TEMPERATURE AND HUMIDITY CONTROLLER

N323RHT

OPERATING MANUAL - V1.8x A

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The 323RHT is a digital controller for relative humidity and temperature with three relay outputs configurable independently for control or alarm. Timer functions are available to all three outputs.

A Relative Humidity and Temperature 3-meter probe is bundled with the instrument. The sensor is protected by a polyamide capsule.

The features of a particular model (input sensor type, sensor range, mains supply, etc) are identified by the label placed on the controller body.

SPECIFICATIONS

INPUT SENSOR: Humidity measurement

Range: 0 and 100 % (RH) (see **Figure 01**);
Accuracy: See **Figure 01**; **Repeatability**: ± 1 % RH;
Hysteresis: ± 1 % RH;
Linearity error: << 1 % RH;
Stability: < 1 % RH / year;
Response time: 4 seconds in the range from 10 to 90 %, with slow moving air. Outside this range, up to 48 hours

INPUT SENSOR: Temperature

Accuracy: Refer **Figure 01**; **Repeatability:** ±0,1 °C;
Range: -40 and 120 °C (See **Figure 01**);
Response time: up 30 seconds in slow moving air;

WARM-UP: ..... 15 minutes

MEASUREMENT RESOLUTION: **RH:** ..... 1 %
T: .....0,1º de –19,9 and 119,9º

OUTPUT1: .....Relay SPDT; 1 HP 250 Vac / 1/3 HP 125 Vac (16 A Res.)
..... Optional: Pulse, 5 Vdc, 25 mA max.

OUTPUT2: .....Relay: 3 A / 250 Vac, SPST-NA

OUTPUT3: .....Relay: 3 A / 250 Vac, SPST-NA

POWER SUPPLY: Tension:.....100 to 240 Vac/dc ±10%
Optional: ..... 12 to 30 Vdc
Frequency:..... 50~60 Hz
Consumption: ..... 5 VA

Dimensions: Width x Height x Depth: .....74 x 32 x75 mm.
Weight: .....100 g
Panel cut-out: .....70 x 29 mm

Instrument operating environment: ..... 0 to 40 °C / 20 to 85 % RH

Probe operating environment: -10 to 100 °C / 0 to 100 % RH

Case: Polycarbonate UL94 V-2, Protection: Front panel: IP65, Box: IP42

Suitable Wiring: Up to 4.0 mm²; RS-485 digital communication; RTU MODBUS protocol (optional)

Serial interface not isolated from input circuitry.

Input circuitry isolated from power supply, except in the 24 V powered model.

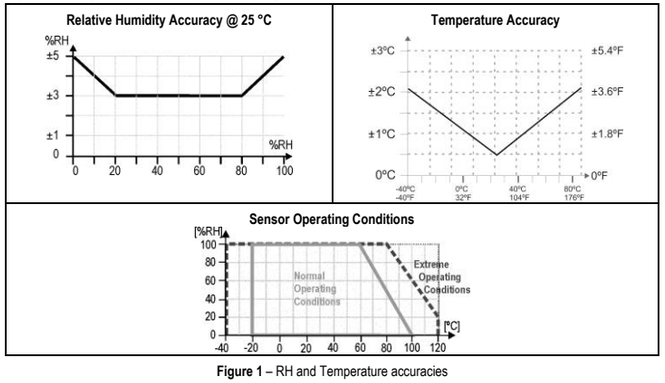


Figure 1 – RH and Temperature accuracies

IMPORTANT

The sensor used in this controller may be damaged or lose calibration if it is exposed to aggressive atmospheres with high concentrations as Chloride Acid, Nitride Acid, Sulphuric Acid or Ammonia. Acetone, Ethanol and Propylene Glycol may cause reversible measurement drifts.

Fine trimming in the indication of RH and Temperature are available at the parameters **0fk** e **0ft,** in the configuration level of parameters

ELECTRICAL WIRING

Figure 1 below shows the controller connections to sensor, mains and outputs.

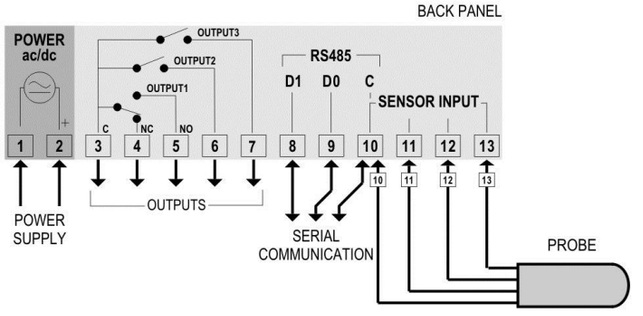


Figure 2 – N323RHT terminals – Relays share a common terminal (standard model)

* The serial communication interface is optional.

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 injury to people.

WORKING WITH THE CONTROLLER

OUTPUT1, OUTPUT2 and OUTPUT3 are the N323RHT outputs for control and alarm. Their respective setpoints are **SP1**, **SP2** and **SP3**. OUTPUT 1, OUTPUT 2 and OUTPUT 3 functions are independently configured by the parameters **a(1**, **a(2** and **A(3**, as follows:

0- Reverse control action.
Activates the corresponding OUTPUT when the process variable (RH or temperature) is **below the setpoint of** that output. Normally used for heating control.

1- Direct control action.
Activates the output whenever the process variable is **above the setpoint** for that output. The direct action is used for refrigeration control.

2- Low Alarm.
Minimum value alarm, indicates that the process value is **below the alarm setpoint** defined for the output.

3- High Alarm.
Maximum value alarm, indicates that the process is **above the alarm setpoint** defined for that output.

4- Low alarm with initial blocking.
Identical to the Low Alarm, with the addition of the initial blocking feature explained in Note 2 below.

5- High alarm with initial blocking.
I Identical to the High Alarm, with the addition of the initial blocking feature explained in Note 2 below

6- Inside Range Alarm.
Activates the output when the process variable is **within** the interval defined by:

(SP1 – SP2) and **(SP1 + SP2)** or **(SP1 – SP3)** and **(SP1 + SP3)**

7- Outside Range Alarm.
Activates the output when the process variable is **outside** the interval defined by:

(SP1 – SP2) and **(SP1 + SP2)** or **(SP1 – SP3)** and **(SP1 + SP3)**

8- Inside the range alarm with initial blocking.
Identical to the inside the range alarm with the addition of the initial blocking feature, describe in Note 2 below.

9- Outside the Range Alarm With Initial Blocking.
Identical to the outside the range alarm with the addition of the initial blocking feature,describe in Note 2 below

Note 1: The action modes 6, 7, 8 and 9 are available to OUTPUT 2 and OUTPUT 3 only. For OUTPUT 2 when **(NT** = 0, 1, 6 or 7. For OUTPUT 3 when **(NT** = 0, 2, 5 or 7.

Note 2: The **Initial Blocking** feature inhibits the alarm from being recognized if an alarm condition is present when the controller is first energized. The alarm will be enabled only after the occurrence of a non alarm condition followed by a new occurrence for the alarm.
The Initial Blocking is useful, for instance, when one of the alarms is configured as a minimum value alarm, causing the activation of the alarm soon upon the process start-up, an occurrence that may be undesirable.

Alarm Timer

The N323RTHT allows the configuration of timer functions to any alarm output. The available options are **delayed activation**, **one shot** (single pulse) and **repetitive pulses**. The mode of operation is defined by the parameters "**1t1**", "**2t1**", "**3t1**", "**1t2**" "**2t2**" e "**3t2**".**Table 1** shows these advanced functions. Times T1 and T2 can be programmed from 0 to 1999 **seconds**. Programming 0 (zero) in T1 and T2 disables the timer function

The display signs **P1**, **P2** and **P3** light to indicate an alarm condition. In the delayed mode, the corresponding sign flashed until the output is activated.

Timer function	T1	T2	ACTION
Normal Operation	0	0	Alarm Output / Alarm Event
Delayed activation	0	1 to 1999 s	Alarm Output, T2 / Alarm Event
One shot (single pulse)	1 to 1999 s	0	Alarm Output, T1 / Alarm Event
Repetitive pulses.	1 to 1999 s	1 to 1999 s	Alarm Output, T1, T2, T1 / Alarm Event

Table 1 – Timer Alarm Functions 1, 2 and 3

OPERATION

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	*Setpoints* Adjustment
2	Configuration
3	Calibration

Upon power-up controller, the N323RHT display shows for **1 second** its firmware version. This information is useful when consulting the factory.

Then, the temperature measured by the sensor is shown on the display. This is the parameter level **0** (Temperature Measurement Level).

To access level **1**, press **P** for 1 second until the "**SP1**" message shows up. To go back to level **0**, press **P** once more.

To access level **2** of paramenters, press **P** for **2 seconds** until the "**rkT**" message is shown. Release the **P** key to remain in this level. 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 ▲ and ▼ keys to alter a parameter value.

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 keyboard activity is detected for over 20 seconds, the controller saves the current parameter value and returns to the measurement level.

Level 1 – *Setpoints* Adjustment

This level contains the 3 setpoints, SP1, SP2 and SP3. They define the RH and the temperature for the process. The display shows the parameter name alternating with the current value. Set the desired value by pressing the keys ▲ and ▼.

SP1	Set point adjustment for control OUTPUT 1. The setting range is limited by the values

Set Point 1	in **SL1** and **Sk1** (these parameter belong to the configuration level)
SP2 ***Set Point 2***	Set point adjustment for control OUTPUT 2. The setting range is limited by the values in **SL2** and **Sk2.**
SP3 ***Set Point 3***	Set point adjustment for control OUTPUT 3. The setting range is limited by the values in **SL3** and **Sk3.**

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 respective value.

rkt *RH - Temp*	Defines how the variables, relative humidity and temperature, will be displayed: **0** Humidity **1** Temperature **2** Toggles the indications of relative humidity and temperature every 2 seconds. **3** Toggles the indications of relative humidity and temperature every 3 seconds. **4** Toggles the indications of relative humidity and temperature every 4 seconds. **5** Toggles the indications of relative humidity and temperature every 5 seconds. For options **0** and **1**, a fast click on the P, key forces the other variable to be displayed for 10 seconds.
Unt *Unit*	**Temperature Unit** – Selects display indication for degrees Celsius or Fahrenheit. **0** Temperature Celsius. **1** Temperature in degrees Fahrenheit
0fk *Offset Humidity*	**RH Offset** - Offset value to be added to the displayed relative humidity to compensate for sensor mismatches (when replacing a sensor, for instance). Adjustment range: between –10.0 and 10.0 % of RH. Default value: 0.0
0ft *Offset temperature*	**Temperature Offset** - Offset value to be added to the measured temperature to compensate for sensor mismatches. Adjustment range: between –10.0 and 10.0 % of RH. Default value: 0.0
Sl1 *SP Low Limit 1*	Lower limit value for **SP1** (minimum value with which **SP1** can be configured). **Sl1** must be programmed with a lower value than **sK1**.
Sk1 *SP High Limit 1*	Upper limit for **Sp1** (maximum allowed value for **Sp1**). **sK1** must be programmed with a value lower than the one configured in **sl1**.
Sl2 *SP Low Limit 2*	Lower limit value for **SP2** (minimum value with which **SP2** can be configured). **Sl2** must be programmed with a lower value than **sK2**.
Sk2 *SP High Limit 2*	Upper limit for **Sp2** (maximum allowed value for **Sp1**). **sK2** must be programmed with a value lower than the one in **sl1**.
Sl3 *SP Low Limit 3*	Lower limit value for **SP3** (minimum value with which **SP3** can be configured). **Sl3** must be programmed with a lower value than **sK3**.
Sk3 *SP High Limit 3*	Upper limit for **Sp3** (maximum allowed value for **Sp3**). **sK3** must be programmed with a value lower than the one in **sl3**.
Ac1 *Action 1*	Control action for OUTPUT 1: **0** Reverse: For heating or humidification. Outputs turn on when variable is lower than SP (See **(nt** parameter below). **1** Direct: For cooling or dehumidification. Output turns on when variable is above SP. **2** Low (minimum value) alarm; **3** High (maximum value) alarm; **4** Low alarm with initial blocking; **5** High alarm with initial blocking;
Ac2 *Action 2* **Ac3** *Action 3*	Control OUTPUT 2 and OUTPUT 3 action: **0** Reverse control action (heating or humidification). **1** Direct control action (cooling or dehumidification). **2** Low (minimum value) alarm. **3** High (maximum value) alarm. **4** Low alarm with initial blocking. **5** High alarm with initial blocking. **6** Alarm inside the range. **7** Alarm outside the range. **8** Inside the range alarm with initial blocking. **9** Outside the range alarm with initial blocking.
	10 Free Timer (available only for **AC3**); The section **Working With The Controller** describes how these functions work.
(nt *Control*	Sets the correspondence between the PV inputs (RH and Temperature) and the outputs. **0** OUTPUT 1 = RH; OUTPUT 2 = RH e OUTPUT 3 = RH **1** OUTPUT 1 = RH; OUTPUT 2 = RH e OUTPUT 3 = Temperature **2** OUTPUT 1 = RH; OUTPUT 2 = Temperature e OUTPUT 3 =RH **3** OUTPUT 1 = RH; OUTPUT 2 = Temperature e OUTPUT 3 =Temperature **4** OUTPUT 1 = Temperature; OUTPUT 2 = RH e OUTPUT 3 = RH **5** OUTPUT 1 = Temperature; OUTPUT 2 = RH e OUTPUT 3 = Temperature **6** OUTPUT 1 = Temperature; OUTPUT 2 = Temperature e OUTPUT 3 = RH **7** OUTPUT 1 = Temperature; OUTPUT 2 = Temperature e OUTPUT 3 = Temperature
Ky1 **Ky2** **Ky3** *hysteresis*	**OUTPUT Hysteresis**: defines the difference between the value of PV at which the OUTPUT is turned on and the value at which it is turned off. In engineering units. Adjustable between 0.1 and 50.0.
dli dl2 dl3 *Delay*	**Delay 1, 2 and 3** - 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. Value in seconds, 0 to 250 s.
Of1 of2 of3 *Off time*	**Off time 1, 2 and 3** - Defines the minimum ***off*** time for control OUTPUT. Once OUTPUT 1 is turned off, it remains so for at least the time programmed in **of1**. This parameter is useful in extending compressor life in refrigeration systems. For heating systems, program **of1** to zero. Value in seconds, 0 to 999 s. Value in seconds, 0 to 999 s.
on1 **on2** **on3** *on time*	**On time 1, 2 and 3** - 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. Value in seconds, 0 to 999 s.
1t1 **2t1** *Timer T1*	Time interval **T1** for alarm temporization. Defines the temporization mode and intervals, as shown in **Table 1**. Not available when outputs 1 and 2 are configured as direct action. Adjustable from 0 to 1999 seconds.
3t1 ***Timer T1***	Time interval **T1** for temporization. Defines the temporization mode and intervals for OUTPUT 3 (see **Table 1**). Not available when OUTPUT 3 is configured as direct action. Adjustable from 0 to 1999 seconds. If **AC3** is configured as **Free Timer**, the unit of time is given in minutes. The **3t1** parameter represents the duration of the active output (output pulse).
1t2 **2t2** *Timer T2*	Time interval **T2** for alarm temporization. Defines the temporization mode and intervals, as shown in **Table 1**. Not available when outputs 1 and 2 are configured as direct action. Adjustable from 0 to 1999 seconds.
3t2 ***Timer T2***	Time interval **T2** for temporization. Defines the temporization mode and intervals, as shown in **Table 1**. Not available when OUTPUT 3 is configured as direct action. Adjustable from 0 to 1999 seconds . If **AC3** is configured as **Free Timer**, the unit of time is given in minutes. This parameter represents the interval between two consecutive output pulses.
Add *Address*	**Address** – The parameter **Add** is presented in instruments loaded with the optional RS485 Modbus RTU communication interface. Set a unique Modbus address to each equipment connected to the network. Address range is from 1 to 247.

Note 3: The correct use of the delays **dL1** and **dL2** contributes to a smooth start-up following a energy fail; the compressors will be turned on in sequence, according to the programmed temporization, reducing the energy demand after power-up.

Level 3 – Calibration Level

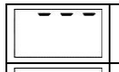
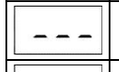
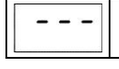
The controller is factory calibrated. The following parameters should be accessed only by experienced personnel. To enter this cycle, the P key must be kept pressed for 10 seconds.

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.

pas	***Password*** - Enter the correct password to unlock write operations on the parameters in the following levels.
(rk	*RH Calibration low*. Offset calibration for RH
(tp	*T Calibration low*. Offset calibration for Temperature
Prt	**Protection** - Defines the levels of parameters that will be password protected. See "Configuration Protection" for details.
Pa(	**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 electronic serial number of the instrument. This is a read only parameter.
sn1	**Serial number** - Second part of the electronic serial number of the instrument. This is a read only parameter.
sn0	**Serial number** - Third part of the electronic serial number of the instrument. This is a read only parameter.

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 input is above allowed range for the sensor. Possible sensor problem.
	Measured input lays above allowed range for the sensor. Possible sensor problem.
	Sensor problem. Revise sensor wiring. If problem persists, contact the factory.

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:

Pas: When this parameter is presented, the correct password should be entered to allow changes of parameters in the following levels.

Prt: 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**.

PA(Parameter for definition of a new password. Since it is located in the calibration level, can only be changed by a user that knows the current password. Valid passwords are in the range 1 to 999.

CONFIGURATION PROTECTION USAGE

The **PAS** parameter is displayed before entering a protected level. If the correct password is entered, parameters in all following levels can be changed. If 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 factory default password is **111**.

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 in 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 + sn2**= 987; **sn1**= 123; **sn0**= 465 = 1 + 9 + 3 + 6

How to use the master password:

1- Enter the master password value at **PaS** prompt.

2- Go to **PA(** 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.