



Hot Runner Controllers

Series HR & HRD

from HRD Version 911006 A
HR Version 903905 A



PSG Plastic Service GmbH
Pirnaer Strasse 12-16
68309 Mannheim
Deutschland
Tel. +49 621 7162 0
Fax +49 621 7162 162
www.psg-online.de
info@psg-online.de



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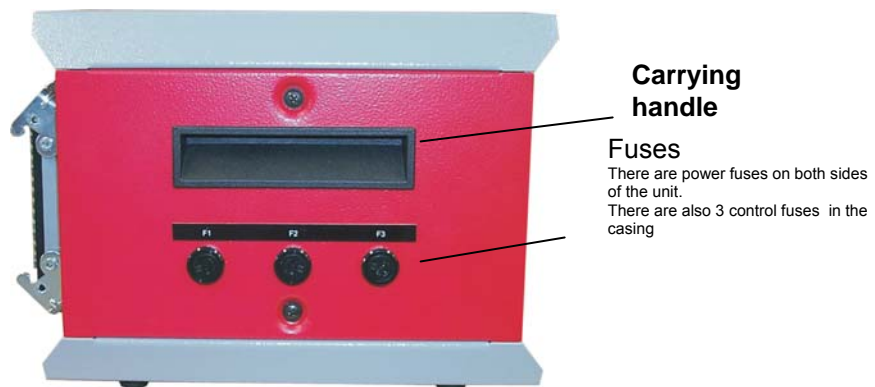
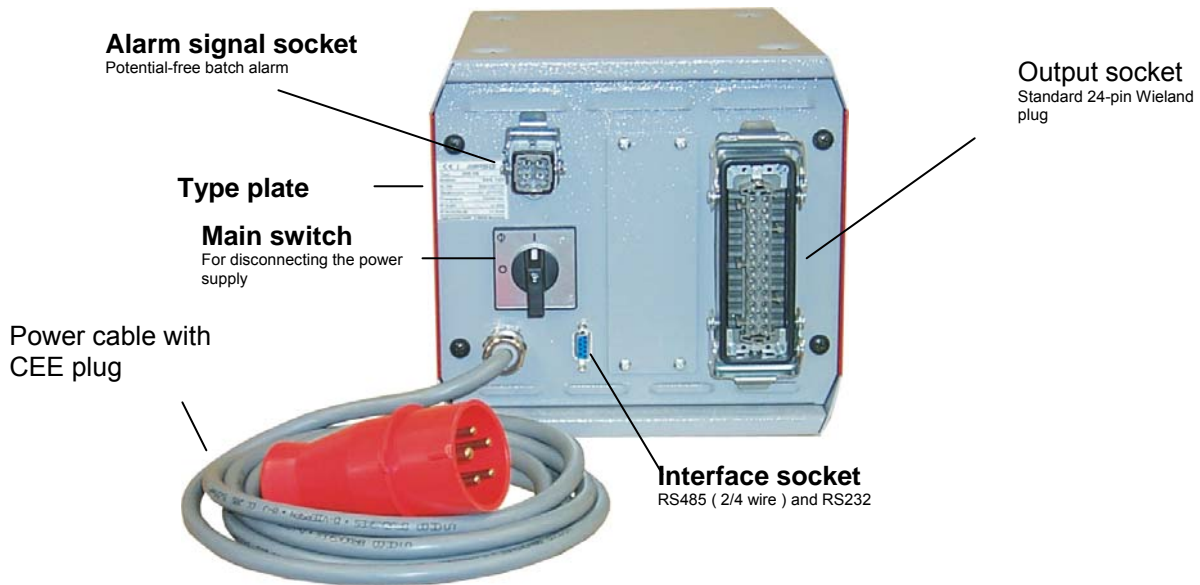
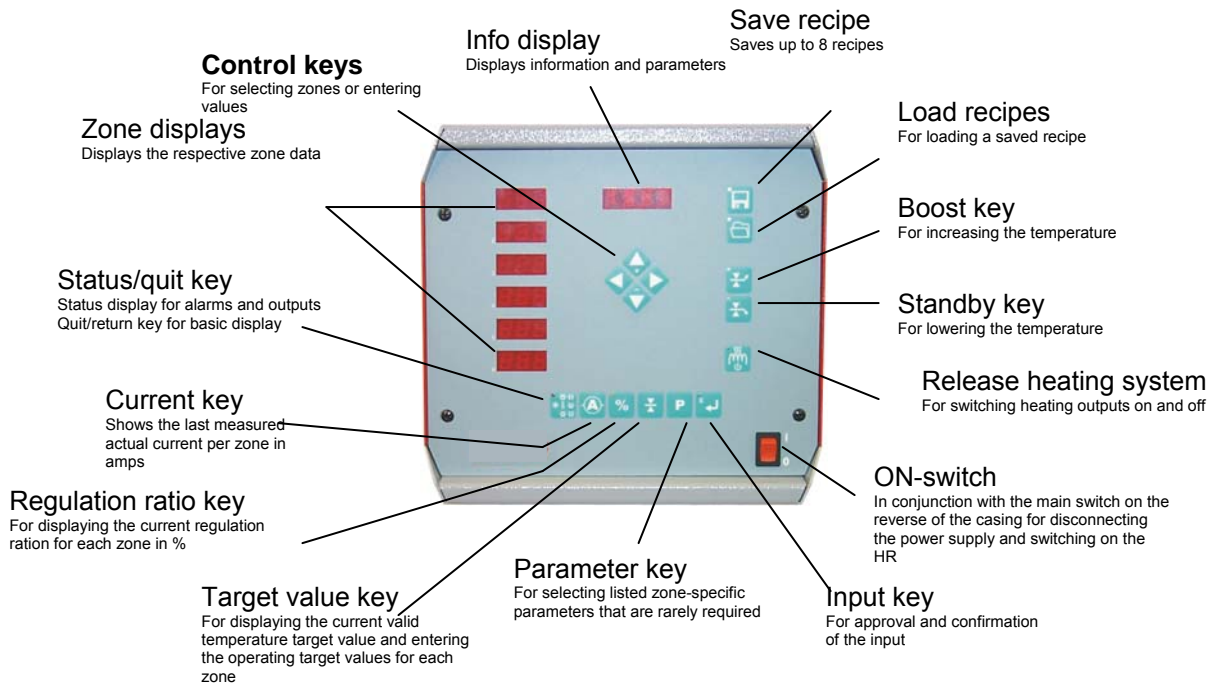
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Brief instructions HR/HRD

Power supply ON/OFF - press the main switch on the reverse of unit and the ON-switch on the front of the casing

Temperature reduction	
Temperature increase	
Release heating system	
Switch between ACTUAL value /difference display	
Target value input	
Single	
Group	
Selection to one value	
Selection by one value	
Block to one value	
Block by one value	
Current acceptance	
Regulation mode	
Regulation ratio input	
Pilot zone	
Save recipe	
Load recipe	

Overview HR/HRD



General information

Congratulations on your purchase of a HR/HRD temperature control cabinet!

To ensure that you can operate your unit easily, please read the following pages which explain how the unit works.

The **HR/HRD** control cabinets have all the function and equipment features listed below

- ✘ Temperature control cabinet based on a microprocessor temperature controller with multi-channel equipment
- ✘ Uniform operation of up to 30 zones
- ✘ Modern adaptive, self-optimising control process MAControl
- ✘ Monitoring of heating current
- ✘ Monitoring functions for sensors, temperature tolerance values and currents
- ✘ Connecting diagnosis (check the wires, only for HR-D series)
- ✘ Zone diagnosis function (only for HR-D series)
- ✘ Measurement of leakage current (only for HR-D series)
- ✘ Start-up function for gentle heating-up during commissioning
- ✘ Start-up function with Boost / Choke function for rapid through-heating of the tool
- ✘ Automatic temperature ramp for even heating-up of the tool
- ✘ Regulation mode in case of sensor failure with automatic acceptance of the last issued and calculated regulation ratio
- ✘ Pilot mode: Allocation of a pilot zone in case of sensor failure
- ✘ 2nd target value (standby mode and 3rd target value (Boost / Choke function)
- ✘ Recipe function for storage of up to 8 recipes
- ✘ Automatic load-breaking when maximum target value is exceeded and/or when current is identified although no heating system is triggered

Delivery scope

In addition to the control cabinet, the delivery scope also comprises

- ✘ the operating instructions
- ✘ the pin assignment plan.

Delivery

The control cabinet is delivered completely mounted in a padded impact-resistant carton. Normally, this provides adequate protection for the unit.

If external damage is evident before the carton is opened, the unit should be examined for damage. **Do not switch on the control cabinet** to check for damage; contact the supplier immediately!

Storage

If the control cabinet is not commissioned immediately, it should be stored where it is protected against dirt and damp. The permissible temperature range is -10...60°C.

Reservation of the right to make amendments

These instructions comply with the latest information; they are complete and accurate. However, technical further development may involve modifications to the unit or the software which are not taken into consideration in these operating instructions.

For this reason, we will not assume liability for malfunctions or failures and any incurred damage in these cases.

These operating instructions are updated after every technical modification. The version number of the operating instructions is changed every time amendments are made to the operating instructions. The version number is entered on the covering sheet of these operating instructions. If you do not have the latest version, we will be happy to send you a copy.

Safety information

CE- symbol on the control cabinet

The control cabinets bear the CE symbol, i.e. it satisfies the requirements of the EU Directive 89/336/EWG (Electro-magnetic compatibility) and the standards listed therein as well as the Directive 73/23/EWG (low-voltage guidelines)

The control cabinets of the series **HR/HRD** are designed for use in industrial environments and satisfy the following requirements

Emitted interference	EN 50081/1
Resistance to jamming	EN 50082/2

and

Electrical safety for MSR units	DIN EN 61010
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Type plate

A type plate is attached to the reverse of the control cabinet. In addition to the exact type designation, this type plate also bears the article, the serial number and the performance features.

To enable us to answer all your questions quickly, please always state the type designation, article and production number.

Caution !

Before commissioning and operating the control cabinet, **you must read these operating instructions carefully.**

The **unit may only be commissioned** by authorised personnel.

The **connection between the HR/HRD and the tool** may only be made using designated fully functional connection cables that comply with the safety standard.

The **power supply** and the **maximum output values** must comply with the information stated on the type plate and may not be exceeded.

The **HR/HRD may not be used in explosive environments.**

The **HR/HRD is not protected against splash-water.**

Only give the **HR/HRD** to third parties **together with the operating instructions.**

The **ON/OFF switch** on the front side of the unit does not completely cut off the power supply!

Before **opening the casing of the HR/HRD**, the power supply needs to be disconnected.

Always send the **HR/HRD to the manufacturer in case of malfunctions.**

Non-compliance with these safety measures and the respective information can result in the failure of the operating and display unit of the controller and/or the system. The resulting damage is not covered by the manufacturer's warranty terms.

Operation

Basic operating information

The operating philosophy focuses on facilitating easy, comprehensible and self-explanatory operation of the unit. All functions are operated in line with 5 basic operating steps:

- **Select function/configuration parameter**
- **Select zones**
 - 3 different zone selection options are available:
 - ✦ the individual zone
 - ✦ several selected zones (selection mode)
 - ✦ group selection of zones that are located one after another (group selection)
 - ✦ selection of all zones (block mode)

- **Approval of the input**

If several zones are selected (selection mode or block mode), these can be changed absolutely to the same value or changed by the same value.

- **Perform change**
- **Acknowledge change / quit or continue input**

Input variants

Easy input options are available in the operating and display unit. The operating examples show how these can be used based on changes to target values. Of course, the sequence of keys that need to be pressed to change the target values also apply to all other configuration parameters.

The following three input **variants** are available:

Variant 1 : Single input

Only the value of one individual zone is changed.

Variant 2 : Input in the block-group mode




The values of all zones or a group are changed at the same time. In addition, it is also possible to define whether the value should be changed **by one value** or **to one value**.

Variant 3 : Input in the selection mode

The values of **selected zones** are changed at the same time. In addition, it is also possible to define whether the value should be changed **by one value** or **to one value**.

Explanation of the symbols for operating examples

The following applies to the operating examples.





	Keys on the operating and display unit
	Information display
	Display in the info screen after pressing a certain key.

Direct selection of the most important functions via function keys

There are separate function keys available for target values, currents, regulation ratios, release of heating system, save recipe/load recipe and increase/lower target value.

	Current		Save recipe
	Regulation ratio		Load recipe
	Target value		Increase target value
	Release heating system		Lower target value

Combined functions have been based on day-to-day language to simplify operation of the unit.



For example, the target values for the currents are displayed using the keys:  and  (current + target value) or the regulation ratio is displayed via the keys  and  (regulation ratio + target value)

The zone displays - Status and error messages

In addition to the actual temperature values and/or function values, further information may appear in the zone displays relating to the status of the control zone and/or control unit. These may just be information messages or they may be error messages. All message texts are listed in the following table. In case of error messages, a note is also issued indicating how the error can be rectified.





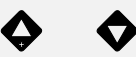




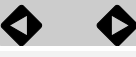


Display	Meaning	Rectification of the error in case of an error message
<i>5t b</i>	Regulation mode	
<i>F5t</i>	Zone in pilot regulation	
<i>AFb</i>	Start-up mode active	
<i>! d</i>	Identification active	
<i>Fb</i>	Sensor failure	Sensors defective. In order to be able to keep operating the zones in the regular mode, the sensors need to be exchanged immediately; otherwise the zones in the Regulation mode or in the pilot regulation zone will switch and continue working with defective sensors.
<i>FP</i>	Sensor reverse voltage	Sensor connections are confused. Swap over the two sensor wires + and – of the corresponding zones.
<i>FUS</i>	Fuse alarm only for HRD	Wiring error. The error is saved and needs to be acknowledged.
<i>Err</i>	Data error in channel data	Change to the parameter level and change a value, then acknowledge the change. The error message will then disappear. Alternatively, enter code number 950.
<i>RL</i>	Maximum temperature / upper measuring range limit exceeded	The actual value of the zones has exceeded the measuring range limit or the maximum temperature (500°C). The heating output for the corresponding zone is switch off. The error is saved and needs to be acknowledged. If the error comes before the error message <i>!-</i> , the power unit may be defective. Please exchange. Likewise, errors in the sensors are possible. Please observe the actual value. Please contact the supplier for a quick remedy.
<i>! F</i>	Error message "No heating current is measured" during the identification phase	The controller switches off the zones and checks in cycles whether a heating current can be measured or not. Reason for error: Fuse failure, heater failure or the connection cable to the heater is defective.
<i>5b y</i>	Temperature reduction / Standby active	
<i>b5t</i>	Temperature increase / Boost active	
<i>d! R</i>	Diagnosis function active	
<i>Rr</i>	Automatic ramp active	
<i>Rr.</i>	Automatic ramp active, zone is currently the slowest zone	
<i>! -</i>	Alarm "Current alarm when heating system is off " active	Heating current is measured although no control is triggered. The heating output for the corresponding zone is switched off. Check the power unit and exchange. The error is saved and needs to be acknowledged.

Target value input

After the target value key  has been called up, the “active” target value is shown! In addition to the operating target value, this may also be the start-up target value (100°C), reduction (Standby) or increased target value (Boost). The information stating which of the target values this is is shown in the basic level in the zone displays. The system only switches to the operating target value after the input key  is pressed.






Individual input

Individual target value input for each zone


 	Press the target value key; the zone displays show the current target values. The display of the currently selected zone flashes quickly.	This may be the Start-up, Standby, Boost or operating target value.
	Select the required zone via the four arrow keys (cursor-control).	
	Approve input for selected zone. The display of the currently selected zone flashes slowly.	The green lamp on the key shines.
	Select the required value using the arrow keys.	Change the value quickly  plus  to increase  plus  to reduce
	If required, select next zone.	
	Confirm entry and quit.	The entered value is stored.
	Return to basic screen (ACTUAL value display).	The system automatically returns to the basic screen after approx. 180 seconds

Group-block input










Group target value input for several connected zones “a group”
 - by one, or to a same value –

 	Press the target value key; the zone displays show the current target values. The display of the currently selected zone flashes quickly.	This may be the Start-up, Standby, Boost or operating target value.
	Select the first zone of the group using the four arrow keys (cursor control).	
	Acknowledge selected zone	
	Select the last zone of the group using the four arrow keys (cursor control).	

Input selection by one value.



 4 seconds	Press the input key for 4 seconds, input is approved for the group.	The green lamp on the key shines and all zones flash.
---	---	---

Input selection to the same value.


 	Press the input key twice quickly; input for the group is approved.	The green lamp on the key shines and all zones flash.
	Select required value. All zones are set to the same value or changed by one value.	Change the value quickly  plus  to increase  plus  to reduce
	Confirm entry and quit.	The entered value is stored.
	Return to basic screen (actual value display).	The system

		automatically returns to the basic screen after approx. 180 seconds.
--	--	--







Block input target value input all zones at once "Block"
 - by one, or to a same value –

 	Press target value key; the current target values are shown in the zone displays. The display of the currently selected zone flashes quickly.	This may be the Start-up, Standby, Boost or operating target value.
---	---	---

Input selection by one value.







 4 seconds	Press the input key for 4 seconds, input is approved for all values.	The green lamp on the key shines and all zones flash.
---	--	---

Input selection to the same value.


 	Press the input key twice quickly; input for all zones is approved.	The green lamp on the key shines and all zones flash.
 	Select required value. All zones are set to the same value or changed by one value.	Change the value quickly ◆ plus ◆ to increase ◆ plus ◆ to reduce
	Confirm entry and quit.	The entered value is stored.
	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds

Selection mode





Target value input for selected zones by/to one value



 	Press target value key; the current target values are shown in the zone displays. The display of the currently selected zone flashes quickly.	This may be the Start-up, Standby, Boost or operating target value.
	Select the first zone using the four arrow keys (cursor control).	
	Acknowledge selected zone	
	Select the next zone using the four arrow keys (cursor control).	
	Acknowledge selected zone	
Repeat selection until all required zones are selected.		

Input selection by one value.

 4 seconds	Press the input key for 4 seconds, input is approved for all selected zones.	The green lamp on the key shines and all zones flash.
---	--	---

Input selection to the same value.

 	Press the input key twice quickly; input for all selected zones is approved.	The green lamp on the key shines and all zones flash.
 	Select required value. All zones are set to the same value.	Change the value quickly ◆ plus ◆ to increase ◆ plus ◆ to reduce

	Confirm entry and quit.	The entered value is stored.
	Return to basic screen (ACTUAL value display).	The system automatically returns to the basic screen after approx. 180 seconds.

Input process at a glance

Press key

The current target value is shown in the zone displays. This may be the - operating, Standby, Boost or Start-up target value!

Only the operating target value can be changed via the target value key !

The Start-up target value is fixed at 100°C.

The Standby and the Boost target value are located in the parameter level under the P key

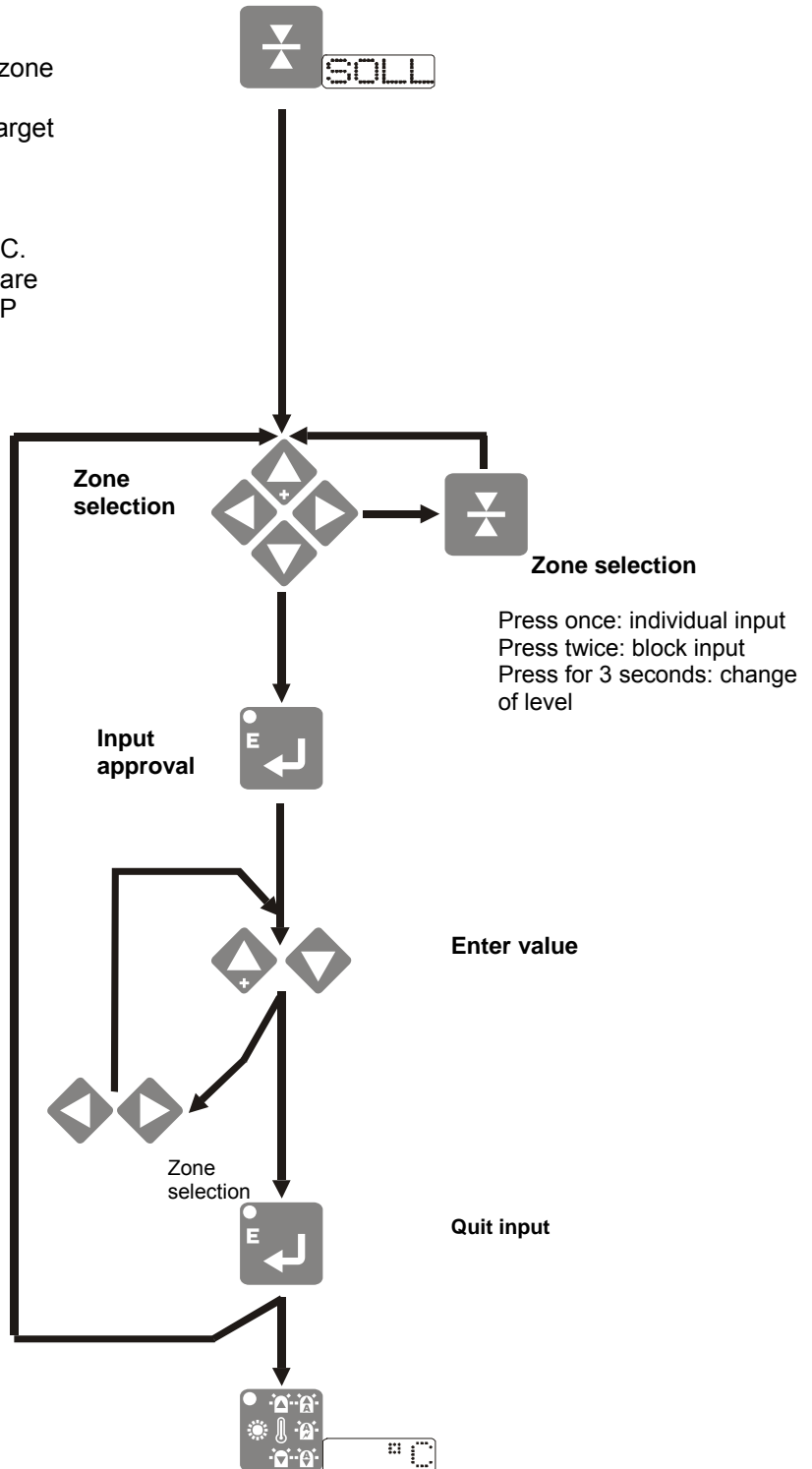
Select individual zone or several zones

Select input type
The operating target value is shown in the zone displays.

Set the required value

If required, set other zones
(only individual input is possible)

Confirm input and quit



Functions


Release heating system

All heating outputs are switched to passive (OFF) or active (ON) via the function key “Release heating system”. When switched off, the heating outputs are not triggered. All operating functions are still possible however they are not regulated to the target values.




2 function variants can be selected during the “Release heating system” process.

- ✘ Manual function (delivery status)
- ✘ Automatic **function after switching on** - switches the heating outputs to active (ON) after a set time period.



Manual

In the standard delivery setting, the heating outputs are at “OFF” passive when the control cabinet is switched on. Note:  is shown in the information display.






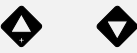


Switch the heating outputs ON/OFF

	Press the ‘Release heating system’ key.	For safety reasons, the user is asked again in the information display  , ‘Do you really want to release the heating systems?’
	Release the heating outputs	



Automatically after switching on

So that the heating outputs are automatically released after the control cabinet is switched on, a time must be set in seconds 1-60sec under the parameter  in the parameter level . If the control cabinet is switched on after this, the user has the opportunity to switch the heating outputs to “OFF” passive during the set time. After this time, the heating outputs are automatically set to “ON” active.

Time specification for the automatic “Release heating system”

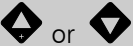



	Press the parameter function key.	The last selected parameter is shown in the information display e.g.  of the regulation ratio.
	Keep pressing the parameter function key until the parameter  ‘Release heating system’ appears in the information display.	The value for the selected parameter 0-60secs is shown in the zone displays.
	Approve input.	The green lamp on the key shines and all zones flash.
	Enter the value using the arrow keys.	Number from 000 to 060secs
	Confirm entry and quit.	The automatic release of the heating system function was activated by entering a value greater than 000secs.
	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds.

Switch off the heating outputs


	After switching off, the countdown of the set time starts.	During the countdown, there is a possibility of switching the heating outputs to "OFF" passive.
	Heating outputs are switched off.	

Switching between the actual value and control difference displays






In the zone displays, only the actual value can be shown in the basic level. However to see a quick overview, it is possible to switch to a display showing the control difference between the target value and actual value $\pm 100^{\circ}\text{C}$, instead of the actual value display.

 or 	Switch-over to the difference display  or the target value display 	$\pm 100^{\circ}\text{C}$ of the target value
--	---	---


Connecting diagnosis (only for the HR-D series)

The connecting diagnosis in the HR-D series checks the wiring of the heating connections for short circuits for every control zone. The diagnosis is only performed once before the heating output is switched on for the first time, e.g. control cabinet reset. This means it is also physically possible to recognise sensors connected to the heating system connections. If one error is recognised, the heating output is immediately switched off. An alarm display  (fuse alarm) is issued in the zone and an alarm message appears. The heating output is switched off for this zone. After the error has been rectified, the heating output first needs to be acknowledged before it can be released again.

Alarm acknowledgement


 	Press the status key; the current zone status is shown in the zone display.	The status of the zones is shown.
	The alarm is acknowledged with the input/enter key.	The heating output is released. No alarm messages appear any more.
 	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds

Monitoring heating currents


The heating current monitoring function monitors the heating outputs in relation to a target current value that needs to be set. If it is recognised that a current lies outside the target current alarm range (20%) when the heating outputs are **switched on**, an alarm is signalised. If a current is measured when the heating system is **switched off**, the heating output of the zone is switched off immediately. An error message for current when the heating system is switched off  is shown in the respective zone. After the error has been rectified, the alarm message needs to be acknowledged to release the heating output.


When the target current is at 0.0A, this means that the current monitoring is passive "OFF". The smallest current value that is recorded is 0.2A. The current tolerance is set ex-works at 20%.

ACTUAL current value

	Press the current function key; the actual current value is shown in the zone displays.	Display value 00.0 – 99.9A
---	---	-------------------------------

Target current value

	Press the current function key; the actual current value is shown in the zone displays.	Display value 00.0 – 99.9A
---	---	-------------------------------

	The saved current target value is shown.	Display value 00.0 – 99.9A
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Target current specification

The target current value can be entered


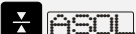



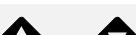



- ✘ automatically (by using the actual current value) or
- ✘ manually in the parameter **ASOL**.

Automatic current acceptance




In this method, the actual current values that are determined during measuring are saved as the target current values. The heating outputs need to be set as released!

	Press the current function key; the actual current values are shown in the zone displays.	
	All zones are switched on briefly one after each other; the measured actual current is then saved automatically as the target current.	AIST is shown again after the target value has been saved.
	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds

Manual input of the target current value

	Press the current function key; the actual current values are shown in the zone displays.	
	The saved target current value is shown.	
	Select required zone using the four arrow keys (cursor control).	
	Acknowledge selected zone	
	Approve input.	The green lamp on the key shines and all zones flash.
	Select required value.	Change the value quickly ◀ plus ▶ to increase ▶ plus ▶ to reduce
	If necessary, select further zones and enter target current value.	
	Confirm entry and quit.	The entered value is stored.
	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds.

I- Acknowledge the alarm



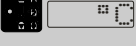
	Press the status key; the current zone status is shown in the zone display.	The status of the zones is shown.
	The alarm is acknowledged with the input/enter key.	The heating output is released. No more alarm messages will appear.
	Return to basic screen (ACTUAL value display).	The system automatically returns to

the basic screen after
approx. 180 seconds





Leakage current display (only for the HR-D series)

The leakage current can be shown as a complete actual value or separately for each control zone. When shown for each zone, only the currently measured zone is active during the measuring process.


Complete leakage current display

	Press the current function key; the actual current values are shown in the zone displays.	
	The whole momentary leakage current is shown.	Range 000 – 999mA
	Return to basic screen (ACTUAL value display).	The system automatically returns to the basic screen after approx. 180 seconds

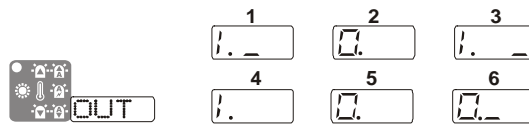
Leakage current per zone

	Press the current function key; the actual current values are shown in the zone displays.	
	The whole momentary leakage current is shown.	Range 000 – 999mA
	Start measuring the leakage current for each zone.	The leakage current for each zone is shown.
	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds

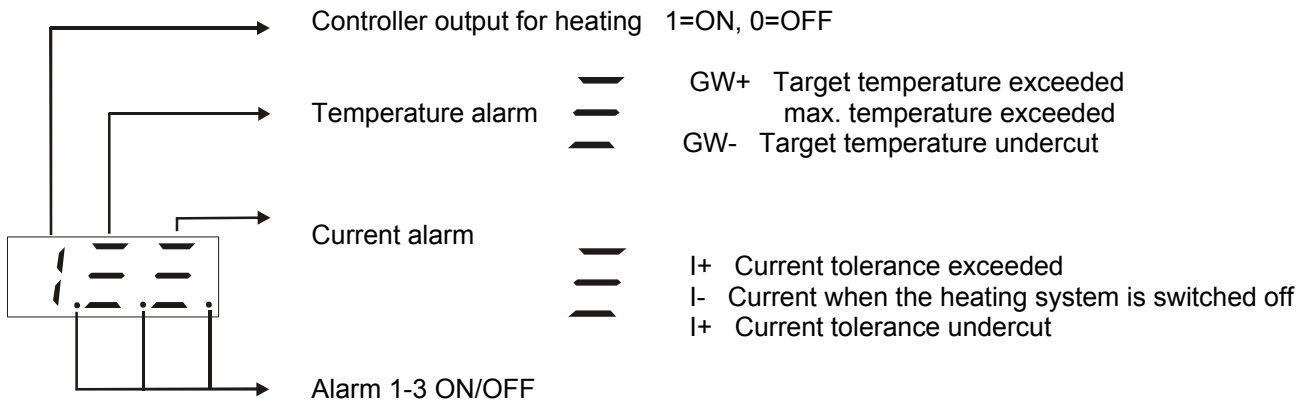
Status display

After the status key  is pressed, information about the status of the control zones is displayed in the zone displays. It includes information about the


- ✘ temperature tolerance level alarms,
- ✘ current alarms
- ✘ status of the alarm outputs and
- ✘ status of the control outputs






Explanations of the information in the zone displays:

















Process control function

The process control function allows changes in the control process to be recognised quickly and reliably for every zone. These changes occur e.g. when the tool has a leak and splashes. The control behaviour is monitored for all control zones during production. If changed control behaviour is recognised, an alarm message is issued and  for process alarm is shown in the zone. The alarm message can be acknowledged. Once the cause of the changed control behaviour has been rectified, the alarm becomes active again immediately.






If however the control behaviour has changed significantly due to production reasons, the new process behaviour can be accepted by entering a code number.

The process control function is activated by the parameter  for process tolerance. When the value is set to 000, the function is switched off. In the process tolerance parameter, settings are made to define how large the change in control behaviour can be before an alarm message is issued. Practical experience has shown that a setting of 010% is expedient for standard applications. After the start,  (process) is shown in each zone to indicate that process monitoring is active. Once the operating target value has been reached, the process monitoring is automatically activated after a learning phase. To indicate that the monitoring function is now active for this zone,  is no longer shown.






Activation of the process control function

	Press the parameter function key.	The last selected parameter is shown in the information display e.g.  of the regulation ratio.
 . .  	Keep pressing the parameter function key until the parameter  is shown in the information display.	The value per zone for the process tolerance is shown in the zone displays.
 	Enter the % value using the arrow keys.	010% is sufficient for standard applications.
   	If necessary, select further zones and enter target current value.	
 	Confirm entry and quit.	The process control function for this zone was activated by the input of a value >000%.

Acknowledgement of the process alarm

 	Press the status key; the current zone status is shown in the zone display.	The status of the zones is shown.
	The alarm is acknowledged with the input/enter key.	The heating output is released. No more alarm messages will appear.
 	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds.

Accepting new process parameters

  	Press both function keys and keep pressed until  appears in the information display .	The code number  is displayed in a zone display
---	---	--



Enter the code number 305 using the arrow keys.

305




Confirm entry and quit.




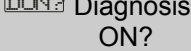


The new process parameters are accepted for all zones.

Mold Check Function (only for the HR-D series)


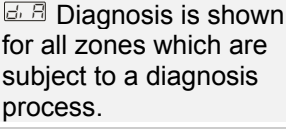

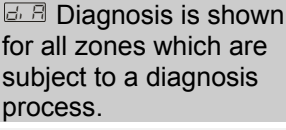

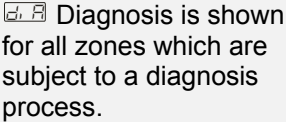

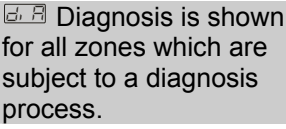

The Mold Check function is used to check the connected heating system and sensors for wiring errors, connected output and leakage current. After the checking phase, the individual test results are shown in the zone display fields. To identify any leakage current in each control zone, these are heated to approx. 70°C. The heating outputs do not need to be released for the diagnosis.

The test results of those control zones in which no diagnosis can be performed are marked in the zone display field with a dash .










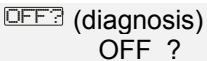
Caution: For reasons of safety, the recognition of sensors' reverse voltage in a control zone will automatically lead to the interruption of the Mold Check function! Rectify the error and restart the function.

  	Call up the Mold Check function by pressing both functions keys.	
 	Start the Mold Check function. For information purposes, the Diagnosis ON field will flash until the start of the first diagnosis.	

Diagnosis_process

	Wiring diagnosis	
	Current diagnosis	
	Temperature increase (time) diagnosis	
	Zone diagnosis	
	End of diagnosis	All zone displays are empty




Diagnosis results

	Wiring diagnosis result No display, no wiring faults detected. FUS display (safety alarm), a fault was found on the heating system connection in this zone.	
	Leakage current diagnosis result Value 000 – 999mA	
	Sensor reverse voltage result No display, sensors are OK. Reverse voltage is shown with a Fp sensor reverse voltage.	
	Sensors results No display, sensors are OK. Fb display, for sensor failure and/or no sensors connected. Digits 1 – n, shows the position of the mistaken sensors. 888 display, no temperature increase recognised in the given testing time.	
	Measuring current when the heating system is switched on Value 00.0 – 99.9A	
	Measuring current when the heating system is switched off Value 00.0 – 99.9A	
  	Quit Mold Check function by pressing both function keys.	





Regulation mode

In the case of defective sensors, it is possible to continue operating zones in the Regulation mode. If the system is changed from the Control mode to the Regulation mode, a determined regulation ratio is shown. This value is created from the last scanning steps and can be accepted. After the Regulation mode is activated, the corresponding zone display no longer shows the actual temperature value but the set regulation ratio. If at least one zone is in the Regulation mode, the LED on the regulation ratio key will shine. The regulation ratio is a value between 0 and 100% which states the percentage of the output at which the zone is operated.













There are two ways of activating the Regulation mode and entering the regulation ratio in %.

- ✘ via the regulation ratio function key 
- ✘ via the parameters  Regulation mode and  regulation ratio in the parameter level. (see parameter level)









Regulation mode – operation via the function key

 	Press the function key.	The system switches to the regulation ratio display in the zone displays
 	Press the target value key.	A regulation ratio is shown in the zone displays which are in Regulation mode.

Switching the Regulation mode on and off

 	Select the Regulation mode function	ON/OFF is used in the zone displays to show whether the zone is in Regulation mode or not
   	Select the zone in which the Regulation mode should be activated / deactivated.	Selected zone flashes
	Approve input.	The green lamp on the key shines.
 	Switch the Regulation mode on and off	ON / OFF
	Confirm the input	The LED of the  key shines to indicate that the Regulation mode is active in one zone.
	Switching from Regulation mode to regulation ratio display.	The current regulation ratio is shown in zones with active Regulation mode.

Regulation ratio input

   	Select zone.	Selected zone flashes.
	Approve input.	The green lamp on the key shines.
 	Select the regulation ratio.	000 -100%
	Confirm input.	






Return to ACTUAL value display.

The set regulation ratio is shown for zones with active Regulation mode.




Recipe – function

The HR/HRD has 8 permanent memory spaces for saving zone-specific settings (recipes / menus). The memory spaces are marked **R1** to **R8**. The setting data can be saved, deleted, locked or loaded. Locked recipes are still available; they are just secured against unintentional loading.





Save recipe

 Save R1	Press the 'Save Recipe' function key.	In the information display, 'Save' and the first memory space R1 is shown alternately.
 R1 - R8	Select the memory space via the four arrow keys.	
 R5*	Save the recipe under the selected memory space.	A star is used to indicate that the memory space is occupied.





Load recipe

 Load R1	Press the 'Load Recipe' function key.	In the information display, 'Load' and the first memory space R1 is shown alternately.
 R1 - R8	Select the memory space via the four arrow keys.	Only memory spaces are shown in which a recipe has been saved.
 R5*	Load selected recipe.	

Delete recipe

 Save R1	Press the 'Save Recipe' function key.	In the information display, 'Save' and the first memory space R1 is shown alternately.
 CLR R1	Press one of the keys until 'CLR' (Clear) for deleting is shown.	
 R5*	Select the memory space that needs to be deleted using the arrow keys.	
	The recipe is deleted by pressing both keys.	

Lock recipe

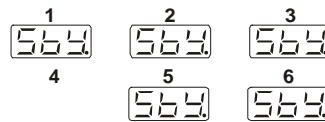
 Save R1	Press the 'Save Recipe' function key.	In the information display, 'Save' and the first memory space R1 is shown alternately.
 Lock R1*	Press one of the keys until 'Lock' for locking the recipe is shown.	
 R5*	Select the memory space that needs to be deleted using the arrow keys.	
 R5 L	The memory space / recipe are locked by pressing both keys.	The memory space is marked with an "L" for lock.

Standby

Temperature reduction which involves reducing the existing operating target value by a temperature set in the parameter **250L** under the parameter level **P**. The reduction function and the temperature reduction value, which is set **relatively** to the operating target value, can be selected individually per zone. At a setting of **000°C**, this function is switched off for this zone.

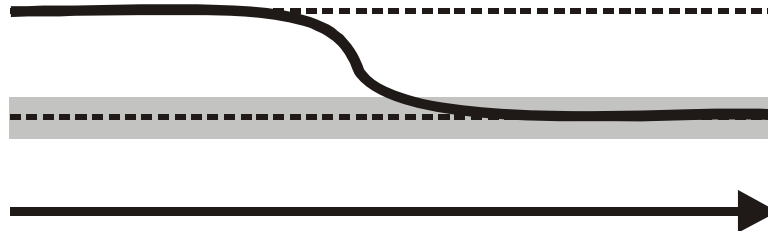
Press key

In all zones in which a reduction value has been set, the temperature of the operating target value is reduced by this value. To indicate that the **Standby function** is activated, the LED in the Standby key will shine. Also **SBY** Standby will be shown in cycles in the activated zones.



Operating target value

Standby reduction

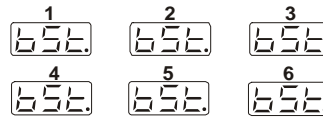


Boost

Temperature increase which involves increasing the existing operating target value by a temperature set in the parameter **BSOL** under the parameter level **P**. The increase function and the temperature increase value, which is set **relatively** to the operating target value, can be selected individually per zone. At a setting of **000°C**, this function is switched off for this zone. For safety reasons, the defined temperature is restricted to **50°C**. The temperature increase can be linked to a defined time in conjunction with the Start-up mode (see Start-up mode).

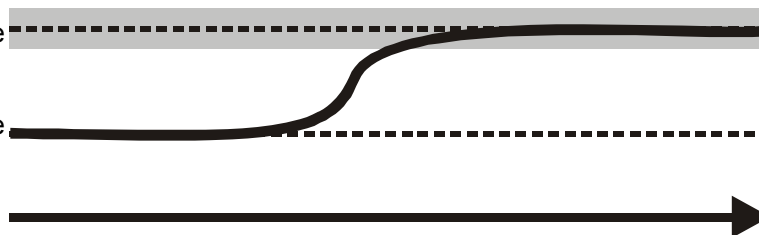
Press key

In all zones in which an increase value has been set, the temperature of the operating target value is increased by this value. To indicate that the **Boost function** is activated, the LED in the Boost key will shine. Also **BST** Boost will be shown in cycles in the activated zones.



Boost Increase

Operating target value



Acknowledge alarm

	<p>Press the status key and the current zone status is shown in the zone display.</p>	<p>The statuses of the zones are shown.</p>
	<p>The alarm is acknowledged by pressing the input/enter key.</p>	<p>The heating output is released. No more alarm messages will be shown.</p>
	<p>Return to basic screen (actual value display).</p>	<p>The system automatically returns to the basic screen after</p>

Load shedding


In case of errors, the control cabinets are fitted with an automatic load-breaking function **per zone**. The load-breaking function (heating systems are disconnected from the voltage) is always initiated,

- ✘ if an actual temperature is higher than the maximum target value and/or the measuring range of the thermo-element

The sensor range for thermo-elements of the type Fe CuNi is 500 °C. If the maximum target temperature is exceeded, AL for temperature alarm is shown cyclically in the respective zone display. The alarm message is saved and needs to be acknowledged.

- ✘ if a "Current alarm when the heating system is switched off" is recognised

In case of a short-circuit in the servo component, the system is continuously heated independent of the controller. The hot runner tool is overheated and at the very least the production results are impaired.

To recognise a "Current when heating system is OFF", the malfunction alarm message  also flashes in the status display of the respective zone.









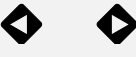




Pilot zone operating mode


In addition to the Regulation mode, it is also possible, in the case of a sensor failure, to control a zone with a defective sensor by means of a zone with a functioning sensor ("Pilot zone").

This function has benefits compared to the Regulation mode because, in contrast to the Regulation mode in which a permanent regulation ratio is constantly issued, in the pilot regulation zone the external influences are taken into consideration.

In the pilot zone operating mode, the zone number of the zone with the defective sensor is entered under the parameter **NrFZ**; this is then used to continue controlling the zone.

Select pilot zone

	Press the parameter function key.	The information display shows the last selected parameter e.g.  of the regulation ratio.
 ..  	Keep pressing the parameter function key until the parameter number pilot zone is shown.	
	Select the zone that should be guided using the four arrow keys (cursor control).	
	Approve input.	The green lamp on the key shines and all zones flash.
	Enter the zone number of the pilot zone using the four arrow keys.	Number from 000 to 999
 	If necessary, select further zones and enter the values.	
 	Confirm entry and quit.	The zone is guided by the pilot zone by issuing a pilot zone number.
	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds.

To indicate that a zone is in the pilot zone mode,  for pilot path is shown in this zone. It is also possible for several zones to be guided by one zone.

Regulation ratio amplification for pilot zone

If the regulation ratio issued by the pilot zone is too high or too low to keep the zone at the required processing temperature, the regulation ratio can be increased or decreased in 1% steps by means of an amplification factor for a zone that is allocated to a pilot zone.


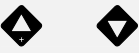


In the parameter level, select the parameter for amplification of the pilot zone K-FZ and the corresponding zone that was allocated to a pilot zone and enter the required amplification in %.

Range : -100...100%

- ✘ 000%; no amplification
- ✘ -001... -100%; of the regulation ratio issued by the pilot zone is reduced.
- ✘ 001...100% ; of the regulation ratio issued by the pilot zone is increased.

Input function code

By means of the function codes, complex system or process-specific functions that simplify handling can be initiated for all zones.

















	Press both function keys and keep pressed until Code , appears in the information display.	The code number 000 is shown in a zone display
	Enter the code number, e.g. 305, using the arrow keys.	
	Confirm entry and quit.	The new process parameters are accepted for all zones.

A table of all important function codes

Code number	Function
30	Direct switching to °C
31	Direct switching to °F
200	Lock operation via operating and display unit
201	Unlock operation via operating and display unit
305	Accept process parameters
440	Acknowledge alarm status/all alarm outputs
600	Start the diagnosis function: Allocation of heating system/sensors
602	Acknowledge check functions and delete alarms
759	Load factory settings for the controllers
769	Load saved customer configuration
770	Save customer configuration
950	Load standard parameters
999	Reset control cabinet

Parameter level

Configuration and process parameters to which no function key has been allocated are summarised in the parameter level.

	Press the parameter function key.	The information display shows the last selected parameter e.g.  of the regulation ratio.
 . .  	Press the parameter function key until the required parameter e.g.  is shown in the information display.	The zone displays show the value of the selected parameter for each zone.
	Select the required zone via the four arrow keys (cursor control).	
	Approve input.	The green lamp on the key shines and all zones flash.
	Enter the value via the four arrow keys.	Number from 000 to 999 or ON / OFF
	If necessary, select further zones and enter values.	
 . .  	If necessary, select further parameters e.g. pilot zone number	The zone displays show the value of the selected parameter for each zone.
 	Confirm entry and quit.	The process control function for this zone was activated by the input of a value >000%..
	Return to basic screen (actual value display).	The system automatically returns to the basic screen after approx. 180 seconds.

List of the parameters summarised below the Parameter key.

The list also shows the ex-works settings of the parameters.

Parameter	Parameter designation	Value range	Unit	Standard value
STGR	Regulation ratio	000...099	%	000
STBE	Regulation mode		on/off	off
GW-	Tolerance limit	000...999	°C/°F	005
GW+	Tolerance limit	000...999	°C/°F	005
2SOL	2nd target value	000...999	°C/°F	100
3SOL	3rd target value	000...999	°C/°F	000
ANFB	Start-up mode		on/off	On
ANFZ	Start-up time (Start-up mode)	000...099	min	015
AFZ3	Start-up time 3rd target value	000...099	min	000
DIAT	Time for the diagnosis function	000...999	min	002
ARMP	Automatic temperature ramp		on/off	off

K-FZ	Amplification pilot zone	100%-100%		000
NrFZ	Number of the pilot zone	000...256		000
ZONE	Zone active/ passive		on/off	on
ADR	Control cabinet address	000...128		000
H-FR	Release heating system	000...060	seconds	000
PTOL	Tolerance process	000...100	%	000
ZADR	Zone address	000...256		001

STGR	Displays the required percentage of the supplied output for the temperature regulation for each zone. This value can only be changed manually in the Regulation mode. The regulation ratio can also be entered using the function key % .
STBE	Switches from Regulation to the Control mode (manual mode). If temperature regulation (with sensors) is switched to Regulation mode (manual mode), the regulation ratio display/parameter shows a regulation ratio determined from the last scanning steps. The Regulation mode can also be operated using the function key % .
GW-	Temperature tolerance by which the target value may be undercut without triggering the alarm message.
GW+	Temperature tolerance by which the target value may be exceeded without triggering the alarm message.
2SOL	Standby/reduction value by which the operating target value in the Standby/reduction mode is reduced.
3SOL	Boost/temperature increase value by which the operating target value in the Boost/increase mode is increased. The input value is limited to 50°C.
ANFB	Switches the start-up mode per zone ON/OFF.
ANFZ	The defined start-up time per zone is the time in which the zone is held at the permanently defined Start-up target value of 100° after the control cabinet is switched on.
AFZ3	Defined Start-up time 3 (Boost-time) for each zone is the period of time during which the zones are in the Boost function/time increase. The defined time means that the zones are automatically controlled to the increased operating target value " Boost mode " after the Start-up mode.
DIAT	Defined diagnosis time for each zone is the time that specifies how long the system will wait (input value always > 000 minutes) for a reaction (change of temperature) during the diagnosis function " Allocation of sensors to the heating system ".
ARMP	Switches the automatic ramp function ON/OFF.
K-FZ	Amplification factor pilot zone. If the regulation ratio of the selected pilot zone is too large or too small, it is possible make specifications so that the regulation ration of the guided zone can be changed compared to the pilot zone.
NrFZ	The zone number of the pilot zone is entered in the pilot zone.
ZONE	Zone ON/OFF; when the zone is OFF/passive, the monitoring functions are also switched off and the zone display is switched off.
Adr	Interface control cabinet address.
H-FR	Define heating release time is the settable time in which the heating outputs are switched off / are passive after the HR cabinet is switched on. After this time, the heating outputs are switched ON/active.
PTOL	Process tolerance 000% function passive, 001 – 100% tolerance range how far the control process can change before an alarm message is triggered.
ZADR	Zone address for numbering the control zones when several temperature control cabinets are switched together; starting with address 001 for the first control zone.

Function descriptions HR/HRD

Start-up mode

The Start-up mode is used for gentle heating up (drying out damp). It controls the connected control zone for the duration of the given Start-up time to a target value of 100 °C.

After the end of the Start-up time, the system is controlled at the set final target value. The Start-up mode is started every time that the HR is switched on if the Start-up mode itself is switched on and the conditions for the Start-up mode are satisfied. The Start-up time is only started when the actual values of all zones have reached the target value in the temperature range of the two tolerance limit alarms at least once. This guarantees that all zones are oriented on the "slowest" zone even during the Start-up mode.

Conditions for the Start-up mode after the control cabinet has been switched on

- ✘ Start-up mode switched on
- ✘ Start-up time >0 minutes
- ✘ Target value >100 °C
- ✘ Actual value < 90 °C

The parameters for the Start-up mode are in the parameter level:

- ✘ ANFB Start-up mode on / off
- ✘ ANFZ Start-up time 0...99 minutes

Start-up mode with Boost function

For rapid heating of the tools during commissioning, it is possible to start up at increased target value for a given time with if the material used allows this (Boost function). The Boost function can be activated manually via the switch on the control cabinet or automatically by defining a time.

The automatic Boost function is linked to the Start-up mode. After the end of the Start-up mode, the system is automatically controlled to the higher Boost target value 3SOL.

Conditions for the performance of the Boost function after switching on the control cabinet are

- ✘ Start-up mode activated
- ✘ 3rd target value > 0 °C
- ✘ Start-up time 3 > 0 minutes

The parameters for the Boost function are in the parameter level

- ✘ 3SOL 3rd target value (target value for the Boost function)
- ✘ AFZ3 Start-up time 3 (time for which the Boost function should be active)

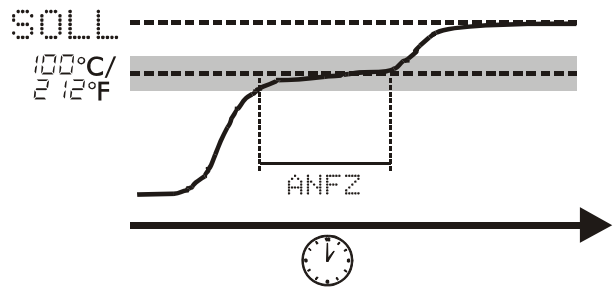


Figure: temperature curve of the Start-up mode

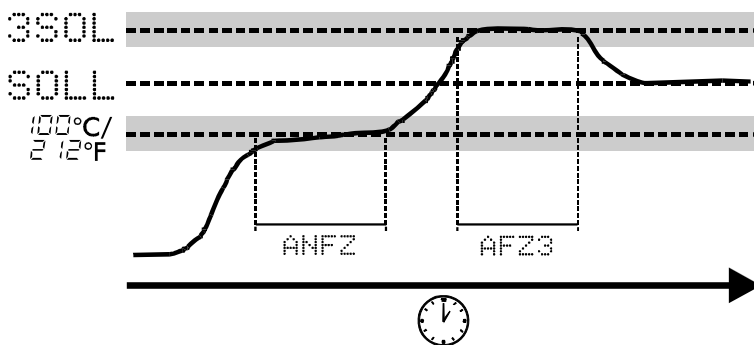


Figure: Temperature curve: Start-up mode with Boost function

Automatic ramp functions

In the ramp function, the target value is not changed abruptly to the pre-selected final target value, it is reached gradually starting from the current actual value. The temperature ramp function prevents e.g. mechanical tension caused by different temperature potentials within a hot runner. These temperature differences result from different increase speeds from e.g. distributors and nozzles.

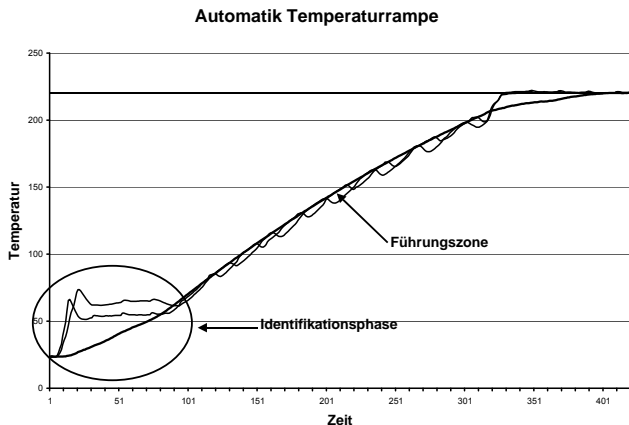


Fig.: Temperature curve for heating up process with automatic ramp; identification is performed

As it is usually very difficult for the operator to estimate the increase speed, the HR has an automatic ramp function. This function is switched on by means of the parameter ARMP.

This function allows the temperature controller to independently identify the zone with the lowest increase speed and to control all zones evenly to the set target values. This happens independently of the current actual values, i.e. any control zones that are already pre-heated and at higher temperature levels wait for the remaining zones so that they can be heated up together in a controlled manner. By means of the target value increase speed, all zones are oriented on the "slowest" zone.

The automatic ramp function can then also be used if a new tool is connected to the control cabinet whose control parameters first need to be determined by the HR during the heating-up phase.

ADVICE

The automatic ramp function is particularly beneficial if zones with different increase speeds are heated up together. In this case, the controller calculates the increase speed and adjusts the increase speed of all zones to the slowest zone.

If there are several zones with low increase speeds (e.g. distribution beam), please only select one of these zones for the group of zones in the automatic ramp function. This will guarantee the shortest possible heating period and an optimum controlling quality.

Monitoring the heating current

For the HR function, the focus is less on exact measuring of the current and more on the heating current monitoring function. The following are important

- ✘ monitoring of the function of the heating element within defined tolerance limits
- ✘ rapid recognition and reporting of defective heating systems
- ✘ rapid recognition and reporting of defective servo components.

The following table is a summary of the different statuses which may occur during the monitoring of heating current.

Controller output	servo component (SSR)	Strom	Alarm	Situation
OFF	OFF	NO	NO	Normal
ON	ON	YES	NO	Normal
ON	ON	YES	YES	Heating current is outside the tolerance limits "Current alarm for heating system ON"
ON	ON	NO	YES	Heating element or power supply is interrupted
ON	OFF	NO	YES	Servo component does not switch, SSR may be defective
OFF	ON	YES	YES	Servo component short-circuit "Current alarm for heating system OFF"
OFF	OFF	YES	YES	Leakage current

Diagnosis function "Allocation of the sensors / heating system"

The control cabinet has a function for checking the allocation of the sensors to the heating systems. The function can be used to determine whether sensors and heating systems are wired as allocated.

The function uses the configuration parameter **DIAT** (diagnosis time) and sets a testing time for specific zones. The testing time defines the time in which a reaction to a regulation ratio input is expected.

To ensure an optimised diagnosis process, the diagnosis function should be performed when the control zones are cold.

- ✘ Set the target value of the zone to one value less than the actual value and $> 0^{\circ}\text{C}$.
- ✘ Check the configuration parameter **DIAT**.
- ✘ Passive zones are not taken into consideration during the diagnosis.

The diagnosis function always runs right to the end. It is only quitted if an increase in temperature is recognised at a regulation ratio of 0%, i.e. there is a defect on one servo component which could lead to overheating of the control zone.

The testing routine is started by entering the code number 600 and runs in two phases:

Phase 1: Complete check of all zones together

In phase 1 the regulation ratios

- ✘ of all active zones,
- ✘ whose target values are $> 0^{\circ}\text{C}$

are set to 0% and all actual values are observed. The message **dE** is shown in the zone displays of the zones that are taken into consideration for the diagnosis process. The zone displays of the other zones remain dark.

If the actual value of any zone in the testing time increases by at least 5°C , the zone display of this zone will alternately show **dE** and **BBB** and the testing routine is completely stopped. **The stopped testing routine must be acknowledged with the code number 602.**

Phase 2: Individual check

After the conclusion of phase 1 (that lasts for as long as the value set under **DIAT**), each zone is checked separately. Each zone is checked one after another.

To do this, the regulation ratio of a zone is set to 100% and observed to see whether a temperature increase of 5°C is recognised within the set testing time **DIAT**. The message **dE** is shown in the zone display of the operating and display unit BA.

After all zones have been checked individually, the result of the diagnosis for the zone is shown immediately in the respective zone display. **dE** (diagnosis result) and a figure are shown alternately from which the diagnosis result can be derived very easily:

Message	Explanation
dE / 0	No error detected: Zone o.k.
dE / 1...32	Error: Sensors connected to the wrong zone. The sensor of this zone is connected to the channel whose number is shown alternately in the display.
dE / -1...-32	Error: Sensor of this zone is connected to the channel whose number is shown alternately in the display, and is also reverse voltage. If the same number as the zone itself is shown the zone display (e.g. 02 for Zone 2), the sensor is connected to the right zone but is reversed voltage.
dE / 777	Error: No temperature increase detected in the set diagnosis time DIAT. Increase the diagnosis time and repeat the diagnosis.
dE / 999	Error: Sensor failure
dE / BBB	Error: Temperature increases although regulation ratio output 0%.

After the end of the diagnosis, the testing routine with the code number 602 needs to be acknowledged. The testing routine is stopped with the same code number.

Self-diagnosis

The **HR** has a self-diagnosis program that continuously checks for system malfunctions after the **HR** has been switched on.

Diagnosis sequence after switching on

- BOOT The system software is started.
- Lamp test All display segments are controlled.
- RUN The control cabinet software is started.
- SCAN Checking of the internal components connected to the BA (operating/display unit).

SCAN – description

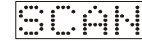
SCAN appears in the information display. The first six zone displays on the left next to the information display are controlled in series from top to bottom.

000 or 001 appear in the displays.

000 – control card cannot be addressed/does not exist.

001 - control card can be addressed.

The first five displays from the top relate to the control cards 1-5 depending on the type of HR zone. The 6th display is the ventilation control that is always required from HR 12 onwards.



Version History

Version	Date	Changes
2.00.06	02/05/2010	Pages tightend; dependent on version 2.00.05 11/2009