

INSTRUCTION MANUAL



Controller N322

Description



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Foreword

Dear customer,



We thank you for having purchased the Controller N322 and we are very glad that you decided to buy a product of **B+B Thermo-Technik GmbH**. We hope this product will fully satisfy you and will assist you effectively in your work.

This Device has been developed to be technically highly up-to-date and has been designed in accordance with the prevailing European and German national directives and rules. For a proper and effective usage of the product the customer shall observe the following Operating Instructions. In the case that against one's expectations any trouble occurs which you can not resolve yourself, please contact our service centers or our authorized dealer. We will provide you rapid and competent help to minimize the risk of long time outfalls.

The following operating Instruction is an indispensable part of this Product. It contains important advices for the starting up and further use of the device.

General Information



This Operation Manual is intended to serve as an aid in the proper setup, installation and operating of the B+B product.

All essential details of the equipment and all actions required on the part are clearly presented and explained. We thus ask that you read this manual carefully before proceeding to work with the equipment. Keep this manual available for ready reference in a convenient and conspicuous location near the equipment.

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Symbols Employed

Sign	Meaning	Notice
	Advice	It is necessary to read the following advices before using the product. The used symbols in the manual acts first of all as eye catcher for security risks. The symbols do not replace the security advices. The text must be read completely.
	Necessarily to observe	This symbol designates important advices and tips which are necessary for the success of a procedure. They have to be followed in order to get good results.

Warning Signs

Warning Signs	Meaning
	This symbol advises the user of danger for persons, material or environment. The text gives information that must be necessarily followed to avoid any risks
	Caution against hot surfaces (BGV A8, GUV-V A8/W26) and hot liquids or substances
	Caution against liquids and hot substances
	Caution against dangerous explosive substances (BGV A8, GUV-V A8/W02)
	Caution against moving machines (W29) Caution against moving parts
	Caution against electromagnetic fields (BGV A8, GUV-V A8/W12)
	Caution against severe cold (BGV A8, GUV-V A8/W17)
	Caution against dangerous high electrical voltage (BGV A8, GUV-V A8/W08)
	Caution against dangerous explosive atmosphere (BGV A8, GUV-V A8/W21)
	Electronic waste

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Safety Instructions



For damages caused by failure to observe these safety and operating instructions, B+B Thermo-Technik GmbH assumes no liability for damages.

This device has been designed and tested in accordance to the safety regulations for electronic devices. However, its trouble-free operation and reliability cannot be guaranteed unless the standard safety measures and special safety advises given in this manual will be observed when using it.

Trouble-free operation and reliability of the device can only be guaranteed if it is not subjected to any climatic conditions than those stated under "Specifications".

If the device is transported from a cold to a warm environment condensation may result in a failure of the function. In such a case make sure the device temperature has adjusted to the ambient temperature before trying a new start-up.

If device is to be connected to other devices the circuitry has to be designed most carefully. Internal connection in third party devices (e.g. connection GND and earth) may result in not-permissible voltages impairing or destroying the device or another device connected.

Warning:



Only devices with mains input: If the device is operated with a defective mains power supply (e.g. short circuit from mains voltage to output voltage) this may result in hazardous voltages at the device (e.g. at sensor socket)

If there is a risk whatsoever involved in running it, the device has to be switched off immediately and to be labeled accordingly to avoid re-starting. Operator safety may be at risk if:

- There is visible damage to the device
- The device is not working as specified
- The device has been stored under unsuitable conditions for a longer time

In case of doubt, please return device to manufacturer for repair or maintenance.

Caution:



Do not use these product as safety or emergency stop devices, or in any other application where failure of the product could result in personal injury or material damage. Failure to comply with these instructions could result in death or serious injury and material damage.

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Intended Use



The use of the unit in fields other than those indicated under “SAFETY INSTRUCTIONS” is not allowed for safety reasons.
This instruction manual does not at all substitute any additional instruction manuals of connected accessories!

Disposal



This unit has been marked in accordance with the European Directive 2002/96/EC on waste electrical and electronic equipment (WEEE).
At the end of its useful operating life, dispose of the unit as electrical scrap.
Please ask either **B+B Thermo-Technik GmbH** or your specialist dealer for information on your local collection point.
Within the scope of application of this Directive, **B+B Thermo-Technik GmbH** is responsible for proper disposal of this unit.

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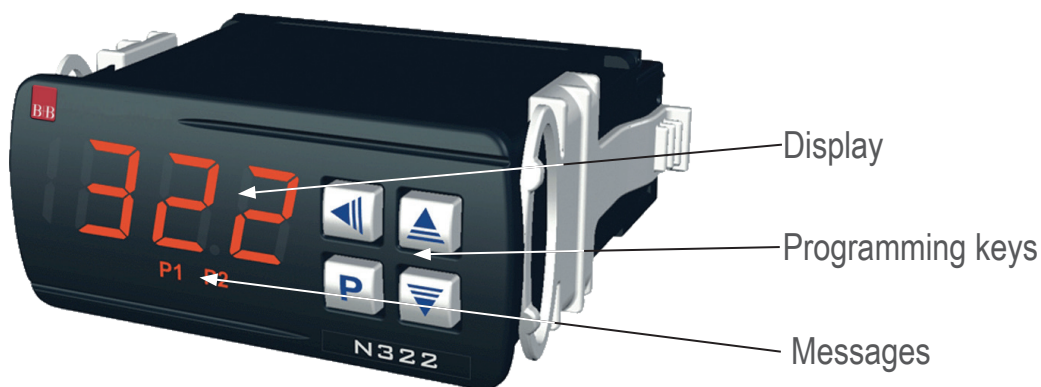
1. Product Description



The N322 is a 2-output digital electronic controller for heating and cooling applications. It is available with input sensor, Pt1000 and NTC thermistor. Sensor offset correction is provided. The 2 independent outputs can be used as control or alarm. The features of a particular model (input sensor type, sensor range, mains supply, etc) are identified by the label placed on the controller body.

1.1. Scope of Delivery

Article Name	Article Number	Description
Controller N322	0556 0109 xxx	1 x Controller N322, 1x User Manual on CD



1.2. Options

Artikelname	Artikel Nummer
Controller N322 for Pt1000	0556 0109
Controller N322 for NTC 10K incl. Probe (-50 to +120°C)*	0556 0109-01



*0556 0109-01 incl. NTC 10K Probe

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1.3. Identification



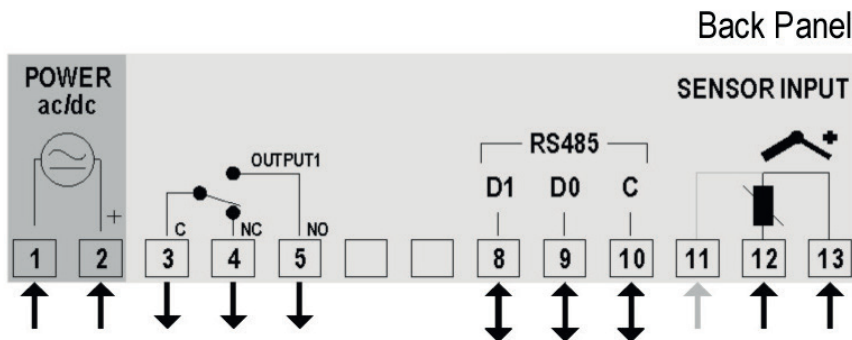
The identification label is located on the housing of the controller. Verify that the properties described comply with your application. The following controls can be found on the device front-panel of the controller.

1.4. Description of the buttons on the front of the Controller

-  Programm-key (P)
-  Back-key (R)
-  Up-key
-  Down-key

1.5. Terminals

The figure below shows the controller connections to sensor, main and outputs on the rear-panel.



Pt1000 with 3 conductors: Terminals 11, 12 and 13 must have the same wire resistance for proper cable length compensation. For 2 wire Pt1000, short circuit terminals 11 and 12.

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2. Operations

The controller requires the internal parameters to be configured according to the intended use for the instrument. The parameters are organized in 4 groups or levels:

Level	Function
0	Measurement
1	Setpoint setting
2	Configuration
3	Calibration

Upon power-up, the N322 RHT display shows for 1 second its firmware version. This information is useful when consulting the factory. Then, the measured variables by the sensor are shown on the display. This is the parameter level 0 (measurement level).

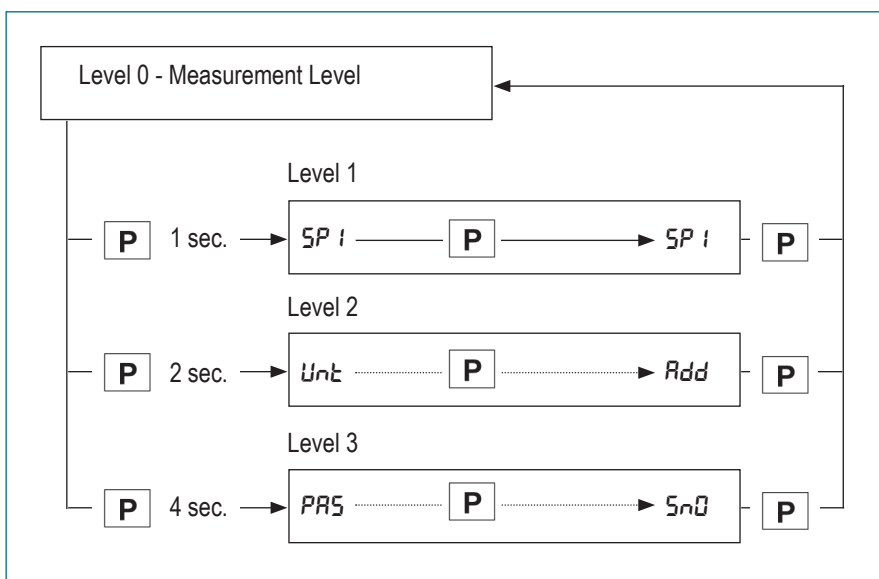
To access level 1, press **P** for 1 second until the *SP 1* message shows up. Pressing **P** again shows *SP 2*. Pressing **P** again to go back to level 0.

To access level 2 of parameters, press **P** for 2 seconds until the *Unit* message is shown. Release the **▲** key to remain in this level. Each new pressing on the **P** key will advance to the next parameter in the level. To return to the previous parameter in the actual level press once the **◀** key. At the end of the level, the controller returns to the first level (0). Use the **▲** and **▼** keys to alter a parameter value.

To access level 3, press **P** for 4 seconds until the display shows *PRS*. Each new pressing on the **P** key will advance to the next parameter in the level. At the end of the level, the controller returns to the first level (0). Use the **P** and **▼** keys to alter a parameter value. The level 3 should be accessed only by experienced personell.

Notes:

1. A parameter configuration is saved when the **P** key is pressed to advance to the next parameter in the cycle. The configuration is stored in a non-volatile memory, retaining its value when the controller is de-energized.
2. If no programm key is detected for over 20 seconds, the controller saves the current parameter value and returns to the measurement level.



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2.1. Level 1 - Setpoint Adjustment



In this level only the Setpoints ($SP\ 1$ and $SP\ 2$) parameter are available, alternating the name with its respective value. Adjust the desired setpoint temperature using the and keys.

Mode	Function
$SP\ 1$ (Set Point 1)	Setpoint adjustment for control OUTPUT 1. $SP\ 1$ value is limited to the values programmed in $SP\ L$ and $SP\ H$ in the programming level (Parameter configuration, level 2)
$SP\ 2$ (Set Point 2)	Setpoint adjustment for control OUTPUT 2. $SP\ 2$ value is limited to the values programmed in $SP\ L$ and $SP\ H$

2.2. Level 2 - Configuration - Parameters configuration Level

Contains the configuration parameters to be defined by the user, according to the system's requirements. Use and keys to set the value. The display alternates the parameter name and their respective value.

Level	Function
$Unit$	Temperature Unit: Selects display indication for degrees Celsius or Fahrenheit. C - Temperature in degrees Celsius F - Temperature in degrees Fahrenheit
oFS	Sensor Offset: Offset value to be added to the measured temperature to compensate sensor error
$SP\ L$	SP Low Limit: Lower range for $SP\ 1$ and $SP\ 2$. $SP\ L$ must be programmed with a lower value than $SP\ H$
$SP\ H$	SP High Limit: Upper range for $SP\ 1$ and $SP\ 2$. $SP\ H$ must be higher than $SP\ L$
$HY\ 1$	OUTPUT 1 Hysteresis: Defines the differential range between the temperature value at which the OUTPUT 1 is turned on and the value at which it is turned off. (In degrees)
$HY\ 2$	OUTPUT 2 Hysteresis: Defines the differential range between the temperature value at which the OUTPUT 2 is turned on and the value at which it is turned off. (In degrees)
$Rc\ 1$	Control action for OUTPUT 1: R - Reverse: For heating applications. Outputs turn on when temperature is lower than SP. D - Direct: For cooling applications. Output turns on when temperature is above SP.
$Rc\ 2$	Control action for OUTPUT 2 or Alarm functions: R - Reverse control action (heating) D - Direct control action (cooling) 2 - Low (minimum) temperature alarm 3 - High (maximum) temperature alarm 4 - Alarm for temperature inside a range 5 - Alarm for temperature outside a range 6 - Low temperature alarm with initial blocking 7 - High temperature alarm with initial blocking 8 - Inside range alarm with initial blocking 9 - Outside range alarm with initial blocking The section Working with the Controller describes how these functions work.
Cnt	Control - Sollwerte und Ausgänge 1 - Setpoint 1 is assigned to Output 1 and Setpoint 2 to Output 2 (factory setting) 2 - Setpoint 1 is assigned to Output 2 where as Setpoint 2 is directed to Output 1



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Level	Function
$oF1$ (Off time)	Off time: Defines the minimum oFF time for control Output 1. Once Output 1 is turned off, it remains so for at least the time programmed in $oF1$. This parameter is intended for refrigeration systems where longer compressor life is desired. For heating systems, program $oF1$ to zero. Value in seconds, 0 to 999 s.
$on1$ (On time)	On time: Defines the minimum on time for control Output 1. Once turned on, Output 1 remains so for at least the time programmed in $on1$. This parameter is intended for refrigeration systems where increased compressor life is desired. For heating systems, program $on1$ to zero. Value in seconds, 0 to 999 s.
$dL1$ (Delay 1)	Delay 1 - Delay time to start control: Upon power-on, control Output 1 is kept off until the time programmed in $dL1$ is elapsed. Its usage is intended to prevent multiple compressors to start simultaneously after the turn-on of a system with several controllers. Value in seconds, 0 to 250 s.
$oF2$	Off time: Defines the minimum oFF time for control Output 2. Once Output 2 is turned off, it remains so for at least the time programmed in $oF2$. For thermocouple inputs this parameter is not available. This parameter is intended for refrigeration systems where increased compressor life is desired. For heating systems, program $oF2$ to zero. Value in seconds, 0 to 999 s.
$on2$	On time: Defines the minimum on time for control Output 2. Once turned on, Output 2 remains so for at least the time programmed in $on2$. For thermocouple inputs this parameter is not available. This parameter is intended for refrigeration systems where increased compressor life is desired. For heating systems, program $oF2$ to zero. Value in seconds, 0 to 999 s.
$dL2$	Delay 2 - Delay time for Output 2 to turn on relative to Output 1. This parameter defines a particular working mode, typically used in multiple stage systems, where Output 2 is allowed to go on only if Output 1 is already on for at least $dL2$ seconds. Also, Output 2 is driven oFF whenever Output 1 goes off. $dL2 = 0$ disables this function. Value in seconds, 0 to 250 s.

2.3. Level 3 - Calibration Level

The controller is factory calibrated. The following parameters should be accessed only by experienced personnel.

To enter this cycle, the **P** key must be kept pressed for 4 seconds.

Don't press the and keys if you are not sure of the calibration procedures. Just press the **P** key a few times until the temperature measurement level is reached again.

Level	Function
$PR5$	Password: Enter the correct password to unlock write operations for the parameters in the following levels
CAL	Calibration low: Offset value of the input. It adjusts the lower measurement range of the sensor
CAH	Calibration High: Gain calibration. It adjusts the upper measurement range of the sensor
FAC	Factory Calibration: Restores factory calibration parameters. Change from 0 to 1 to restore the calibration parameters with factory values
PrL	Protection: Defines the parameter levels that will be password protected. See „Configuration Protection“ for details
PAC	Password Change: Allows changing the current password to a new one. Values from 1 to 999 are allowed
$Sn2$	Serial number: First part of the controller electronic serial number
$Sn1$	Serial number: Second part of the controller electronic serial number
$Sn0$	Serial number: Third part of the controller electronic serial number

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3. Working with the Controller



Multiple output controllers are suited for controlling multiple stage systems. Other applications require Output 1 to be the control output and Output 2 to be alarm. There are 8 distinct alarm functions implemented in Output 2, selected by the parameter RCZ , described below:

Mode	Function
2	Low alarm: Output 2 is turned on when the selected variable, as assigned for Output 2 in the CnE parameter, falls below the $SP2$.
3	High alarm: Output 2 is turned on when the selected variable exceeds the value programmed in $SP2$.
4	Inside range alarm: Output 2 is turned on when the selected variable is within the range defined by: $(SP1 - SP2)$ and $(SP1 + SP2)$
5	Outside range alarm: Output 2 is turned on when the selected variable falls outside the range defined by: $(SP1 - SP2)$ and $(SP1 + SP2)$

Functions 6, 7, 8 and 9 are identical to the above ones except that they incorporate the initial blocking feature, which inhibits the output if an alarm condition is present at start-up. The alarm will be unblocked after the process reaches a non-alarm condition for the first time.

In a multiple stage application, $SP1$ and $SP2$ are configured to operate at different settings, creating a progressive sequence for turning on the outputs (compressors or resistances) in response to a systems demand. The output delays for turning on the compressors ($dL1$ and $dL2$) cause the outputs to be turned on one by one, minimizing energy demand.

Another usage for multiple output controllers is in systems that require both direct and reverse actions (for cooling and heating, simultaneously, for instance.) In these applications, one output is configured as reverse action and the other as direct action. The output status leds P1 and P2 in the instrument panel signal the current action being performed.



3.1. Configuration Protection



A protection system to avoid unwanted changes to the controller parameters is implemented. The level of protection can be selected from partial to full. The following parameters are part of the protection system:

Mode	Function
PRS	When this parameter is presented, the correct password should be entered to allow changes of parameters in the following levels
PrL	Defines the level of parameters that will be password protected: 1. Only calibration level is protected (factory configuration) 2. Calibration and Configuration levels are protected 3. All levels are protected: Calibration, configuration and setpoints
PRC	Parameter to define a new password. The password is located in the calibration level, and can only be changed by a user that knows the current password. Valid passwords are in the range 1 to 999

3.2. Configuration Protection Usage



PRS-parameter:

PRS-parameter is displayed before entering a protected level. If the correct password is entered, parameters in all following levels can be changed. If a wrong or no password is entered, parameters in the following levels will be read only.

Important notes:

1. After five consecutive attempts to enter a wrong password, new tentative will be blocked for the next 10 minutes. If the current valid password is unknown, the master password can be used only to define a new password for the controller.
2. The password for a brand new device is 111.

3.3. Master-Password

The master password allows user to define a new password for the controller, even if the current password is unknown. The master password is based on the serial number of the controller, and calculated as following:

[1] + [higher digit of SN2] + [higher digit of SN1] + [higher digit of SN0]
for example the master password for the device with serial number 987123465 is: 1 9 3 6
as follows: $1 + 5n2 = 987$; $5n1 = 123$; $5n0 = 465 = 1 + 9 + 3 + 6$



How to use the master password:

1. Enter the master password value at *PRS* prompt.
2. Go to *PRS* parameter and enter the new password, which must not be zero (0).
3. Now you can use this new password to access all controller parameters with modify rights.

4. Error Messages



Sensor measurement errors force the controller outputs to be turned off. The cause for these errors may have origin in a bad connection, sensor defect (cable or element) or system temperature outside the sensor working range. The display signs related to measurement errors are shown below:

	Measured temperature exceeded maximum allowed range for the sensor. Broken Pt1000 or T/C . Short circuited NTC sensor.
	Measured temperature is below minimum measurement range of the sensor. Short circuited Pt1000 or T/C . Broken NTC .

5. Electrical Wiring

It is important to follow the recommendations below:



- Signal wires should be installed in grounded conduits and away from power or contactor wires.
- The instrument should have its own power supply wires that should not be shared with electrical motors, coils, contactors, etc.
- Installing RC filters (47 R and 100 nF, series combination) is strongly recommended at contactor coils or any other inductors.
- System failure should always be taken into account when designing a control panel to avoid irreversible damage to equipment or people.



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6. Technical Data

Properties	Values
Input Sensor	Pt1000 and NTC Note: In the controller with NTC input, a 3 m sensor-cable is bundled with the controller.
Measuring range	Pt1000 -200 to 530°C (-328 to 986°F)
Accuracy	Pt1000: $\pm 0,7^{\circ}\text{C}$ ($\pm 1,3^{\circ}\text{F}$)
Resolution	from -19.9 to 199.9°C display units with Pt1000 and NTC = 0.1
Output 1	Relay SPDT, 1 HP 250 V AC / 1/3 HP 125 V AC (16 A Resistive)
Power supply	100 - 240 V AC ($\pm 10\%$) or 24 V DC Mains frequency: 50-60 Hz, Power consumption: 5 VA Caution: Check the power supply specification before energizing the controller
Environment	Ambient temperature: 0 to 40°C (32 to 122°F) Storage temperature: -20 to 60°C (-4 to 140°F) Relative humidity: 20 to 85%, non condensing
Case	Polycarbonate UL94, V-2, Suitable wiring: up to 4,0 mm ² (AWG11)
Ingress Protection	Front panel: IP65, Housing IP42
Dimensions	74 x 32 x 75 mm
Warm-Up	15 minutes
CE-conformance	2014/30/EU
Electromagnetic conductivity	EN 61326-1

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7. Article Numbers

Article Number	Description
0556 0109	Controller N322 for Pt1000
0556 0109-01	Controller N322S for 2 x NTC 10K incl. probe

Questions

If you still have questions concerning this product of B+B Thermo-Technik GmbH, please do not hesitate to contact us at:

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We wish you a successful measuring!

Your Temperature-Partner
B+B Thermo-Technik GmbH

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