputs); 50 V insulation between RS485 and extra low voltage section.

7.2 – MECHANICAL DATA

Housing: Self-extinguishing plastic;

Dimensions: 72 x 144 mm DIN, depth 77 mm;

Weight: 600 g approx.;

Mounting: Flush in panel in 68 x 139 mm hole;
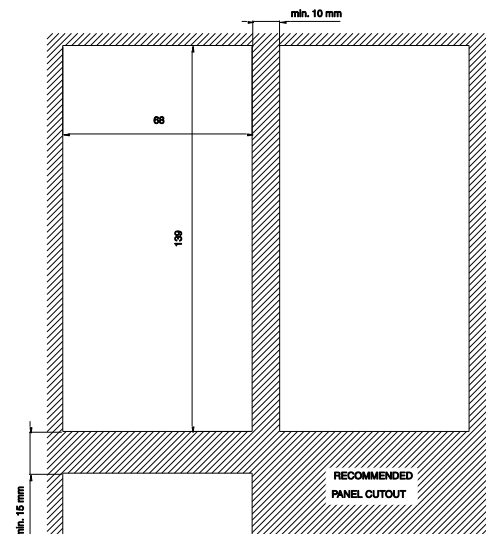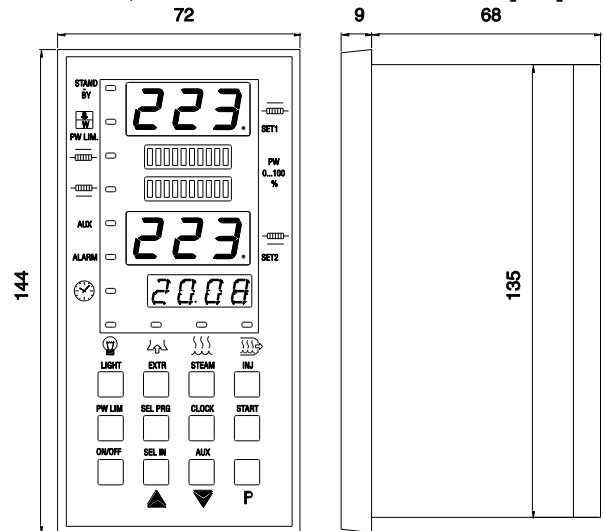
Connections: Extractable 2.5 mm^2 screw terminals block;

Pollution situation: 2;

Operating temperature: 0... 50°C;
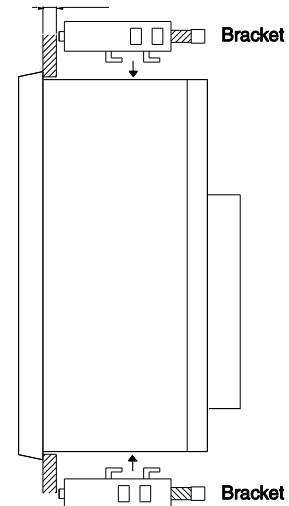
Operating humidityU 30... 95 RH% with no condensation

Storage temperature: -10... +60°C.

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

7.4 - FUNCTIONAL FEATURES

Control: ON/OFF;
Measurement range: According to the used probe (see range table);
Display resolution: 1°;
Overall accuracy: ±0.5% fs;
Sampling rate: 300 ms;
Serial Interface: RS485 insulated;
Communication protocol: MODBUS RTU (JBUS);
Baud rate: Programmable from 2400... 38400 baud;
Endurance time of the internal clock without power supply: 7 years approx. by internal battery;
Display: Temperature: 3 Digits Red h 14 mm;
          Clock: 4 Digit Red h 7 mm;
Compliance: ECC directive EMC 89/336 (EN 61326), ECC directive LV 73/23 and 93/68 (EN 61010-1)

7.5 - MEASURING RANGE TABLE

INPUT	RANGE
tc J Model C **"SEn" = J**	-50 ... 999 °C - 58 ... 999 °F
tc K Model C **"SEn" = CrA**	-50 ... 999 °C - 58 ... 999 °F
Pt100 (IEC) Model D	-50 ... 600 °C - 58 ... 999 °F

7.6 - INSTRUMENT ORDERING CODE

TCO 30 a b c d e f g hh

a: INPUTS TYPE
C = thermocouples (J - K)

b: SUPPLY
D = 230 VAC

c: AUXILIARY PROBE INPUT
- = none
A = YES

d: AUXILIARY OUTPUT
- = none
R = YES

e: STEAMER PROBE INPUT
- = none
V = YES

f: COMMUNICATION INTERFACE
S = RS 485 Serial interface

g = DIGITAL INPUTS
I: 3 programmable digital inputs

hh: SPECIAL CODES

TCO PASSWORD = 381