

Man 5001227

The N321R is a controller for cooling applications, with defrost function (forced compressor shut-down). It accepts **NTC**, **Pt100** and **Pt1000** temperature probes, depending on the product code (the user must observe the measurement range of the selected sensor). The N321R control output is capable of driving a compressor load of up to 1 HP directly.

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

## SPECIFICATIONS

**SENSOR INPUT:** The input sensor type can be chosen from the options below (specified when placing the order):

- Thermistor NTC, Type 10 kΩ @ 25 °C; Range: -50 to 120 °C (-58 to 248 °F); Accuracy: 0.6 °C; Sensor interchangeability: 0.75 °C. This error can be compensated by the offset parameter in the controller.
- Pt100; Type: Range: -50 to 300 °C; α= 0.00385; 3-wire; Accuracy: 0.7 °C; IEC-751;
- Pt1000; Type: Range: -200 to 530 °C; α= 0.00385; 3-wire; Accuracy: 0.7 °C;

**Note:** Two 3-meter probe cable are bundled with the instrument. The cable can be extended up to 200 m.

**Measurement Resolution:** ..... 0.1 ° from -19.9 to 199.9 °  
 ..... 1 ° elsewhere

**Note:** the equipment keeps its precision all over the range, despite the lack of display resolution in a part of the range does not allow its visualization.

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

**POWER SUPPLY:** .....100 to 240 Vac/dc ±10 %  
 ..... Optionally:..... 12 to 30 Vdc  
 Mains frequency: .....50-60 Hz  
 Power 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

**ENVIRONMENT:** Operating temperature: .....0 to 40 °C (32 to 104 °F)  
 Storage temperature: ..... -20 to 60 °C (-4 to 140 °F)  
 Relative humidity: .....20 to 85 % RH

Case Polycarbonate UL94 V-2

Protection: Box IP42, Frontal panel IP65

Suitable wiring: Up to 4.0 mm<sup>2</sup>

Serial interface not isolated from input circuitry.

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

## ELECTRICAL WIRING

Fig. 01 below shows the controller connections to sensor, mains and outputs.

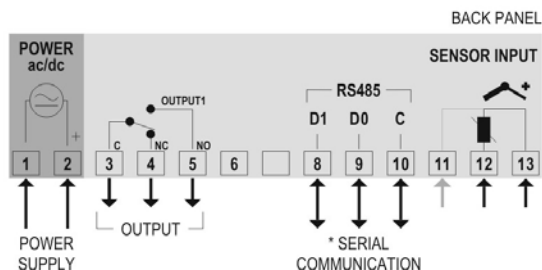


Fig. 01 - N321R terminals

\* The serial communication interface is optional.

Pt100 with 3 conductors: Terminals 11, 12 and 13 must have the same wire resistance for proper cable length compensation. For 2 wire Pt100, short circuit terminals 11 and 13.

## INSTALLATION

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 inductor.
- Use protection devices like circuit breakers and fuses.

## 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	Temperature measurement
1	Setpoint Adjustment / Voltage indication
2	Configuration
3	Calibration

Upon power-up, the N323R 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 "SP" message shows up. Pressing **P** again to go back to level 0.

To access level 2 of parameters, press **P** for 2 seconds until the "Unt" 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 that 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 – Setpoint Adjustment

In this level only the Setpoint (SP) parameters are available, alternating the names with their respective values. Adjust the desired temperature for each setpoint clicking on the **←** and **→** keys.

<b>U</b> <i>Voltage</i>	The screen voltage measurement. For values lower than 150 Vac and higher than 254 Vac presents the message 0. Function available only for model N321R-NTC-LVD.
<b>SP</b> <i>Set Point</i>	Temperature adjustment for control OUTPUT 1. <b>SP</b> value is limited to the values programmed in <b>SPL</b> and <b>SPH</b> in the programming level (Parameter Configuration, Level 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 respective value.

<b>Unt</b>	<b>Temperature Unit.</b> Selects display indication for degrees Celsius or Fahrenheit. <b>0</b> Temperature in degrees Celsius. (factory default) <b>1</b> Temperature in degrees Fahrenheit.
<b>oFS</b>	<b>Sensor Offset</b> - Offset value to be added to the measured temperature to compensate sensor error.
<b>SPL</b>	<b>SP Low Limit</b> - Lower range for <b>SP</b> . <b>SPL</b> must be programmed with a lower value than <b>SPH</b> .
<b>SPH</b>	<b>SP High Limit</b> - Upper range for <b>SP</b> . <b>SPH</b> must be greater than <b>SPL</b> .
<b>HYS</b> <i>Hysteresis</i>	<b>OUTPUT 1 Hysteresis:</b> Defines the differential range between the OUTPUT 1 temperature value at which it is turned off. In degrees.
<b>oFt</b>	<b>Off time</b> - Defines the minimum <b>off</b> time for control OUTPUT 1. Once OUTPUT 1 is turned off, it remains so for at least the time programmed in <b>oFt</b> . This parameter is intended for refrigeration systems where longer compressor life is desired. Value in seconds, 0 to 999 s.
<b>ont</b>	<b>On time</b> - Defines the minimum <b>on</b> time for control OUTPUT 1. Once turned on, OUTPUT 1 remains so for at least the time programmed in <b>ont</b> . 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 <b>ont</b> to zero. Value in seconds, 0 to 999 s.
<b>dLY</b> <i>Delay</i>	<b>Delay time to start control.</b> Upon power-on, control OUTPUT 1 is kept off until the time programmed in <b>dLY</b> 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.
<b>dIb</b> <i>Defrost Interval Base</i>	<b>Time base for dF i:</b> <b>0</b> Seconds <b>1</b> Minutes <b>2</b> Hours
<b>dTb</b> <i>Defrost Time Base</i>	<b>Time base for dFt:</b> <b>0</b> Seconds <b>1</b> Minutes <b>2</b> Hours
<b>dFi</b> <i>Defrost interval</i>	<b>Interval between defrost cycles.</b> Can be selected 0 to 999 seconds/minutes/hours, according the value specified at <b>dIb</b> .
<b>dFt</b> <i>Defrost time</i>	<b>Defrost duration.</b> Can be 1 to 999 seconds / minutes / hours, according the value specified at <b>dTb</b> .
<b>dFh</b> <i>Defrost hold</i>	<b>Hold the temperature indication throughout the defrost interval or the time defined by this parameter.</b> <b>0</b> Do not hold the indication during the defrost; <b>1</b> to <b>250</b> Time (seconds / minutes / hours) besides the defrost time the indication will remain held.

<b>CPE</b> <i>Compressor Protect</i>	Enables compressor protection by voltage monitoring. If the network voltage is not between the SetPoints <b>CPL</b> and <b>CPH</b> . <b>0</b> Disables compressor protection. <b>1</b> Enable compressor protection. Function available only for model N321R-NTC-LVD.
<b>CPt</b> <i>Compressor Protect Time</i>	Determines a delay in the compressor shutting down when compressor protection's activities by voltage monitoring. Adjustable time interval between adjustable between 5 to 30 seconds. Function available only for model N321R-NTC-LVD.
<b>CPL</b> <i>CP Low Limit</i>	Voltage lower limit used by the compressor protection. Voltage minimum value that the compressor can operate. Parameter adjustable between 150 to 254 Vac must be obligatorily 5 Vac lower than the value set at the higher limit ( <b>CPH</b> ). Function available only for model N321R-NTC-LVD.
<b>CPH</b> <i>CP High Limit</i>	Voltage lower limit used by the compressor protection. Voltage minimum value that the compressor can operate. Parameter adjustable between 150 to 254 Vac must be obligatorily 5 Vac higher than the value set at the lower limit ( <b>CPL</b> ). Function available only for model N321R-NTC-LVD.
<b>Rdd</b>	<b>Adress</b> - Controllers with the optional RS485 Modbus RTU communication interface have the <b>Rdd</b> parameter at the Configuration level. Set a unique Modbus address for each equipment connected to the network. Address range is from 1 to 247.

### 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.

<b>PRS</b>	<b>Password</b> - Enter the correct <b>password</b> to unlock write operations for the parameters in the following levels.
<b>CLL</b>	<b>Calibration low</b> - Offset value of the input. It adjusts the lower measurement range of the sensor.
<b>CAH</b>	<b>Calibration High</b> - Gain calibration. It adjusts the upper measurement range of the sensor.
<b>UoL</b>	<b>Voltage Calibration</b> - Offset adjustment for calibrating the voltage indication. Function available only for model N321R-NTC-LVD.
<b>CJL</b>	<b>Cold Junction Offset calibration</b> - This parameter is available only for thermocouple.
<b>FAC</b>	<b>Factory Calibration</b> - Restores factory calibration parameters. Change from <b>0</b> to <b>1</b> to restore the calibration parameters with factory values.
<b>PrL</b>	<b>Protection</b> - Defines the levels of parameters that will be password protected. See "Configuration Protection" for details.
<b>PAC</b>	<b>Password Change</b> - Allows changing the current password to a new one. Values from 1 to 999 are allowed.
<b>Sn2</b>	<b>Serial number</b> - First part of the controller electronic serial number.
<b>Sn1</b>	<b>Serial number</b> - Second part of the controller electronic serial number.
<b>Sn0</b>	<b>Serial number</b> - Third part of the controller electronic serial number.

## WORKING WITH THE CONTROLLER

The controller turns on and off the compressor output such as to maintain the temperature at the selected *Setpoint*. The front panel display shows the symbol ❄ whenever the compressor is active.

The defrost process of this controller is executed by stopping the compressor. This procedure is done every time interval defined by the user. The control output remains off by time also defined by the user. During the defrost procedure the temperature indication can be held by adjusting the parameter **dFH**.

The **dF1** and **dFt** parameters define, respectively, the time interval between defrosts and the duration of the defrost cycle. The controller display shows the symbol ⚡ to indicate that a defrost cycle is in progress.

**Manual defrost:** The ⚡ key allows that a defrost cycle be initiated or terminated immediately. Pressing this key for 1 second will toggle the current defrost status.

## 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:

- PRS:** 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 **SP**.
- PAC** 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 **PRS** 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 password for a brand new device 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 987123 465 is: **1936**



As follows:  $1 + \text{Sn2} = 987$ ;  $\text{Sn1} = 123$ ;  $\text{Sn0} = 465 = 1\ 9\ 3\ 6$

### How to use the master password:

- 1 - Enter the master password value at **PRS** prompt.
- 2 - Go to **PAC** 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

Probe 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.

	<ul style="list-style-type: none"> <li>• Measured temperature exceeded <b>maximum</b> allowed range for the sensor.</li> <li>• Broken <b>Pt100</b> or <b>Pt1000</b>. Short circuited NTC sensor.</li> </ul>
	<ul style="list-style-type: none"> <li>• Measured temperature is below <b>minimum</b> measurement range of the sensor.</li> <li>• Short circuited <b>Pt100</b> or <b>Pt1000</b>. Broken NTC.</li> </ul>

## COMPRESSOR PROTECTION (N321R-NTC-LVD)

The controller constantly monitors the voltage of power network and shuts the compressor if this tension is not within limits. These limits are defined in parameters **CPL** and **CPH**, adjustable between 150 and 254 Vac. In addition to turning the compressor off, the driver passes the signal on your display this occurrence: Toggles the indication of voltage value measured with the temperature value.

When the voltage exceeds limits (lower than 150 Vac and higher than 254 Vac) is signaling to indicate temperature alternating with the message **0**.

## WARRANTY

Warranty conditions are available on our website [www.novusautomation.com/warranty](http://www.novusautomation.com/warranty).