TEMPERATURE AND HUMIDITY
CONTROLLER

N322RHT

OPERATING MANUAL - V1.7x A

SPECIFICATIONS

INPUT SENSOR:

Humidity measurement:
Accuracy: Refer to Figure 01;
Stability: < 1 %RH / year;
Range: 0 and 100 % RH
Linearity error: << 1 % RH;
Long term Stability: < 1 % RH
Response time: 4 seconds in the range from 10 to 90 %, with slow moving air. Outside this range, up to 48 horas.

Temperature measurement:
Accuracy: Refer to Figure 1;
Repeatability: ±0.1 °C;
Range: -40 and 120 °C (-3.8 to 211.8 °F)
Response time: up to 30 seconds in slow moving air.

WARM-UP: 15 minutes

MEASUREMENT RESOLUTION:
Temperature: 0.1°.....for indications between –19.9° and 119,9°
1°..... elsewhere
RH: 1%

OUTPUT1:..... Relay SPDT; 1 HP 250 Vac / 1/3 HP 125 Vac (16 A Resistive)

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

POWER SUPPLY: ..... 100~240 Vac (± 10 %) or 24 Vdc/ac (12~30 Vdc/ac)
.....Mains frequency: 50~60 Hz. Power consumption: 5 VA

Caution: check the power supply specification before energizing the controller.

DIMENSIONS:..... Width x Height x Depth: 74 x 32 x 75 mm

PANEL CUT-OUT: .....70 x 29 mm

WEIGHT: .....100 g

ENVIRONMENT:..... Operating 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; 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.

Serial interface isolated from input circuitry, except in 24 V powered model.

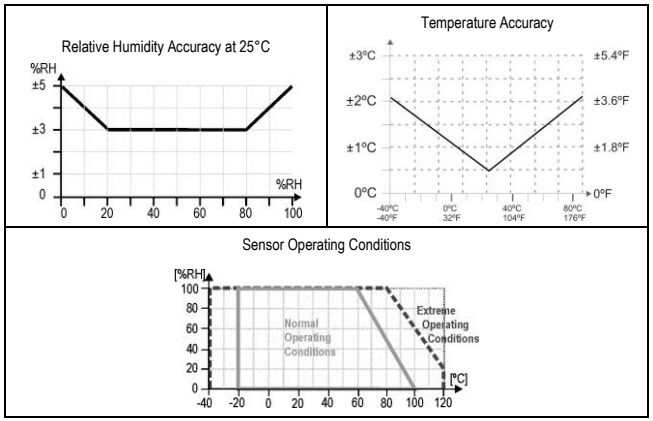


Figure 01- RH and Temperature accuracies.

The 322RHT is a digital controller for relative humidity and temperature. Its 2 relay outputs can be configured independently as control or alarm, either for temperature or relative humidity. The RHT probe (3 m length) is provided along with the instrument.
The features of a particular model (mains supply, digital communication, etc) are identified by the label placed on the controller body.

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.

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

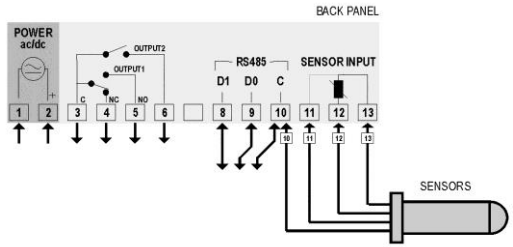


Figure 02 – N322RHT terminals

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	Setpoint Adjustment
2	Configuration
3	Calibration

Upon power-up, the N322RHT display shows for 1 second its firmware version. This information is useful when consulting the factory.

Then, the measured input variable is shown on the display. This is the parameter level **0** (measurement level).

To access level **1**, press P for 1 second until the "**SP1**" message shows up. Pressing P again, the "**SP2**" parameter is presented. 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 instrument 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 –Setpoint Adjustment

In this level only the Setpoint (**SP1** and **SP2**) parameters are available, alternating the names with their respective values. Adjust the desired value for each setpoint clicking on the ▲ and ▼ keys.

SP1 *Set Point 1*	Set Point adjustment for control OUTPUT 1. **SP1** value is limited to the values programmed in **SPL** and **SPk** in the programming level (Parameter configuration, level 2).
SP2 *Set Point 2*	Set Point adjustment for control OUTPUT 2. **SP2** value is limited to the values programmed in **SPL** and **SPk**

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** Relative Humidity **1** Temperature **2** Toggles the indication every 2 seconds. **3** Toggles the indication every 3 seconds. **4** Toggles the indication every 4 seconds. **5** Toggles the indication 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	**Temperature Unit** - Selects display indication for degrees Celsius or Fahrenheit. **0** - Temperature Celsius **1** - Temperature in degrees Fahrenheit
0fk	**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	**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	Lower limit value for **SP1** (minimum value with which **SP1** can be configured). **Sl1** must be programmed with a lower value than **sK1**.
Sk1	Upper limit for **Sp1** (maximum allowed value for **Sp1**). **sK1** must be programmed with a value lower than the one configured in **sl1**.
Sl2	Lower limit value for **SP2** (minimum value with which **SP2** can be configured). **Sl2** must be programmed with a lower value than **sK2**.
Sk2	Upper limit for **Sp2** (maximum allowed value for **Sp1**). **sK2** must be programmed with a value lower than the one in **sl1**.
ky1	**OUTPUT 1 Hysteresis**: defines the differential range between the input variable value at which the OUTPUT 1 is turned on and the value at which it is turned off. In degrees.
ky2	**OUTPUT 2 Hysteresis**: defines the differential range between the input variable value at which the OUTPUT 2 is turned on and the value at which it is turned off. In degrees.
Ac1	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 - Control OUTPUT 2 action or Alarm functions: **0** Reverse control action (heating or humidification). (See **(nt** parameter below). **1** Direct control action (cooling or dehumidification). **2** Low (minimum value) alarm. **3** High (maximum value) alarm. **4** Alarm inside the range **5** Alarm outside the range. **6** Low alarm with initial blocking. **7** High alarm with initial blocking. **8** Inside the range alarm with initial blocking. **9** Outside the range alarm with initial blocking. The section **Working with the RHT Controller** describes how these functions work.
(nt	Assigns the relay for each variable: **0** OUTPUT 1 = RH; OUTPUT 2 = RH; **1** OUTPUT 1 = RH; OUTPUT 2 = Temperature; **2** OUTPUT 1 = Temperature; OUTPUT 2 = RH; **3** OUTPUT 1 = Temperature; OUTPUT 2 = Temperature;
of1	**Off time 1** - 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**. For thermocouple inputs this parameter is not available. 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 1** - Defines the minimum ***on*** time for control OUTPUT 1. Once turned on, OUTPUT 1 remains so for at least the time programmed in **on1**. 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 **on1** to zero. Value in seconds, 0 to 999 s.
dl1	**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 instruments. Value in seconds, 0 to 250 s.
of2	**Off time 2** - 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 an issue. For heating systems, program **on2** to zero. Value in seconds, 0 to 999 s.
on2	**On time 2** - 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. Value in seconds, 0 to 999 s. For heating systems, program **of2** to zero.
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.
Add	**Adress** – The parameter **Add** is presented in instruments loaded with the optional RS485 Modbus RTU communication interface. Set a unique Modbus address for each equipment connected to the network. Address range is from 1 to 247.

Level 3 – Calibration level

The N322RHT 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 measurement level is reached again.

pas	**Password** - Enter the correct password to unlock write operations for the parameters in the following levels.
[Al	**Calibration low** - Offset value of the input. It adjusts the lower measurement range of the sensor.
[Ak	**Calibration High** - Gain calibration. It adjusts the upper measurement range of the sensor.
[JL	**Cold Junction Offset calibration** - This parameter is available only for thermocouple.
FA(	**Factory Calibration** - Restores factory calibration parameters. Change from **0** to **1** to restore the calibration parameters with factory values.
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.

WORKING WITH THE RHT 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 the alarm. There are eight distinct alarm functions implemented in OUTPUT 2, selected by the parameter **Ac2**, described below:

2 - Low alarm – OUTPUT 2 is turned on when the selected variable, as assigned for OUTPUT 2 in the **(nt** parameter, falls **below** the **SP2** value.

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** e **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 system's 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.

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:

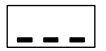
1- Enter the master password value at **PaS** prompt.

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.

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:

	Overflow
	Underflow
	Sensor error

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