AK300 INSTRUCTIONS MANUAL

1   INTRODUCTION

1.1 Description

Model AK300 is the SALVIO's most advanced temperature control solution for the injection moulding systems. This compact equipment is the result of years of research in this field.

Model AK300 is based on the Ak70 controller. It can equip up to 12 control zones. All those controllers are connected to a MODBUS/TRU network. This network, is also connected to an operator terminal touchscreen working in a Windows CE environment

Each AK70 module has a unique MOBUS address in such a way that the module with address 1 is the one located in the upper most left position. Module with address 2 is the one located right to the first. The module with address 1 controls the zones 1 and 2; module with address 2 controls zones 3 and 4, and so on.

The output power stage is composed by a solid state relay and an individual magnetothermic illuminated switch. The zone number distribution is the same as for the AK70 modules. The module located in the upper most left position corresponds to zone 1, and so on.

The control capabilities of the AK300 are the same specific capabilities included in AK70 controllers for this type of applications, along with the individual current measurement for each zone, preheating using a master controller, emergency stop if a protection temperature is exceeded, and more. Due to the facility of updating the terminal software with an USB pendrive, all those capabilities can be increased depending on each client needings.

1.2 Recommended spare parts

CO1600	Magnetothermic illuminated switch 16A
CO2500	Magnetothermic illuminated switch 25A
RS2525	Solid state relay
AK70-11	Dual loop temperature controller
AK70-80	Current measurement module

1.3 AK300 ordering guide

Model	Zones(3 digits)	Power/zone	Options
AK300	6 up to 12	1: 1000 W 2: 2200 W 3: 3500 W 4: 5500 W 9: Other	0: none 1: Current measurement
AK300	12	3	0

Example: **AK300-12-3-0** (AK300 with 12 zones of 3500W without current measurement)

2.0   INSTALLATION

2.1 Preliminary

Model AK300 operates at 380V with neutral and ground. **Note that the installation to 3x380 + T + N must be verified because a wrong connection may harm the equipment.**

2.2 Power supply connection

The power supply connection is through the cable located in the back side of the enclosure. This cable is given without any connector because each client has a different facility setup.

Previous to connect the power supply, the user must verify that the main switch placed in the rear position is in its OFF position.

2.3 Output to the mould

The output connection from the AK300 to the mould is done through multipole connectors located on the back side of the enclosure with 4 meters cables as a standard.

The number of connectors and its distribution are manufactured according to the customer instructions.

2.4 Power on

The power supply to the AK300 can be activated by means of the main switch placed in the back side of the enclosure. The power supply lines from the main magnetothermic switch are distributed to a main contactor switch, placed at the bottom inside the box, wich distributes lines to the magnetothermic illuminated switches. Those switches can cut down the power output.

The first time the AK300 is turned on, or each time the mould is changed, is recommended to start an autotuning function and save the results in a profile once it has ended.

3.   OPERATION

3.1 Introduction

All the interaction between the operator and the AK300 is done through the device's touchscreen. This chapter will describe the application installed in the touchscreen.

When the AK300 is turned on, the preinstalled application starts.

At the first stage the application will check for the units connected to the network. During this check, the application will ignore the activations by the user of any button. Once this stage has ended, the controller begins to work.

3.2 User interface

User interface has two areas: A toolbar in the upper side of the screen and a working area which occupies the main area of visualization.

3.2.1 Data input

All the data input is performed through dialogs. As those dialogs are so commonly used in the following chapters, is appropiate to describe them first. Any parameter modification won't be permanent until it will be saved in a profile(It will be loaded the last profile saved or loaded on startup).

3.2.1.1 Numerical data input

The dialog for numerical data input is as follows:

Initially, the dialog shows the current value. When any numerical button is pressed the value will be cleared to enter the new value. If the new value is going to exceed the allowed high limit, the new digit won't appear. Use '<' button to delete the last digit. Use OK button to validate the value and 'Cancel' button to cancel the data input. If the input value is out of the valid bounds, an error message will be shown and the value will be required again.

3.2.1.2 Text input

Some data needs to be entered as a character string, such as filename. The dialog for text input is as follows:
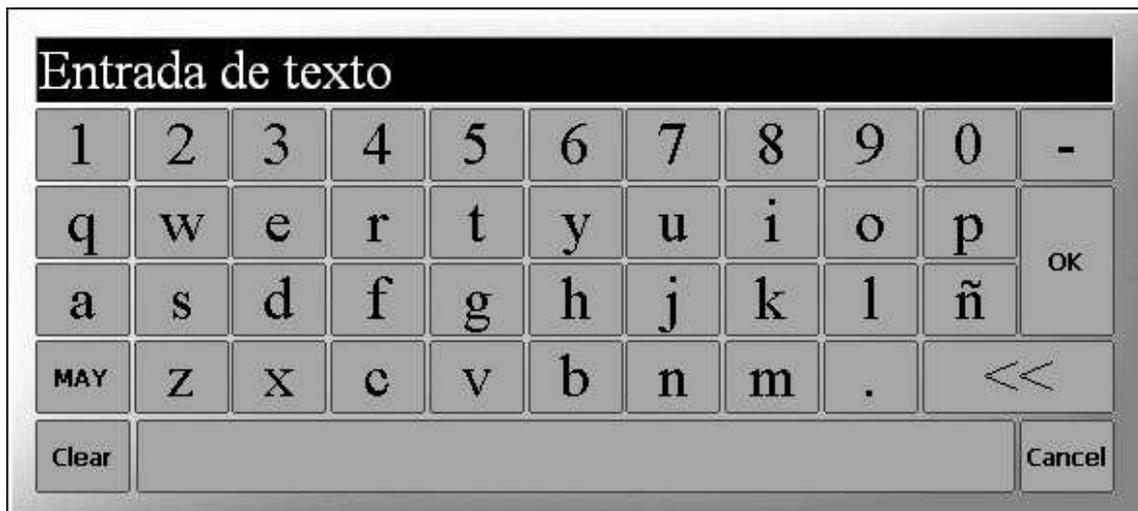
When a character is pressed, it will be added to the text in the edit box. The utility of the special keys is as follows.

"MAY"/"min"	Change the keyboard layout from majuscules to minuscules and from minuscules to majuscules respectively
Clear	Clears the full text
OK	Validates text
<<	Deletes last character
Cancel	Cancels the text input

3.2.1.3 Selection input

Some functions require one or a list of zones to be applied on. In order to select zones is used the next dialog:

This dialog shows a selection list with the zone number available. The zones displayed in blue are the selected zones.

The selection is done pressing over the desired zone number. Once selection is done, it's validated pressing 'OK' button. 'None' button unselects all the zones. 'Cancel' button cancels the selection operation.

If multiple selection is allowed, it will be shown the 'All' button, which selects all the available zones. If single selection is going on, selection a zone will unselect the last selected zone.

If is mandatory to select a zone, 'None' button won't be shown.

3.2.2 Toolbar

The toolbar is composed by a unrollable button, 3 standard buttons and a button that only will be shown if there is an active alarm.

The unrollable button will show the current selected option. It is composed by the following buttons:

 The working window will be the file options window

 The working window will be the control window

 The working window will be the graphics window

 The working window will be the advanced options window

The next chapters will explain the functionality of each of those windows.

The other buttons are:

 Show the upper controller group in the control window

Show the lower controller group in the control window

 Shows the controllers status and switch on/off the equipment respectively. When 'On' is shown it means that there are some zones on, and if pressed all zones will be stopped. If 'Off' is shown, any of the zones are on, and I pressed all zones will be switched on

 Shows incidences dialog. This button is visible only if there are active alarms

The incidence dialog is as follows:

This dialog shows the controllers with an active alarm and the controllers that have lost communication with the application. The only error shown for a disabled zone will be the "communication error". This dialog is closed pressing any point on the text surface.

If any exceed the protection temperature, it will be shown automatically an incidence dialog showing this situation and control will be stopped. This dialog won't be possible to close until no zones exceed the protection temperature.

Temperatura máxima superada

Zonas que superan Temperatura de seguridad: Controlador 3, Controlador 4, Controlador 5, Controlador 6

Zonas que superaron Temperatura de seguridad: Controlador 3, Controlador 4, Controlador 5, Controlador 6
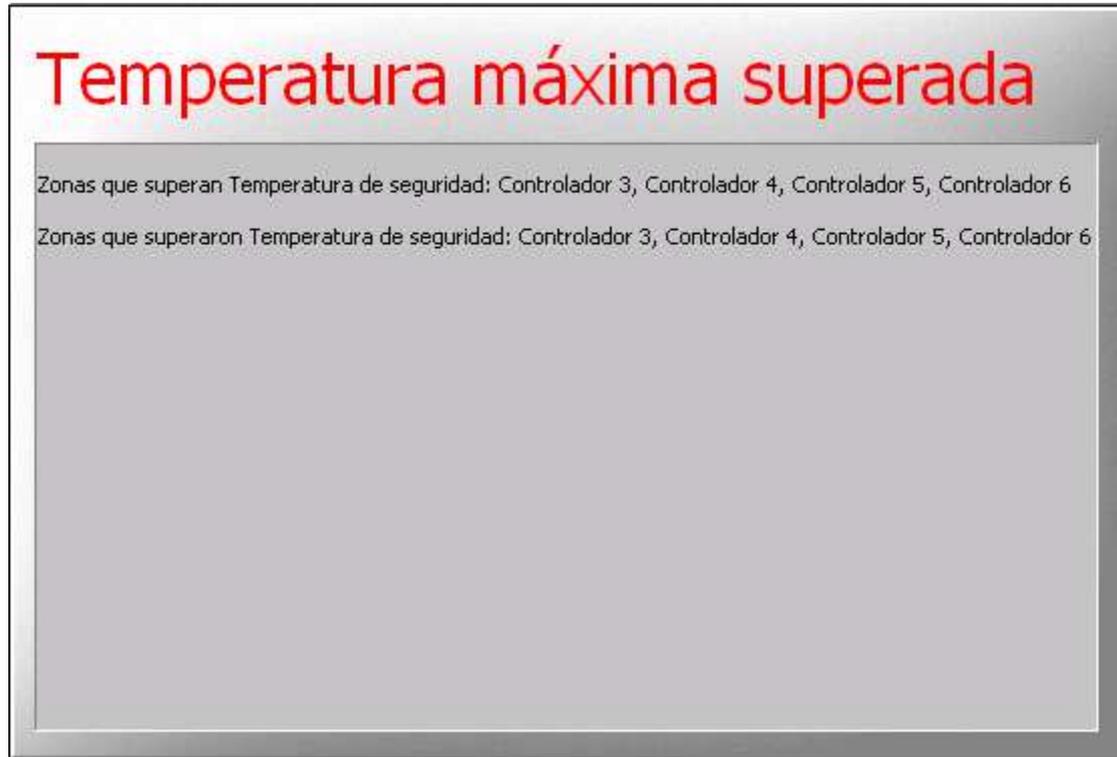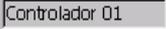
3.2.3 Main window

3.2.3.1 Controllers window

Once initialization stage has ended controllers window will be shown. This window shows information about each one of the control zones in groups of 8. Through the toolbar buttons ⬇ and ⬆ it will be shown the next or previous 8 zones.

Each of this control blocks shown information about the zone, and also allows to reconfigure the main controller parameters. They are composed by the following elements.

	Switch:	Shows if zone is switched on(green) or off(red). If a controller is switched off it won't supply a control output. To change only this zone status, this indicator can be pressed. When a zone is switched on, it's alarm gets masked until it reaches the working temperature margin. The alarm notification is controlled if this alarm was enabled trough the advanced options window.
	Temperature:	Shows the current control zone temperature. If 'EEE' is shown it means that temperature is over 600ºC or that the thermocouple is broken. If thermocouple is reversed '---' will be shown. If this control zone is enabled and preheating is not going on, pressing this panel will show the control zone setup dialog

200	Setpoint:	Shows the current control zone setpoint. If this control zone is not doing preheating, it can be changed pressing on it. If it shows 'EEE' it means that there were errors communicating with this control zone.
P00	Power output:	Shows the power output ratio given by this control zone. If this control zone is working in manual mode, this value can be changed pressing on it. If it shows 'EEE' it means that there were errors communicating with this control zone.
Controlador 01	Zone name:	Shows the control zone name. If this control zone is enabled and preheating is not going on, pressing this panel will show the control zone setup dialog. This dialog allows to modify the most common control parameters. The background color has the following meanings: • Yellow: Zone defined Bushing • Blue: Zone defined as Manifold • Red: Zone defined as Manifold and used as master controller(Preheating mode) • Grey: Disabled zone
Regulando	Status information:	If this control zone is enabled, it can indicate the following: • Open Thermocouple (Open TC) • Reversed Thermocouple(Reversed TC) • Alarm • Autotune • Preheating • Controlling • Off • Manual • Danger(protection temperature exceeded) • Broken link(this zone is linked to a disabled zone) • Linked • Comm Error If there are more than one of this situations at the same time, they will shown alternatively on this panel

The control zone setup dialog is as follows (it is possible that not all the fields are shown depending on zone configuration, because some options are not compatibles) :

To modify any of the values, just press on the desired panel and an input dialog will be shown.

Some of the fields have a 'Selection' button on his right. When pressed it will be shown a selection input dialog to choose which zones this modification will affect (controller from which this dialog was opened cannot be unselected). If there are more than one zone selected, the 'Selection' button will be marked

Once all desired fields are modified, 'OK' button will transfer this information to controllers and will close the dialog. If you don't want the dialog to be close, you may use the 'Apply' button to transfer the information. To discard changes, press 'Cancel' button.

The following table shows the parameters that can be modified,their meaning and their availability:

Absolute Setpoint:	Shows the setpoint value that will be set for the selected zones. The zones selected for 'Vary Setpoint' (if there were any) will be unselected if a value is set manually to this field.
Vary Setpoint:	Shows a variation from the current setpoint that will be set for the selected zones. The zones selected for 'Absolute Setpoint'(if there were any) will be unselected if a value is set manually to this field.
Alarm Window:	Sets the value for the alarm window of the controller. The alarm activates if the temperature is out of the working range (Setpoint±Alarm Window) and the alarm is enabled. If alarm gets activated the incidences button will be shown(if not shown already) and the free voltage contact 1-2 placed on the rear side will get closed. When a controller becomes switched on the alarm is masked until it enters the range defined by this window
Manual:	If this box is selected, it means that the zone is in manual mode. Once marked this box, the field Output will be shown. If this box is unmarked the zone is in automatic control mode. If this box is

	selected, 'Autotune' box becomes unselected
Autotune:	After activating this button the controller will switch to Autotuning mode. If the option was activated and the user deactivates it, the autotuning function stops and the controller returns to normal operation. If this box is selected, 'Manual' box becomes unselected
Output:	This field will be shown if 'Manual' box is selected. This field shows the power control ratio that will be fixed to the selected zones.
Link Controller:	Upon selection of this option, the controller will provide the output power given by another controller which will act as a master. After activation of this option, the text box on the right side will show the controller name acting as master
Show current	The AK300 is equipped current transformers to measure the current consumption of each heating element. The user can select whether to show output power ratio or current consumption. The current measurement is disabled during autotuning and preheating, and on disabled zones.

3.2.3.2 File options window

The file options window allows the user to save, load, delete and edit working profiles. The window is as follows:
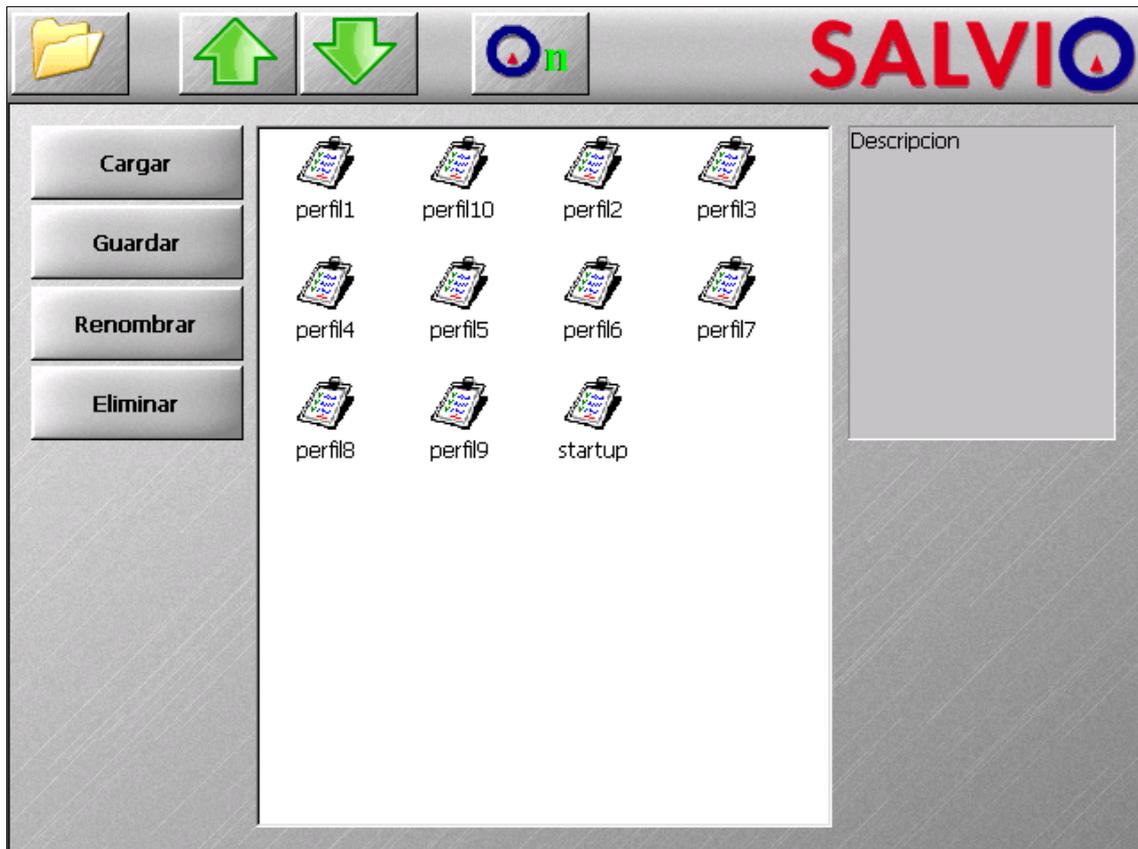
This windows is composed by a selection list were the existing profiles are shown, a description text box, and 4 buttons to manage the profile list.

A profile holds for each controller the setpoint, alarm window, proportional band, derivative time, integral time, alarm enabled/disabled, controller linked to, manual or automatic mode, output(if manual mode), zone type and if it is enabled or disabled.

There is a special filename: startup. This file holds the profile that will be loaded on startup. When a profile is loaded or saved it is also copied to this file, and this way the AK300 know the profile data to load on startup Any parameter modification is discarded if it's not saved in a profile before powering off the AK300. If startup profile is deleted AK300 will startup with default factory parameters. Is advisable to only delete this file to return to factory settings after power on.

The buttons' function are as follows

Save: Saves a profile. The user must enter the file name. If the name already exists, the user must confirm to overwrite the previous file

Load: Loads a profile. Upon selection of a profile, all the controllers are disabled, the profile is loaded and the new parameters and settings are sent to the controllers.

Delete: Deletes the selected file

Rename: Changes the name of the selected file

3.2.3.3 Graphs Window

The graphs window shows graphically information about the control zones. There can be shown 2 types of graph: 'Temperature and power over time(TvsT graph)' and 'Temperature Bargraph(bargraph)'. The button placed on the top left side of the window allows to select the desired graph.

3.2.3.3.1 T vs T Graph

This graph shows the evolution of the temperature and output power ratio trough time. The zone represented is shown in the graph.
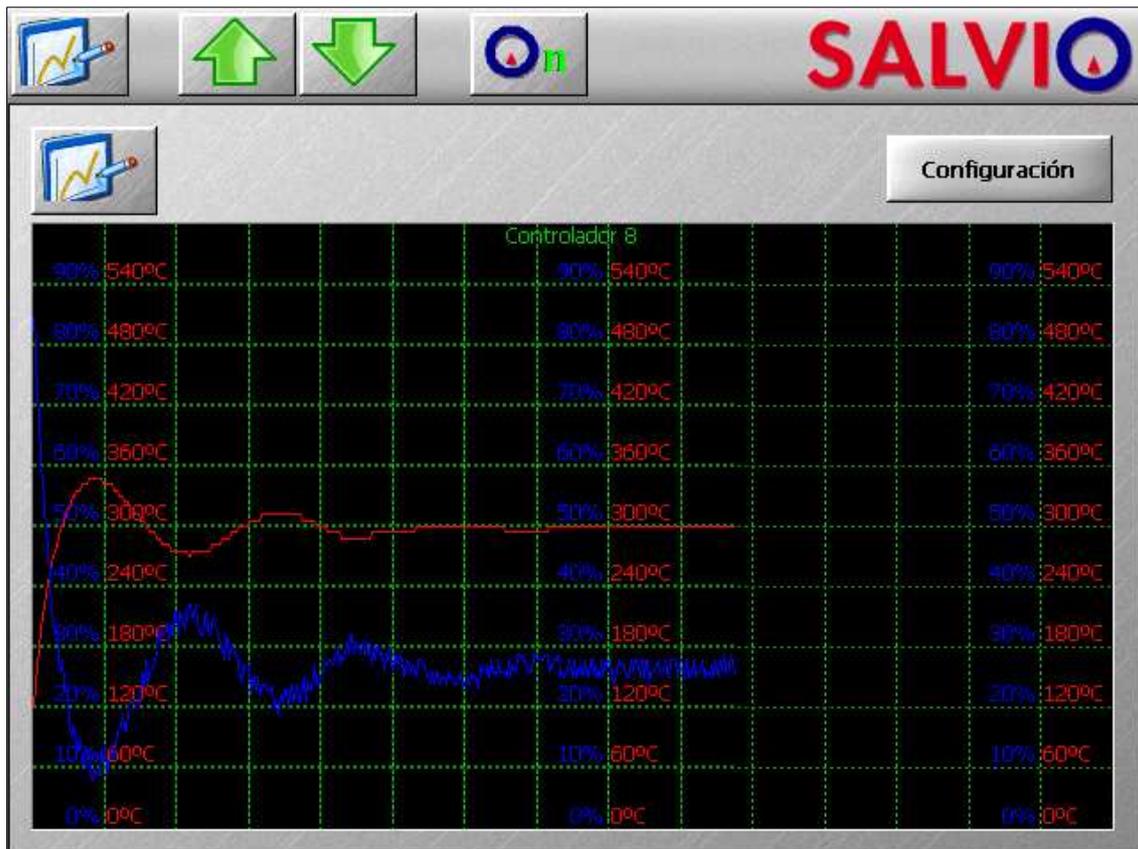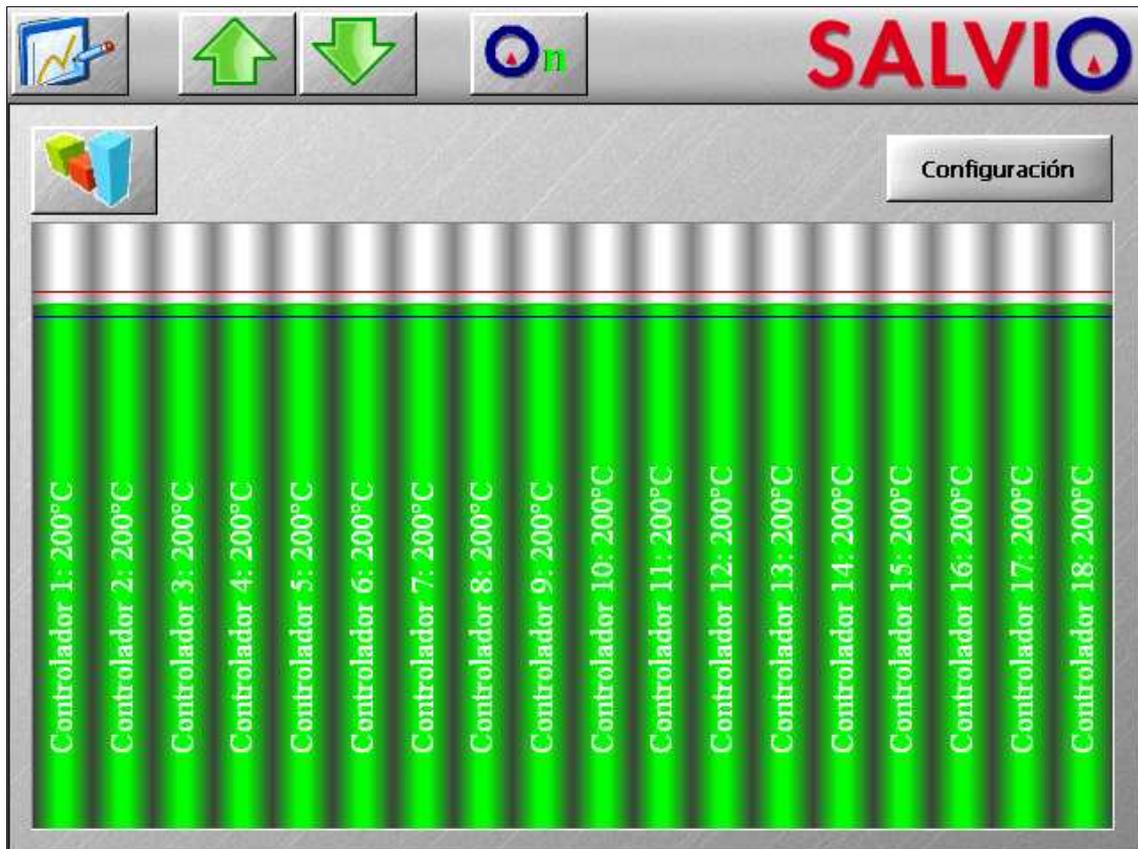

Each time division represents 200 seconds in real time. In red is represented the temperature, and in blue is represented the output power. The temperature range to show can be set pressing the 'Configuration' button.

3.2.3.3.2 Bargraph

This graph shows the current temperature of all the zones using a bar for each one.

The meaning of the colors of those bars is the following:

Blue: The current temperature is below the working range
Red: The current temperature is above the working range
Green: The current temperature is within the working range
Black: There are problems communicating with this controller. No data can be retrieved
Grey: The controller is disabled
Yellow: The controller is linked to another one

The bargraph also includes 3 colored marks: The upper working temperature limit (setpoint +alarm window) is marked in deep red, the setpoint is marked in deep green, and the lower working temperature limit(setpoint -alarm window) is marked in deep blue.

The 'Configuration' button does nothing when this graph type is shown.

3.2.3.4 Advanced options window

From the advanced options window the user can enable or disable some functionalities of the equipment, modify some not so common working parameters and modify PID parameters.

The functions that can be accessed from this window are:

|	
Enable Zones	When this option is pressed, a multiple selection input dialog is shown with the enabled zones marked on it. All zones unmarked will become disabled. A disabled zone doesn't control temperature, power output becomes 0% always and cannot be affected by any alarm. If a zone is linked to a disabled zone, an alarm will be shown.
Choose Manifold Zones	When this option is chosen, a multiple selection input dialog is shown with the manifold defined zones selected. Only a manifold zone can be used as master controller.
Enable Alarms	When this option is chosen, a multiple selection input dialog is shown with the zones with the alarm enabled marked. An enabled alarm will become activated when temperature gets out of the working range after being inside this range. By default all controllers have the alarm enabled.
Control Parameters	This option allows to change the PID parameters for a control zone that's not ding autotune. These parameters are proportional band, derivative time, integral time. Once a zone is selected, the following dialog will be shown:

This dialog shows the control zone being modified, and the current value for the parameters. To modify the values, press over the desired field and change the value. Once the modification has ended press 'OK' to send the changes, or 'Cancel' to discard them. This dialog only modifies the selected zone.

Master Controller Preheating

This function allows the user to activate a special preheating mode. Usually, the fast zones (bushings) reach the working temperature much faster that the slow zones (manifold).

This special preheating mode allows the user to define a manifold zone as a preheating master for the bushing zones in such a way that the temperature in the bushing zones never go above the temperature in the manifold zones. In this way all the temperatures reach the working temperature almost at the same time.

The working mode of this preheating is as follows:

- All the zones start the standard preheating up to 'Drying temperature' (see AK70 user manual).
- All the zones wait on 120 ºC, until master controller gets to 120 ºC.
- At this point, the bushing zones will increase the temperature up to the 'Waiting temperature' and will remain at this temperature until master controller reaches 'Ramp start' temperature. At this point, the bushing controllers will ramp to the setpoint at a rate defined by 'Ramp Time".
- Manifold zones will follow the master temperature up to the 'Ramp start' temperature. At this point the controller will run normally up to the setpoint.
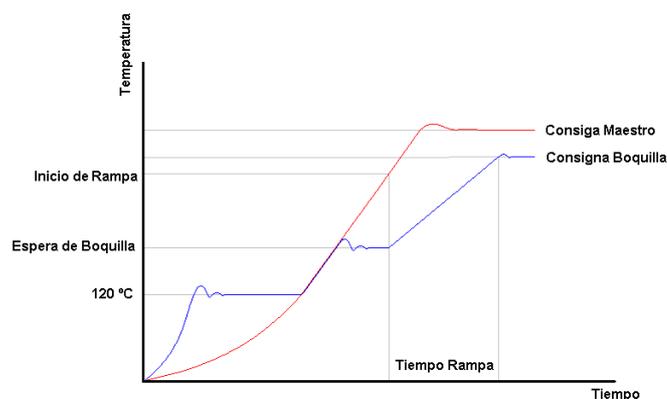
On this sample, red line represents the temperature evolution for the master controller, and blue the temperature evolution for a bushing zone

The preheating setup is done trough the following dialog:

Only manifold zones can be selected as master controller.

The activation of this preheating mode will start the next time that a preheating function starts or at any time that the master controller drops below the 'Ramp Start' temperature.

Protection Temperature   This option defines the protection temperature. If the temperature of any zone goes above this limit, all the controllers will be stopped and the outputs will be cut to prevent damage to the mould. A dialog will open showing the zones which are above the protection temperature limit. This dialog will remain open until ALL the zones are below the protection temperature limit.

4. ERROR AND ALARM MESSAGES

Some exceptions need the activation of alarms and error messages to call the attention of the operator. These situations are:

|	
Alarm	If the temperature of a zone has the alarm enabled and goes out of the working range(setpoint± alarm window) an alarm will be activated. It will appear ⚠ button in the toolbar(if not already visible) and it will be shown in a message in the status panel of the controller.
Protection temperature exceeded	If a zone exceeds the protection temperature, all the zones will be stopped. A dialog will be shown notifying this situation
Broken link	If a zone with another linked to it gets disabled, the link becomes broken. This situation is shown in the status panel of the zone. The zone output will be 0%
Communication error	If the AK300 cannot communicate with any module, a communication error will be shown. The controller with communication error will show 'EEE' in all of their fields and ⚠ will be shown on the toolbar. This zone won't be modified while this error persists. The zone will be represented with a black bar in the bargraph. This alarm cannot be disabled because it is a potentially serious problem.
Communication exception	If it's not possible to set a parameter it can be produced an communication exception. This is a specific error and is only notified once on the setting message. To close this message, only press it.

5.   UPDATE

Due to the continuous evolution of our software, the preinstalled application has the ability to update. To do so a pendrive is needed with the update files. If it's needed, we will send you the updates and detailed instructions to place the needed files in the pendrive.

If it's detected a pendrive with a valid update while AK300 power on , this dialog will be shown:
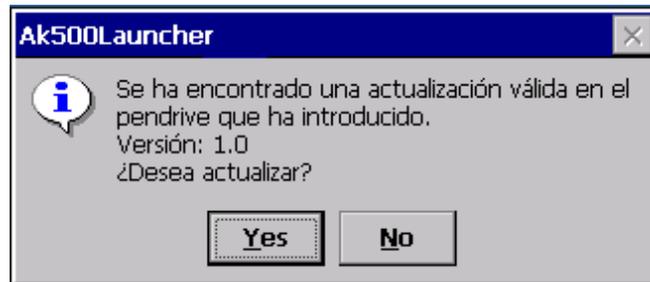
Choosing 'Yes' will initiate the update process.
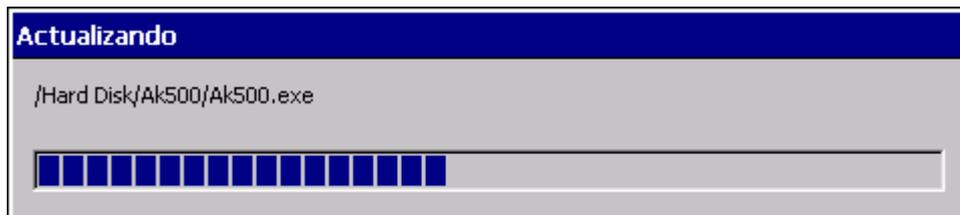
Once ended, the startup will be able to continue after pressing 'OK'

6.   TECHNICAL SPECIFICATIONS

Power Supply	3x380Vca + T + N
Consumption	Depends on the number of zones
Ambient Temperature	0..50°C (for use indoor)
Relative Humidity	max. 80% without condensation
Installation Category	II according to EN61010-1
Dust Level	I according to EN61010-1
Dimensions	225 x 430 x 228 mm minimum
Screen	Color 5,7" touchscreen
Inputs	Thermocouple J (IEC584)
Accuracy	± 0,25% f.s.v
Control type	PID with autotuning algorithm