JCT
Analysentechnik GmbH

Installation and Operating Instructions
HT55 electronic thermostat
Version Software V1.4

Contents

1. Safety
This chapter provides important information about the safe operation of your HT55 and the use of these instructions.

1.1 Intended Usage
The HT55 is a microprocessor-based temperature regulator for industrial applications intended for installation on standard rails inside a switchgear cabinet or junction box. This configurable regulator is used to impose control, according to the parameters set, on manufacturer-approved heating elements (resistive loads) with defined sensors.

1.2 Non-intended usage
All usage outside the scope of those described in Point 1.1 are non-intended usage and may be hazardous and/or lead to consequential damage.

1.3 Operator
Installation, electrical connection, commissioning, operating and maintenance of the HT 55 may only be performed by trained professionals who have been authorised or instructed for these activities by the operating authority.

1.4 Safety-relevant notices
Safety notices in this guide are marked by symbols. These notices are placed immediately before the procedure step to which they apply and must be followed precisely in order to avoid hazardous situations for persons and property damage to objects.

The following pictograms are used to call attention to notices:

Attention ! is used to call attention to potential health hazards or lethal situations.

Note ! is used for notices which, if disregarded, could result in failures during operational processes.

Tip ! is used to provide advice or additional information.

1.5 Liability exclusion
We herewith expressly serve notice that Hillesheim is not liable for any damage resulting from incorrect or negligent operation, maintenance or non-intended usage. This also applies to device modifications, attachments and conversions which could be detrimental to safety. In these cases the manufacturer's warranty is voided.

2. General

2.1 Unpacking and inspecting
The product must be inspected for possible shipping damage when it is unpacked. If damage is found then the freight carrier, railway company or postal authority is to be notified so that a damage report can be initiated.

2.2 Standards and regulations
This product complies with the following national and European regulations:

The "Electromagnetic compatibility" directive (89/336/EEC and 93/68/EEC)

The "Low voltage equipment" directive (73/23/EEC und 93/68/EEC)

2. Important Information – please read before operating

Under the EMC Directive 89/336/EEC, this device represents only a component in a system. Following connection of a heating system, the EMC Directive 89/336/EEC requires a new EMC check. We would like to point out that the person putting the system into operation is required to comply with these guidelines according to Directive 89/336/EEC.
We have suppressed this device according to practical measurements so that there should be no EMC interference when operating with ohmic consumers / heating equipment.
Where an electrical heating system or heating device is planned to be operated in an unsupervised mode (night operation), we would point out the German Federation for the Electrical Industry (VDE) regulations (Safety in Electrical Heating Systems DIN EN 60619-2 [VDE 0721 Part 411]) and the provisions of the industry associations, which in such cases require thermal monitoring (or a thermal limiter) or a fail-safe construction. In such cases, please contact HILLESHEIM.

4. Mounting

The device is designed as standard for mounting on a 36 x 7.5 mm mounting rail per EN 50022. The build-in width is 70 mm. Please note that when using the internal triac, unhindered heat dissipation for the mounted cooling element must be provided for. The maximum connected rating for both triacs is 1200W (ED 70%) and can be divided as required. Please note the enclosed connection diagram.
This means that the device can be easily built into distribution boxes and switch cabinets. Cases in IP65 can be ordered as accessories. Furthermore, these cases may be equipped with multi-pole sockets matching our complete heating systems (heating hoses, heating collar…).

Electrical connection
Electrical connection is by way of screw terminals for wire cross sections of up to max. 1 x 2,5 mm^2 and must be carried out according to the enclosed connection diagram. The generally accepted technical rules, VBG 4, especially the low-voltage guidelines (DIN-VDE 0100...), and accident prevention regulations are to be observed. Mounting and set value may only be carried out by specialists or trained persons.

5. Functional overview

Suitable for thermocouples and PTC resistors.

- 2 x 16A switching relay to control 230 VAC heating voltage 2 x 1500 Watt.

- 2 internal triacs for switching at zero crossing of the 230 V heating voltage 2 x 600 Watt.

- 2 outputs to activate solid state power relays for switching at high ratings.

- 1 alarm relay with DC decoupled contact for high/low temperature alarm.

- Version available for DC supply voltages of 24VDC (+/- 10%), respectively, protected against polarity reversal.

- Version available for AC supply voltages 230 V (OPTION) 115V.

- Heating channels can be switched off to operate as a 1-channel controller.

- Operating mode controller / limiter

- Safe operation mode by connecting the relay in series before the triac control to switch off on fault alarm.

- LED display of set and actual values. Scan operation between channel 1 and channel 2.

- Self-optimisation of control parameters for rapid adjustment to ambient conditions.

- Supply terminals also available as plug-in version.

- 2 independent 4-20 mA inputs for external setpoint entry for both channels (OPTION)

Digital display - 1 digit:
Displays the current channel number in normal operation and the menu number during set value. The decimal point flashes when displaying the menu number.

Digital display - 3 digit:
Displays the current set value or actual value as well as other default values.

Key functions:

▼   DOWN: To switch between the menu items and to adjust numerical values downwards.

↘   ESC: To exit the menu to the next level up.

▲   UP: To switch between the menu items and to adjust numerical values upwards.

↵   ENTER: To go to the menu level and the selected menu, and to confirm entries.

Menu functions:

Menu 1: Channel 1 On/Off	Display: *I. On* for on and *I. OFF* for Off.
Menu 2: Channel 2 On/Off	Display: *2. On* for on and *2. OFF* for Off.
Menu 3: Channel 1 Low temp. alarm	Display: *I. L10* (Low alarm 10°C from set value)
Menu 4: Channel 1 High temp. alarm	Display: *I. H10* (High alarm 10°C from set value)
Menu 5: Channel 2 Low temp. alarm	Display: *2. L10* (Low alarm 10°C from set value)
Menu 6: Channel 2 High temp. alarm	Display: *2. H10* (High alarm 10°C from set value)

Menu 7: Sensor type Channel 1   Display: *1.F J* for Channel 1 Fe-CuNi type J sensor
                                                   Display: *1.C r* for Channel 1 Ni-CrNi sensor
                                                   Display: *1.P I* for Channel 1 Pt-100 sensor
                                                   Display: *1.n I* for Channel 1 Ni-120 sensor

Menu 8: Sensor type Channel 2   Display: *2.F J* for Channel 2 Fe-CuNi type J sensor
                                                   Display: *2.C r* for Channel 2 Ni-CrNi sensor
                                                   Display: *2.P I* for Channel 2 Pt-100 sensor
                                                   Display: *2.n I* for Channel 2 Ni-120 sensor

Menu 9: Operating mode   Display: *S u r* for controller/limiter operating mode
                                                     Display: *H A L* for 2-channel triac control with relay switch-off
                                                     Display: *A u r* for 1-channel triac control with two sensors
                                                     Display*: *S P r* for 1 channel triac-special control with two sensors (Software V1.3)
                                                     Display*: *S.1 S* for relay switching control with 10-sec. interval
                                                     Display*: *S.2 S* for relay switching control with 20-sec. interval
                                                     Display*: *S.3 S* for relay switching control with 30-sec. interval

Menu 10: Self-optimisation K1 ("Enter" key starts the optimisation process)
Menu 11: Self-optimisation K2 ("Enter" key starts the optimisation process)
Menu 12: Channel 1 P value
Menu 13: Channel 1 I value
Menu 14: Channel 1 D value
Menu 15: Channel 2 P value
Menu 16: Channel 2 I value
Menu 17: Channel 2 D value
Menu 18: Ambient temperature
Menu 19: Maximum temperature setting (reference value limit)
Menu 20: Factory settings menu (activating the Enter key restores all setting menus to the factory setting "RESET")

* These menu items are not available for devices with Air software.

Normal operation:
In normal operation the current actual temperature for channels 1 and 2 are displayed alternating. The decimal point flashes beside the displayed channel number for the channel switched on. To change the current set value, e.g. for channel 1, press the "DOWN" key once. The decimal point goes out and the display now shows Channel 1 and the current set value. The set value can now be changed with "UP" or "DOWN". Then store the set value by pressing "ENTER". Proceed in the same way for channel 2, beginning by pressing "UP" once.

After confirming the set value, the decimal point flashes again and the controller displays the actual value for channels 1 and 2 alternating. The controller is now in normal operating mode again.

Setting the controller

This opens access to the starting point for the menu selection level.
Press "ESC ↘" until the display blinks <u>once</u>, (lock-up occurs again at the second blink).

Only now is it possible to use "Enter ↵" to gain access to the menu selection level. Once all settings have been made completely, close this level again by one long activation of "ESC ↘", to avoid inadvertent re-access. You can also switch off the regulator. When it is switched on again the menu selection level will automatically be locked.

Switch on channel 1 or 2: (in menu 1 and 2)

Channels 1 and 2 are initially switched on depending on whether the device is to be used as a single or two-channel temperature controller.
Press "ENTER" once. You are now in the menu selection level.
(18 different menus can be selected using "UP" or "DOWN").
The first menu is displayed with the number 1. The decimal point is off.
(Channel one is switched "ON" or "OFF" accordingly in this menu).
Confirm the selection of menu 1 by pressing "ENTER" again once. Thus you go to the menu and you can now set channel 1 by pressing "UP" or "DOWN" once.
(While you are in a menu the decimal point flashes beside the menu number)
Then confirm your entry by pressing "ENTER" once. The set value will be stored and you automatically return to the menu selection level.
Proceed in the same way for channel 2, here you select menu 2.

Setting alarms: (example: low temperature alarm, channel 1, in menu 3)

Select menu 3 (1 x ENTER and 2 x "UP") and enter (1 x ENTER").
A "Low" value of 10 °C is displayed. This can be adjusted between 5 and 20. The value relates to the current set value concerned.
Example: You set 10 degrees. The current set value is 150 °C. An alarm will now be triggered on a temperature drop to 140 °C (the same applies to the respective high temperature alarm).
After setting the alarm limit, confirm this again (1 x "ENTER"). Your entry will be stored and you return automatically to the menu selection level.
Please note: An alarm can only be switched off by increasing the value concerned to more than 20°C.
Proceed in the same way to set the remaining alarm limits. (See **menu functions 4-6**).

Setting sensor for channel 1 and 2: (menu 7 and 8)

Select menu 7 (1 x "ENTER" and 6 x "UP") and enter it (1 x "ENTER"). Now select the corresponding sensor using "UP" or "DOWN" and confirm by pressing 1 x ENTER.
(See menu functions 7 and 8). Proceed in the same way for the channel 2 sensor by selecting menu 8.

Setting operating mode: (Menu 9)

Switch to menu 9 as above (1 x "ENTER", 8 x "UP", 1 x "ENTER").
Various operating modes are now available, which will be described in more detail here.

S u r : Safety relay and control with triac.
In this operating mode, the controller channel 1 is used as additional monitoring for control (channel 2). The set limit values work across all channels. This means that in the event the channel 1 sensor signals a faulty temperature, both load switching relays K1 and K2 are switched off. Control channel 2 will be switched off.
The solid state output 1 is connected functionally in parallel to both relays K1 and K2.
Both internal triacs and the solid state output 2 are connected functionally in parallel and function as control output for channel 2. Any fault on channel 1 will also generate a continuous alarm signal in addition to switching off the relays. The alarm can only be turned off and the channels switched on again by acknowledgement of the alarm after correcting the fault. Press the ESC key once and then switch both channels on again.
Channel 1 shows the high temperature limit for control channel 2. Example: Set value K2 is 100 °C, the high value of K1 is set at 15 °C. Thus, 115 °C is displayed for channel 1, while K2 shows the current actual temperature. Using the Down key, the actual value for channel 1 can also be checked.

H A L : Semiconductor control with internal triacs.
In this mode, the internal triacs are used to <u>independently</u> control both channels. These switch at zero crossing of the supply voltage. The solid state outputs are connected functionally parallel to the respective triacs. Thus, the solid state outputs can be used to activate external semiconductor relays for higher ratings.
In this mode, the load switching relays also function as protection relays and can thus be used to switch off the heating voltage in the event of a fault. In the event of a fault, these remain switched off until the fault is corrected and acknowledged. In this mode, both channels work absolutely independent of one another. For example, in the event of a fault in channel 2, channel 1 can continue to work "uninterrupted" and vice versa.

A u r : Monitor and control with the channel 2 internal triac.
This mode is intended for special applications for which two sensors are used to control a temperature because of process-specific circumstances.
Example: Medium heating by means of a heating system with integrated sensor and a subsequent sensor in the medium.
In this example, the medium's temperature is controlled in the hose behind the heating system with the help of the external sensor (channel 2 sensor and triac). The special feature is the fact that thermal coupling between heating and sensor, which makes control possible in the first place, only exists as long as the medium flows.

If the flow is interrupted, this would normally lead to overheating of the heating system. However, here the sensor in the heating system is used to now adjust the temperature to the set value in "standby operation". As the internal sensor in the heating system will cool down and can thus not be applied to measure the medium temperature generated, control is only possible with an external sensor.

Summary:
Medium flowing: Controller takes over control with external sensor (channel 2).
Medium stopped: Sensor K2 cools down. Heating system is kept at standby temperature by the internal sensor.

In this mode, the solid state output 1 and the load switching relays K1 and K2 are also switched on when channel 2 is switched on. The solid state output and the relay only switch off in the event of a fault or by manually switching off. The alarm relay K3 will be switched off when the High alarm value is exceeded until the temperature has dropped again. There is no permanent cut-off. The display shows the cut-off temperature for channel 1 and the actual temperature for channel 2 alternating. The set value for channel 2 can be checked with the "Up" key and the actual value of channel 1 with the "Down" key.

S P r : single channel regulation which accommodates a second maximum Actual temperature (software V1.3)
(not available for L versions!)
In this operational mode the channel 1 sensor is used to capture an additional Actual value for channel 2 regulation. Two different reference values can be set. The reference value/sensor for channel 1 is to be set or mounted in a heater-oriented manner. The reference value/sensor for channel 2 takes over the actual regulation and is to be set or mounted in a processor-oriented manner (e.g. in medium). The regulating output is channel 2. Preset regulation parameters effect only this output. Channel 1 is always set to "off" for this operational mode.
This mode can be used to monitor heating systems during the heating element warm-up time (reference value 1) and, at threshold temperature, be regulated according to the process or medium (reference value 2).

Solid-state output 2 is connected in parallel with triac 2 and operates as the regulation output for channel 2.
Both Actual values are displayed alternately. The maximum permissible temperature at the heater element is set as the reference value for channel 1. The alarm signal output uses the channel 2 reference value, the process temperature. For channel 2, this connection corresponds to the HAL mode.

S. 1 S : **S**witching control with load switching relays at **1**0 **s**ec. interval.
In this mode, the load switching relays K1 and K2 are used to control the temperature. The time between switch on phases can be minimum 10 sec.
The internal triacs and the solid state outputs remain switched off in this mode.

S. 2 S : **S**witching control with load switching relays at **2**0 **s**ec. interval.
In this mode, the load switching relays K1 and K2 are used to control the temperature. The time between switch on phases can be minimum 20 sec.
The internal triacs and the solid state outputs remain switched off in this mode.

S. 3 S : **S**witching control with load switching relays at **3**0 **s**ec. interval
In this mode, the load switching relays K1 and K2 are used to control the temperature. The time between switch on phases can be minimum 30 sec.
The internal triacs and the solid state outputs remain switched off in this mode.

Self-optimisation: (Menü 10 und 11)

Important: Self-optimisation cannot be employed in the S P r operational mode.

For self-optimisation, the channel concerned must first be switched off. The set value for the respective channel must be set at the operating set value for which the parameters should be optimised. The heating system must be "cold" so that the controller can determine the heat-up rate. The system will heat up to 80% of the set value with 100 % heating performance. It is then automatically controlled to the set value with the optimised parameters. On very slow heating systems a subsequent fine tuning by hand can lead to a further improvement

Please note: Depending on the operating mode selected, start-up of the optimisation process may take up to 30 sec.

Start the respective self-optimisation process in menu 10 or 11 with (1 x "ENTER"). In addition to the actual temperature, the controller now indicates that the self-optimisation process is running by the decimal point flashing behind the actual value. During this process the corresponding temperature monitor is switched off. This process can take a few minutes. At the end of the process, the control parameters are set in the heating system connected to achieve a control behaviour as even as possible. However, a manual correction can be made at any time in the respective menus.

Reference value limit: (Menu 19)
This menu can be used to set the maximum reference value setting limit. Due to design requirements, standard regulator maximum values are limited to 250°C and devices with Air software to 125°C. This stage can be lowered to any value beneath this limit in order to prevent subsequent improper settings in normal operation.

4-20 mA inputs for external set value (OPTION)
During normal operation, a control current of 4-20 mA (0.8 - 4V) can be connected via a 3-pole optional plug terminal 25, 26, 27 (same type as 12-pole terminal) to change the set value for the respective channel. Here, the controller reacts automatically when the 4 mA threshold is reached at the input. In this condition, the set value can no longer be adjusted via the keypad. Depending on the controller version, a control current of 4-20 mA per channel corresponds to a set value of 0-100 % of the set value range of 0-125 °C or 0-250 °C.

Terminal assignment:
Terminal 25: Input 4-20 mA (positive potential) for channel 1.
Terminal 26: GND reference ground for both inputs.
Terminal 27: Input 4-20 mA (positive potential) for channel 2.

Internal measuring resistor: 200 ohms per channel.

The device detects and displays various faults:
*ER1* **:** Sensor failure
ER2 **:** Sensor short-circuit (only for PTC sensor).
*ER3* *:* High temperature on channel 1 in SUR operation.
The channel number shows the respective channel. The error message appears in the upper 3-digit display.

On switching on the controller, the low and high temperature alarm function is only activated once the respective set temperature is reached for the first time. On adjustment of the set temperatures during operation, the alarm detection is switched off and again only activated when the new set value is reached. A high or low temperature only causes the alarm relay to drop out for the time that the respective limit is exceeded.

6. Writing diagram
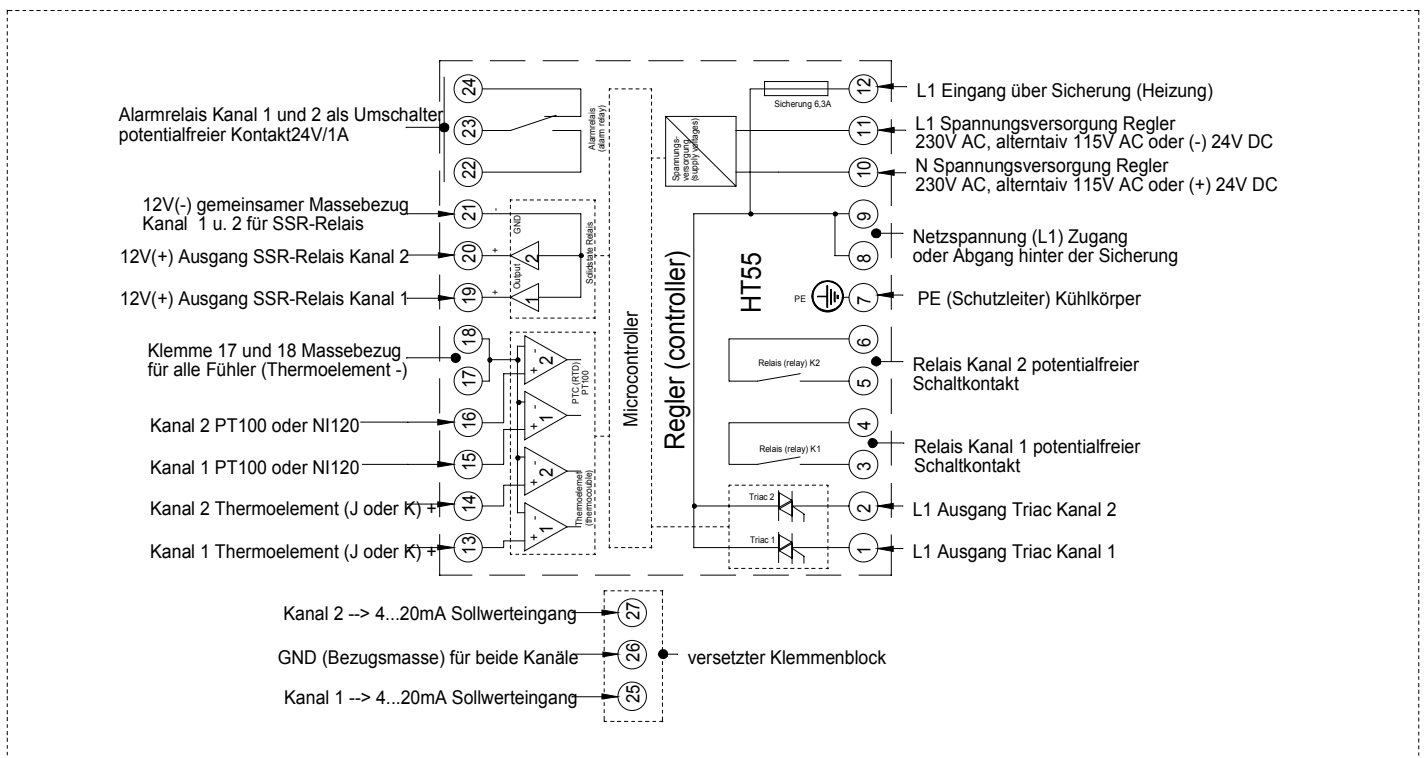
7. Dimensions
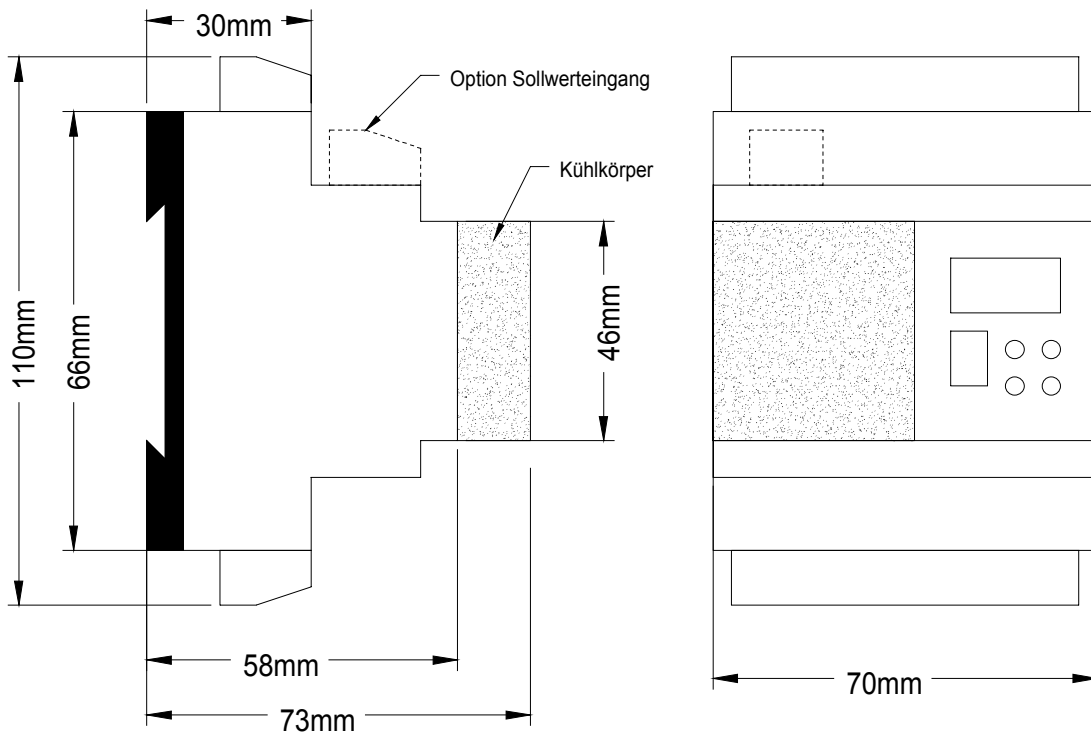
8. Special notices

Special notice HT55H (complete device with 2 flanged sockets)
This device is permanently set to H A L mode, it is controlled by an internal triac. Emergency shutoff is wired by way of the K1/K2 relay. Two loads, having a combined power rating of 1200 W (5.2 A current switching), can be connected to each regulator device. The combination can be arranged freely.
The settings may not be changed.

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Depending on selection, the probes are positioned and wired. Among other changes, a different probe selection requires a change in the wiring. Incorrect connection can lead to the destruction of the connected load. If alternative flange sockets are attached at the customer's request, their layouts are to be taken from the order confirmation.

Contact layout:
|			
1 & 2	=	L	heater
3 & 4	=	N	heater
5 (+)	=	sensor	regulator
6 (-)	=	sensor	regulator
PE	=		heater

Special notice HT55H-D3 (complete device with 1 flanged socket)
This special version switches the heater circuit by way of internal relays K1 and K2 connected in series. The operational mode is set to S.10 (10 second relay circuit) and may not be changed. This configuration allows the sensors to be set to different temperatures. Channel 1 is used to monitor the heater (sensor at hose inlet). Channel 2 regulates the temperature at the hose outlet.

Contact layout:
1 = L	heater	
2 = N	heater	
3 = PT100	monitor	channel 1
4 = PT100	monitor	channel 1
5 = PT100	regulator	channel 2
6 = PT100	regulator	channel 2
PE	heater	

Special notice HLD55-... (single channel, 25 A current switching, terminal connections or HANQ5)

HT55 in HAL mode built into a small distribution box with terminal connections. Channel 1 is wired for regulation by way of an SSR (solid-state relay). Alarm relay and sensor connections are brought out to terminals (2.5 mm²). The load circuit (L) is connected via 4 mm² terminals. The N and PE connections are made
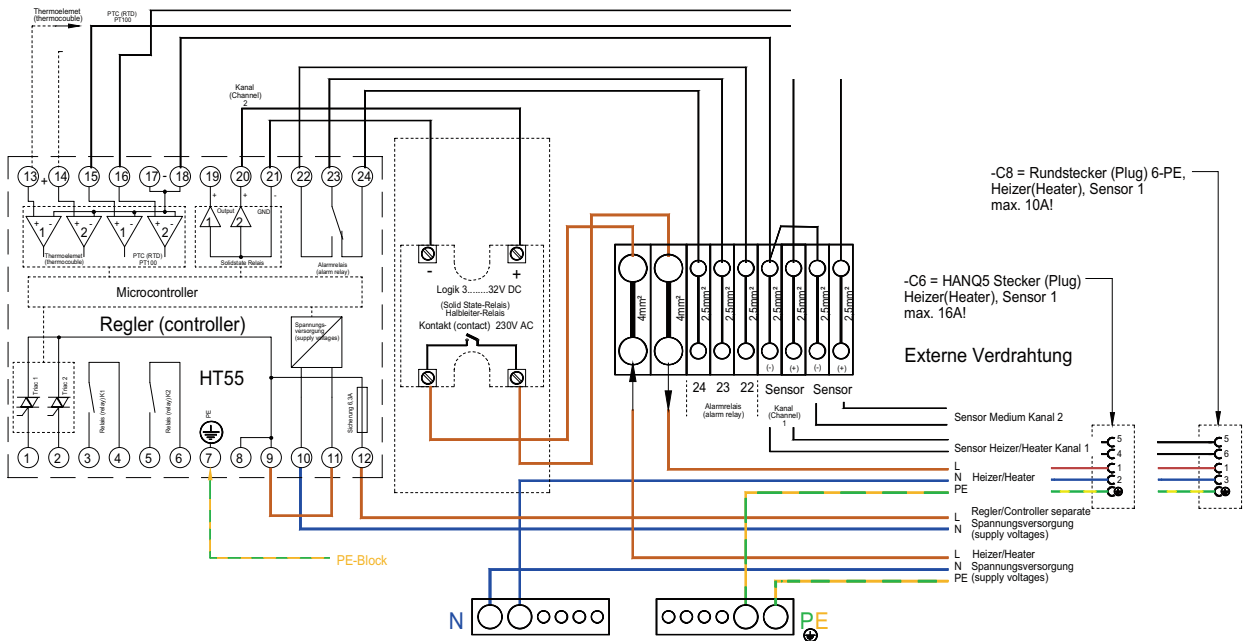
9. Disposal

Packaging
Materials used to package the device for transport are to be disposed of in an environmentally-friendly manner by giving them to the appropriate local disposal facilities.

Device components
Defective components are to be collected and disposed according to applicable regulations. The same applies to the device itself.

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