

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 Fig. 1);

Accuracy: See Fig. 1; Repeatability: $\pm 1\%$ RH;

Hysteresis: $\pm 1\%$ 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 Fig. 1; Repeatability: $\pm 0.1\text{ }^\circ\text{C}$;

Range: -40 and $120\text{ }^\circ\text{C}$ (see Fig. 1);

Response time: up 30 seconds in slow moving air;

WARM-UP: 15 minutes

MEASUREMENT RESOLUTION: RH: 1 %
T: 0.1° from -19.9 to 119.9°

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 $\pm 10\%$
Optional: 12 to 30 Vdc
Frequency: 50-60 Hz
Consumption: 5 VA

Dimensions: Width x Height x Depth: 75 x 33 x 75 mm.
Weight: 100 g
Panel cut-out: 70 x 29 mm

Instrument operating environment: 0 to $40\text{ }^\circ\text{C}$ / 20 to 85 % RH

Probe operating environment: -10 to $100\text{ }^\circ\text{C}$ / 0 to 100 % RH

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

Suitable wiring: Up to 4.0 mm^2 ; 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.

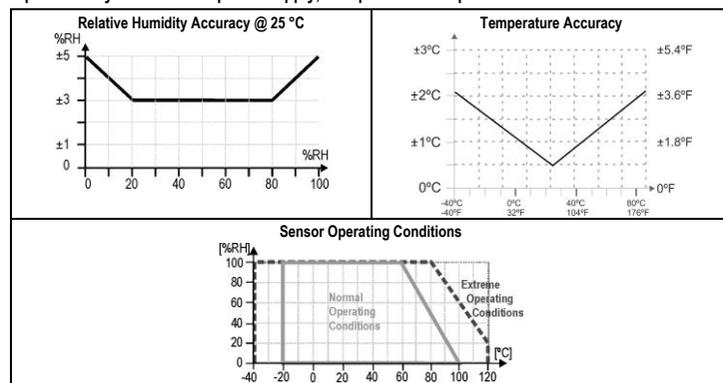


Fig. 1 – RH and temperatures accuracies

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 **DFH** e **DFt**, in the configuration level of parameters.

ELECTRICAL WIRING

The figure below indicates the connection to the sensor, power supply and controller output, as well as a connection example.

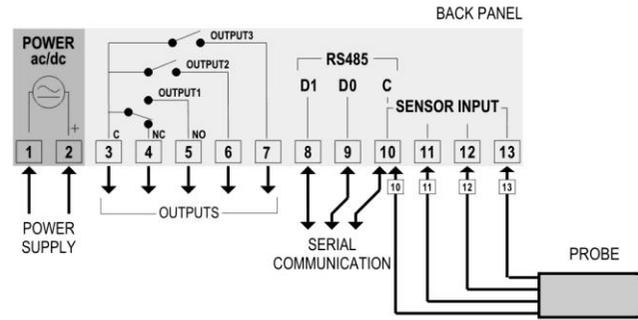


Fig. 2 – N323RHT terminals – Relays share a common terminal (standard model)

It is important to follow the recommendations below:

- The humidity sensor Conductors shall go through the system plant separately from the control and feeding output conductors, if possible in grounded electrical ducts.
- The controller feeding shall be preferably provided from a proper instrumentation network with a phase different from the one used for the control output.
- It is recommendable to use RC FILTERS (47 R and 100 nF, series) in contactor coils, solenoids, etc.

WORKING WITH THE CONTROLLER

The controller operates on the outputs OUTPUT1, OUTPUT2 and OUTPUT3 to lead the measured variable (temperature or humidity) to the intended value, defined by the setpoint (**SP 1**, **SP2** and **SP3**).

OUTPUT1, OUTPUT2 and OUTPUT3 can operate either as control outputs, when they operate directly on the system load (resistance, compressor, humidifier, etc.) or as alarm outputs that operate notifying the operator about the occurrence of any specific situation, defined by the user. The operation modes are presented below and they can be defined on parameters **RC 1**, **RC2** and **RC3**.

- 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.
- 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.
- Low Alarm.**
Minimum value alarm, indicates that the process value is **below the alarm setpoint** defined for the output.
- High Alarm.**
Maximum value alarm, indicates that the process is **above the alarm setpoint** defined for that output.
- Low alarm with initial blocking.**
Identical to the Low Alarm, with the addition of the initial blocking feature explained in **Note 2** below.
- High alarm with initial blocking.**
Identical to the High Alarm, with the addition of the initial blocking feature explained in **Note 2** below.
- Inside Range Alarm.**
Activates the output when the process variable is **within** the interval defined by:
(SP 1 – SP2) and (SP 1 + SP2) or (SP 1 – SP3) and (SP 1 + SP3)
- Outside Range Alarm.**
Activates the output when the process variable is **outside** the interval defined by:
(SP 1 – SP2) and (SP 1 + SP2) or (SP 1 – SP3) and (SP 1 + SP3)
- 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.
- 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 **Cnt** = 0, 1, 6 or 7. For OUTPUT 3 when **Cnt** = 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 impedes (blocks) the alarm from being switched on in the beginning of the control process.** The alarm will only be unblocked after the passage of the variable measured by a non-alarm condition. This feature is useful when, for example, a minimum alarm is programmed in a heating process. Without the blocking, the process would start with an enabled alarm until the control setpoint is achieved.

Output Timing

The controller allows for the Output Timing programming, where the user can establish three conditions: output **tripping delay**, **temporary activation** and **sequential activation**.

The timing is available only for outputs 1, 2 and 3 and is programmed by means of the "**T1**", "**T2**", "**T1**", "**T2**", "**T1**", "**T2**" and "**T1**".

The figures below represent these functions; T1 and T2 can vary from 0 to 1999 seconds and their combinations determine the timing mode. For normal operation of the alarms, without timing, program 0 (zero).

On the front panel, the controllers **P1**, **P2** and **P3** light when the respective outputs are activated. During the delay, the respective signaller remains flashing.

TIMER FUNCTION	T1	T2	ACTION
Normal operation	0	0	Alarm Output Alarm Event
Delayed activation	0	1 to 1999 s	Alarm Output Alarm Event
Temporary activation	1 to 1999 s	0	Alarm Output Alarm Event
Sequential activation	1 to 1999 s	1 to 1999 s	Alarm Output Alarm Event

Table 1 – Timer alarm functions 1, 2 and 3

OPERATION

The controller shall be set up by the user before using. This consideration consists in the definition of the values for the various parameters that determine the equipment operation mode.

These set up parameters are organized in groups or Levels, called parameter levels.

Level	Function
0	Measurement
1	Setpoints Adjustment
2	Configuration
3	Calibration

Upon power-up controller, the controller 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 or Temperature Measurement level.

For access to level 1 press **P** for 1 second till the "**SP 1**" parameter appears. Press **P** again to go back to the temperature measurement level.

To access level 2 of parameters, press **P** for 2 seconds until the "**rHt**" message is shown. Release the **P** key to remain in this level. Press **P** again to access other parameters from this level. After the last parameter, the controller goes back to the temperature measurement level.

To change the parameters values, use the keys **▲** and **▼** until the achievement of the desired values.

- Notes:**
- The programming is saved by the controller when the latter goes from one parameter to the other and only then it is considered valid. The programming is stored in a permanent memory, even if there is a power supply interruption.
 - 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, **SP 1**, **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 .

SP 1 Set Point 1	Set point adjustment for control OUTPUT 1. The setting range is limited by the values in SL 1 and SH 1 (this parameter belongs 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 SH2 .
SP3 Set Point 3	Set point adjustment for control OUTPUT 3. The setting range is limited by the values in SL3 and SH3 .

Level 2 – Configuration Level

Presents a sequence of other parameters that shall be defined by the user. The parameters are shown alternately with the respective values. In order to obtain the desired values, use the keys and .

rHt 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 - Allows the user to choose the measured temperature presentation unit. 0 Temperature in degrees Celsius. 1 Temperature in degrees Fahrenheit
OFH Offset Humidity	Correction value for humidity indication. Allows the user to perform small adjustments on the relative humidity indication, trying to correct measurement errors that appear, for example, in the sensor replacement. Adjustment range: between -10.0 and 10.0 % of RH. Default value: 0.0
OFt Offset temperature	Correction value for Temperature indication. Allows the user to perform small adjustments on the relative temperature indication, trying to correct measurement errors that appear, for example, in the sensor replacement. Adjustment range: between -10.0 and 10.0 % of RH. Default value: 0.0
SL 1 SP Low Limit 1	Lower limit value for SP 1 (minimum value with which SP 1 can be configured). SL 1 must be programmed with a lower value than SH 1 .
SH 1 SP High Limit 1	Upper limit for SP 1 (maximum allowed value for SP 1). SH 1 must be programmed with a value lower than the one configured in SL 1 .
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 SH2 .
SH2 SP High Limit 2	Upper limit for SP2 (maximum allowed value for SP 1). SH2 must be programmed with a value lower than the one in SL2 .
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 SH3 .
SH3 SP High Limit 3	Upper limit for SP3 (maximum allowed value for SP3). SH3 must be programmed with a value lower than the one in SL3 .
Rc 1 Action 1	Control action for OUTPUT 1: 0 Reverse: For heating or humidification; 1 Direct: For 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.

Rc2 Action 2	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 Rc3). The section Working With The Controller describes how these functions work.
Rc3 Action 3	
Cnt Control	Defines the outputs positioning in relation to the variables. 0 OUTPUT 1 = RH; OUTPUT 2 = RH and OUTPUT 3 = RH 1 OUTPUT 1 = RH; OUTPUT 2 = RH and OUTPUT 3 = Temperature 2 OUTPUT 1 = RH; OUTPUT 2 = Temperature and OUTPUT 3 =RH 3 OUTPUT 1 = RH; OUTPUT 2 = Temperature and OUTPUT 3 =Temperature 4 OUTPUT 1 = Temperature; OUTPUT 2 = RH and OUTPUT 3 = RH 5 OUTPUT 1 = Temperature; OUTPUT 2 = RH and OUTPUT 3 = Temperature 6 OUTPUT 1 = Temperature; OUTPUT 2 = Temperature and OUTPUT 3 = RH 7 OUTPUT 1 = Temperature; OUTPUT 2 = Temperature and OUTPUT 3 = Temperature
H41 H42 H43 Hysteresis	Control hysteresis: Differential between the point of switching on and off the relay of the output, set up as a control output . Adjustable between 0.1 and 50.0.
dL 1 dL2 dL3 Delay	Time of delay for starting the control. After the controller has been switched on, the output (1, 2 or 3) will only be switched on when the time programmed in this parameter has passed. Used in large refrigeration systems to impede simultaneous routing of compressors upon recovery of power supply interruption. Value in seconds, 0 to 250 s.
oF 1 oF2 oF3 Off time	Defines the minimum off time for control OUTPUT. Once OUTPUT 1 is turned off, it remains so for at least the time programmed in oF 1 . This parameter is useful in extending compressor life in refrigeration systems. For heating systems, program oF 1 to zero. Value in seconds, 0 to 999 s.
on 1 on2 on3 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 on 1 . This parameter is intended for refrigeration systems where increased compressor life is desired. For heating systems, program on 1 to zero. Value in seconds, 0 to 999 s.
t1 1 t1 1 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.
t1 1 t1 1 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 Rc3 is configured as Free Timer , the unit of time is given in minutes. Timer output activation duration (<i>timer</i>).
t2 2 t2 2 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.
t2 2 t2 2 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 Rc3 is configured as Free Timer , the unit of time is given in minutes. Interval between the timer output activation operations (<i>timer</i>).
Rdd Address	The controllers with incorporated serial communication interface RS485 present the parameter Rdd in their programming level. In this parameter, the user defines a communication address for each network element. The defined address shall be between 1 and 247.

Note 3: The correct use of the delays **dL 1** 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 3 seconds. In case of accidental access, the keys and shall not be pressed; Just pass through all parameters, till the controller goes back to the measuring screen.

PR5	Password - Enter the correct password to unlock write operations on the parameters in the following levels.
CrH	RH Calibration low . Offset calibration for RH.
CtP	T Calibration low . Offset calibration for Temperature.
PrL	Protection - Defines the levels of parameters that will be password protected.
PRC	Password Change - Allows changing the current password to a new one. Values from 1 to 999 are allowed.
Sn2	Shows the first two digits of the controller electronic serial number.
Sn 1	Shows the three central digits of the controller electronic serial number.
Sn0	Shows the three last digits of the controller electronic serial number.

ERROR MESSAGES

The controller shows messages on the display that correspond to the problems related to the humidity measurement. The control output relay is immediately switched off, when they are shown.

	Indicates that: the measurement exceeded the upper level of the sensor range. Possible sensor problem.
	Indicates that: the measurement exceeded the lower level of the sensor range. 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:

- PR5:** When this parameter is presented, the correct **password** must 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 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 **PR5** 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:

- 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.
- 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:

$$[1] + [\text{higher digit of SN2}] + [\text{higher digit of SN1}] + [\text{higher digit of SN0}]$$

For example the master password for the device with serial number 987123465 is: **1 9 3 6**

As follows: **1 + Sn2= 987; Sn 1= 123; Sn0= 465 = 1 + 9 + 3 + 6**

How to use the master password:

- Enter the master password value at **PR5** prompt.
- Go to **PRC** parameter and enter the new password, which must not be zero (0).
- Now you can use this new password to access all controller parameters with modify rights.