



## **AK53 / AK54**

### **User manual**

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# USER MANUAL

## 1 Description

The **AK53/AK54** model is a temperature controller system for hot runner plastic injection moulding

### 1.1 Functionality

- ✧ Can read thermocouple or Pt100
- ✧ Pulse control output
- ✧ Secondary setpoint/Main setpoint
- ✧ Selectable PID control or PI+D control
- ✧ Autotune function
- ✧ 1 voltage free alarm contact.
  - Alarm can be setup as absolute high, absolute low, relative high, relative low and window.
  - Alarms can be latched and/or masked
- ✧ Preheating phase
- ✧ Ramp may be applied to setpoint changes
- ✧ Manual or automatic control
- ✧ Menus can be protected
- ✧ Setpoint or power output(when in manual mode) can be changed directly without entering controller menu

## 2 Operation modes

- ✧ Normal Mode: Controller shows temperature in the upper display and setpoint in the lower display. If Manual mode is enabled, power is shown in lower display preceded by a 'P' character.

Depending on protection level, current setpoint or output power(if manual mode is active) can be changed pressing up or down for 2 seconds. Lower display will blink one time and value begin to change. Once desired value is set, wait 2 seconds without pressing any key to save value (lower display will blink one time again when accepted).

To activate Manual Mode hold MANUAL button for 1 second. Output power will be shown instead setpoint.

To deactivate Manual Mode hold MANUAL button for 2 seconds.

To activate Secondary Setpoint hold SSP button for 1 second. To deactivate Secondary Setpoint hold SSP button for 2 seconds. SSP led shows Secondary Setpoint status

- ✧ Menu Mode: When pressed FUNC button in normal mode, controller passes to Menu Mode. Depending on the protection level, controller will wait for a password to be entered. In menu mode, upper display shows the current parameter value and the lower display will show the parameter name.

Pressing up/down button will vary the parameter value. If up/down button is hold, the variation will be faster. To accept the new value press FUNC button. To reset the parameter to its previous value press MANUAL button.

If any key is pressed for a time (configurable through Advanced Menu Mode) controller will turn back to Normal Mode.

- ✧ Advanced Menu Mode: When hold FUNC button for 10 seconds when in menu mode, controller will pass to Advanced Menu Mode. Depending on the protection level, controller will wait for a password to be entered. Advanced Menu Mode works like Menu Mode but contain parameters that are rarely changed
- ✧ Password enter mode: Depending on protection level, a password must be entered to show menu items or modify "lock" parameter (the parameter that lock/unlock protected parameters). When a password is needed PASS message is shown. Use up and down to set the number and FUNC to accept. If password is correct the appropriate menu option will be shown. If not, controller will return to Normal Mode.

In the case of "Lock" parameter, value will change from Lock to unlock if password is correct. It will be set to Lock if password is incorrect.

## 3 Menu Layout

### 3.1 Main Menu

When pressed FUNC on normal mode, controller will enter to Menu Mode. The options shown in menu are:

| Symbol       | Name                    | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>LOCK</i>  | Locked Parameters       | FrEE: Protected parameters are unlocked<br>Lock: Protected parameters are locked<br><br>Additional details: Shown if "Lock Configuration" > 5000                                                                                                                                                                                                                                                                                              |
| <i>SP</i>    | Setpoint                | Temperature value to use as setpoint.<br>Limited by "Setpoint High Limit" and "Setpoint Low Limit"                                                                                                                                                                                                                                                                                                                                            |
| <i>tune</i>  | Autotune                | On: Autotune active<br>Off: Autotune inactive<br><br>Additional details: Shown if manual mode is disabled and "Tune Option" is not oFF                                                                                                                                                                                                                                                                                                        |
| <i>rSEtA</i> | Reset Alarm Status      | On: Try to reset latched alarm status<br>Off: Do nothing<br><br>Additional details: Shown if "Alarm Setup" is not oFF and "Latched Alarm" is truE                                                                                                                                                                                                                                                                                             |
| <i>SSP</i>   | Secondary Setpoint      | Temperature value to use as secondary setpoint<br>Limited by "Setpoint High Limit" and "Setpoint Low Limit"                                                                                                                                                                                                                                                                                                                                   |
| <i>LOCK</i>  | Locked Parameters       | FrEE: Protected parameters are unlocked<br>Lock: Protected parameters are locked<br><br>Additional details: Shown if "Lock Configuration" is between 2 and 5000 (2 and 5000 not included)                                                                                                                                                                                                                                                     |
| <i>SPtA</i>  | Alarm Absolute Setpoint | Temperature value used to activate/deactivate alarm status<br>Limited by selected input type<br><br>Additional details: Shown if "Alarm Setup" is Hi or Lo and "Show Alarm On Operation" is On<br>Cannot be changed if parameters are locked                                                                                                                                                                                                  |
| <i>SP,r</i>  | Alarm Relative Setpoint | If "Alarm Setup" is rHi or rLo this value is added to the current setpoint to activate/deactivate alarm status.<br>If "Alarm Setup" is Wnd this value is the maximum deviation of the temperature from the setpoint (higher or lower) before alarm is activated<br><br>Range: 0 to 9999<br><br>Additional details: Shown if "Alarm Setup" is rHi,rLo or Wnd and "Show Alarm On Operation" is On<br>Cannot be changed if parameters are locked |
| <i>HYtA</i>  | Alarm Histeresys        | Alarm histeresys to avoid too fast activation/deactivation of the alarm<br><br>Range: 1 to 9999<br><br>Additional details: Shown if "Show Alarm On Operation" is On and "Alarm Setup" is not Off<br>Cannot be changed if parameters are locked                                                                                                                                                                                                |
| <i>Pb</i>    | Proportional Band       | PID control parameter                                                                                                                                                                                                                                                                                                                                                                                                                         |

|             |                          |                                                                                                                                                                                                                                                   |
|-------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             |                          | <p>Range: 0,1 to 100,0</p> <p>Additional details: Cannot be changed if parameters are locked or autotune is on</p>                                                                                                                                |
| <i>ti</i>   | Integral Time            | <p>PID control parameter</p> <p>Range: 1 to 4000</p> <p>Additional details: Cannot be changed if parameters are locked or autotune is on</p>                                                                                                      |
| <i>td</i>   | Derivative Time          | <p>PID control parameter</p> <p>Range: 1 to 4000</p> <p>Additional details: Cannot be changed if parameters are locked or autotune is on</p>                                                                                                      |
| <i>cy</i>   | Output Cycle             | <p>Time in seconds for a pulse with 100% output power</p> <p>Range: 1 to 120</p> <p>Additional details: Cannot be changed if parameters are locked</p>                                                                                            |
| <i>SPLL</i> | Setpoint Low Limit       | <p>Minimum available value for setpoint</p> <p>Limited by selected input type</p> <p>Additional details: Cannot be changed if parameters are locked</p>                                                                                           |
| <i>SPHL</i> | Setpoint High Limit      | <p>Maximum available value for setpoint</p> <p>Limited by selected input type</p> <p>Additional details: Cannot be changed if parameters are locked</p>                                                                                           |
| <i>rup</i>  | Setpoint Ramp Up         | <p>inF: Do nothing<br/>1 to 100: When setpoint is changed to a higher value, the internal setpoint value will be ramped up increasing this number of degrees by minute</p> <p>Additional details: Cannot be changed if parameters are locked</p>  |
| <i>rdn</i>  | Setpoint Ramp Down       | <p>inF: Do nothing<br/>1 to 100: When setpoint is changed to a lower value, the internal setpoint value will be ramped down decreasing this number of degrees by minute</p> <p>Additional details: Cannot be changed if parameters are locked</p> |
| <i>EPH</i>  | Preheating Time          | <p>1 to 120: Maximum time in minutes preheating is active.<br/>inF: no maximum time</p> <p>Additional details: Cannot be changed if parameters are locked</p>                                                                                     |
| <i>incd</i> | Maximum Output Variation | <p>1 to 25: Maximum variation of output power in a second<br/>inF: free output</p> <p>Additional details: Cannot be changed if parameters are locked</p>                                                                                          |

### 3.2 Advanced Menu

When hold FUNC button for 10 seconds while on Menu Mode, Advanced menu will be shown. If parameters are locked, a password will be required

| Symbol        | Name                    | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>INP</i>    | Input type              | tc-J: thermocouple J (0..600°C)<br>tc-L: thermocouple L (0..600°C)<br>tc-K: thermocouple K (0..1200°C)<br>tc-N: thermocouple N (0..1200°C)<br>tc-t: thermocouple T (0..400°C)<br>tc-r: thermocouple R (0..1600°C)<br>tc-S: thermocouple S (0..1600°C)<br>Rtd1: Pt100 (-200..600)<br>Rtd2: Pt100 (-99,9..200,0)<br><br>If temperature is over the specified maximum range, temperature display will show Over. If temperature is under minimum range, display will show Under                                                                                                                                                                                                  |
| <i>UNIT</i>   | Unit                    | °C: celsius degree<br>F: Farenheit degree                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>HEAT</i>   | Heat                    | Off: Output PID control is direct<br>On: output PID control is reverse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>ALARM</i>  | Alarm Setup             | Off: Alarm is disabled<br>Hi: Alarm is an absolute high alarm (alarm active if temperature higher than Alarm Absolute Setpoint)<br>Lo: Alarm is an absolute low alarm (alarm active if temperature lower than Alarm Absolute Setpoint)<br>rHi: Alarm is an relative high alarm (alarm active if temperature higher than current setpoint + Alarm Relative Setpoint)<br>rLo: Alarm is an relative low alarm (alarm active if temperature lower than current setpoint + Alarm Relative Setpoint)<br>Wnd: Alarm is a windowed alarm (alarm is active if temperature is outside the margin (current setpoint- Alarm Relative Setpoint, current setpoint+Alarm Relative Setpoint)) |
| <i>LALARM</i> | Latched Alarm           | Off: Do nothing<br>On: Once alarm is set active, it remains in active status until it is reset using "Reset Alarm Status"<br><br>Additional details: Shown if "Alarm Setup" is not Off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>MASK</i>   | Masked Alarm            | Off: Do nothing<br>On: If on startup or setpoint change alarm status is active, controller mask it until it gets to an inactive condition. Once alarm is inactive mask is removed<br><br>Additional details: Shown if "Alarm Setup" is not Off                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>ALDIR</i>  | Alarm Direction         | reV: alarm contact open on active alarm<br>dir: alarm contact closed on active alarm<br><br>Additional details: Shown if "Alarm Setup" is not Off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>OPAL</i>   | Show Alarm On Operation | Off: Alarm parameters are shown on advanced menu<br>On: Alarm parameters are shown on normal menu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <i>SPAL</i>   | Alarm Absolute Setpoint | Temperature value used to activate/deactivate alarm status<br><br>Limited by selected input type<br><br>Additional details: Shown if "Alarm Setup" is Hi or Lo and "Show Alarm On Operation" is Off<br>Cannot be changed if parameters are locked                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                       |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>SP<sub>r</sub></i> | Alarm Relative Setpoint            | <p>If "Alarm Setup" is rHi or rLo this value is added to the current setpoint to activate/deactivate alarm status.<br/>If "Alarm Setup" is Wnd this value is the maximum deviation of the temperature from the setpoint (higher or lower) before alarm is activated</p> <p>Range: 0 to 9999</p> <p>Additional details: Shown if "Alarm Setup" is rHi,rLo or Wnd and "Show Alarm On Operation" is Off<br/>Cannot be changed if parameters are locked</p>                                                                                                                                                                                                                                                                                                                                              |
| <i>HYS</i>            | Alarm Histeresys                   | <p>Alarm histeresys to avoid too fast activation/deactivation of the alarm</p> <p>Range 1 to 9999</p> <p>Additional details: Shown if "Show Alarm On Operation" is Off<br/>Cannot be changed if parameters are locked</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>EPH</i>            | Preheat End                        | <p>If temperature is higher tha "Preheat End", preheat becomes inactive</p> <p>Range: From "Setpoint Low Limit" to "Setpoint"</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <i>CFGL</i>           | Lock Configuration                 | <p>0: All parameters are unlocked</p> <p>1: All parameters are locked. Advanced menu is protected by password(233). Exceptions are SP, SSP, Reset Alarm and tune</p> <p>2-4999: password. Advanced menu is protected by password. SSP, and direct modification of current setpoint/output power is available without unlock parameters. Inside Menu, Setpoint, Reset Alarms, and Secondary Setpoint are not protected. Autotune is protected depending on "Autotune Enable". The other parameters are locked depending on "Lock" parameter</p> <p>5000-9999: password. Advanced Menu is protected by password. All parameters are locked depending on Lock parameter. If Lock is true, password is required before enter menu, and direct modification and Secondary Setpoint button are blocked</p> |
| <i>bias</i>           | Bias                               | <p>Value added to the process value</p> <p>Range : -199 to 199</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>SHPr</i>           | Show Protected                     | <p>Off: Protected parameters are not shown on menu while Lock is true<br/>On: if "Lock Configuration" is between 2 and 4999 (both included) and Lock is true, locked parameters are shown on menu, but they cannot be modified</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <i>MANE</i>           | Manual Enabled                     | <p>Off: Manual mode is not available<br/>On: Manual mode is available</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>EN<sub>E</sub></i> | Autotune Enable                    | <p>Off: Autotune is not available<br/>On: Autotune is available<br/>Prot: Autotune is protected depending on Lock value</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <i>nPB</i>            | Minimum Autotune Proportional Band | <p>Minimum allowed value for Proportional Band calculated by Autotune</p> <p>Range from 0.1 to ("Maximum Autotune Proportional Band" - 0.1)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|              |                                    |                                                                                                                                                                                 |
|--------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>PPb</i>   | Maximum Autotune Proportional Band | Maximum allowed value for Proportional Band calculated by Autotune<br>Range from ("Minimum Autotune Proportional Band" +0.1) to 100,0                                           |
| <i>nTi</i>   | Minimum Autotune Integral Time     | Minimum allowed value for Integral Time calculated by Autotune<br><br>Range: 1-4000                                                                                             |
| <i>rSt</i>   | Remember Start Mode                | Off: Controller always starts in automatic mode<br>On: Controller starts in the last state it was left (Automatic/Manual). If it starts in Manual mode, output power will be 0% |
| <i>t, nE</i> | Menu Timeout                       | Time to exit menu when no key is pressed<br><br>Range: 10 to 30                                                                                                                 |
| <i>OutL</i>  | Output Limit                       | Maximum output power allowed<br>Range: 0 to 100                                                                                                                                 |
| <i>CtTy</i>  | Control Type                       | PID<br>PI+D                                                                                                                                                                     |
| <i>SPSH</i>  | Show Real Setpoint                 | Off: If ramp is active, end of ramp setpoint will be shown<br>On: If ramp is active, internal ramp setpoint will be shown                                                       |

## 4 Functions

### 4.1 Preheating

On Normal Mode, while controller is in preheating state it will show the message PreH alternatively to temperature. The preheating phase works as follows:

- ⤴ The first minute the output will be 1%
- ⤴ The second minute, output will rise to the 10%
- ⤴ Output will be increased each 7.5 seconds until temperature increases at a minimum of 8 degrees per minute

If preheating is active for longer than "Preheating Time" or temperature is higher than "Preheat End", preheat ends.

### 4.2 Autotune

On normal mode, when autotune is active it will be shown the message tune alternatively to temperature. The implemented autotune version applies 0% and 100% output around the setpoint temperature to induce some oscillations on the process.

While autotune is On, Pb, Ti and Td cannot be changed. If Manual Mode is activated autotune gets deactivated

## 5 Default Parameters

If there is any problem, or password is forgotten everything can be restored to factory settings pressing up and down button on power up. The factory settings are:

|                          |     |                                    |          |
|--------------------------|-----|------------------------------------|----------|
| Setpoint                 | 150 | Alarm Setup                        | Diasbled |
| Secondary Setpoint       | 100 | Latched Alarm                      | Off      |
| Alarm Absolute Setpoint  | 200 | Masked Alarm                       | Off      |
| Alarm Relative Setpoint  | 5   | Alarm Direction                    | direct   |
| Alarm Histeresys         | 1   | Show Alarm On Operation            | On       |
| Proportional Band        | 2,5 | Preheat End                        | 120      |
| Integral Time            | 320 | Bias                               | 0        |
| Derivative Time          | 60  | Show Protected                     | Off      |
| Output Cycle             | 1   | Manual Enabled                     | On       |
| Setpoint Low Limit       | 0   | Autotune Enable                    | Prot     |
| Setpoint High Limit      | 600 | Minimum Autotune Proportional Band | 0,1      |
| Setpoint Ramp Up         | inF | Maximum Autotune Proportional Band | 100,0    |
| Setpoint Ramp Down       | inF | Minimum Autotune Integral Time     | 1        |
| Preheating Time          | inF | Remember Start Mode                | Off      |
| Maximum Output Variation | inF | Menu Timeout                       | 10s      |
| Input type               | J   | Output Limit                       | 100      |
| Unit                     | °C  | Control Type                       | PID      |
| Heat                     | On  | Show Real Setpoint                 | On       |