

N323R

TEMPERATURE CONTROLLER – USER GUIDE – V2.1x



1. SAFETY ALERTS

The following symbols are used on the equipment and throughout this manual to draw the user's attention to important information related to the safety and use of the equipment.

CAUTION: Read the manual completely before installing and operating the equipment.	CAUTION OR HAZARD: Risk of electric shock.

All safety recommendations appearing in this manual must be followed to ensure personal safety and prevent damage to the instrument or system. If the instrument is used in a manner other than that specified in this manual, the device safety protections may not be effective.

2. SUMMARY

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3. INTRODUCTION

N323R is a temperature controller suitable for refrigeration. It has functions specially designed for temperature control and defrost optimization applications.

The equipment has two input channels for temperature sensors (NTC thermistor type) that measure the temperature of the monitored environment and the evaporator module. In addition, it has three independent outputs for controlling the compressor (refrigeration output), the defrost module and the fan.

The features of each controller are identified on the identification label, attached to the equipment, and are in accordance with the purchase order.

4. SPECIFICATIONS

PROBE INPUT:

- 2 Thermistor NTC
- Type 10 k Ω @ 25 °C
- Measurement range: -50 to 120 °C (-58 to 248°F)
- Accuracy: 0.6 °C between -19.9 and 99.9 °C
- Accuracy: 1 °C between -50 and -20 °C and 100 and 120 °C

Note: The sensors come with the equipment.

Its operating range is limited to -30 to 105 °C (-222 to 221 °F). It has cable of 3 m in length, 2 x 0.5 mm², and can be extended up to 200 meters.

Maximum error in the interchangeability of original NTC sensors: 0.75 °C (33.35 °F). This error can be eliminated through the **Offset** parameter of the equipment.

Measurement resolution:..... 0,1° from -19.9 to 119.9°
..... 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 / 30 Vdc /
- 1/3 HP 125 Vac (16 A Resistive)
- Optionally: Pulse, 5 Vdc, 25 mA max.

OUTPUT2:

- Relay SPST-NO, 3 A / 250 Vac / 30 Vdc

OUTPUT3:

- SPST-NO, 3 A / 250 Vac / 30 Vdc

POWER SUPPLY:

- Voltage: 100 to 240 Vac/dc $\pm$ 10 %
- Optionally: 24 V (12~30 Vdc) (*)
- Mains frequency: 50~60 Hz
- Power consumption: 5 VA

(*) **Note:** Models with a 24 V power supply do not have electrical isolation between the power supply, input, and RS485 communication circuits.

In direct current (Vdc) supply networks, you must observe the polarity of the connection.

DIMENSIONS:

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

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

Housing: Polycarbonate UL94 V-2.

Protection index: Front panel: IP65 | Housing: IP42.

Suitable wiring: Up to 4.0 mm².

RS485 Interface with Modbus protocol (optional).

Certifications: CE, UKCA, UL.

The RS485 interface (when available on the controller) is NOT electrically isolated from the input circuit.

It is also NOT isolated from the power supply circuit in 24V power supply models (12~24 Vdc).

It is electrically isolated from the supply circuit in models with a 100~240 Vac/dc power supply.

5. ELECTRICAL CONNECTIONS

The figure below indicates the connection terminals for the sensor, power, and controller output:

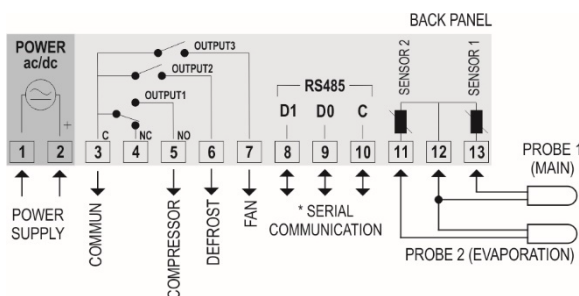


Figure 1 – Electrical connections

* Serial communication feature is not always available in the controller.

5.1 INSTALLATION RECOMMENDATIONS

- Input signal conductors must run through the plant separately from the supply and output conductors. If possible, in grounded conduits.
- The power supply for the electronic instruments must come from a proper instrumentation network.
- It is recommended to use RC FILTERS (noise suppressors) at contactor coils, solenoids, etc.
- In control applications, it is essential to consider what can happen when any part of the system fails. The internal devices of the equipment do not guarantee full protection.

6. OPERATION

Before use, you must configure the controller. To configure it, you must set values for the parameters that determine how the equipment operates.

These configuration parameters are organized in groups or Levels, called Parameter Levels.

LEVEL	RELATED FUNCTIONS
0	Temperature measurement
1	Setpoint Adjustment
2	Operation Mode
3	Calibration

Table 1 – Parameter levels

When you turn on the controller, the display will quickly show the internal software version. This information is important for eventual consultations with the manufacturer. The controller will then enter operation and start displaying the ambient temperature value, measured by sensor 1. This is level 0 or the Temperature Measurement level.

To access Level 1, press **P** for **1 second**, until the parameter **SP** is displayed. Release **P** to remain in this level. To return to the Temperature Measurement level, press **P**.

To access Level 2, press **P** for **1 second**, until the parameter **Unit** is displayed. Release **P** to remain in this level. To access other parameters in this level, press **P**. After the last parameter, the controller will return to the Temperature Measurement level.

To change the parameter values, use the and keys.

Notes:

- When switching from one parameter to another, the setting will be saved automatically and only then considered valid. Even during a power outage, the configuration will be saved in permanent memory.
- When in configuration, if the keys are not used for a period longer than 20 seconds, the controller will return to the Measurement Level, ending and saving the configuration done so far.
- When in Temperature Measurement mode, by giving a short touch on the key, the controller will temporarily show the temperature value measured by sensor 2 – Evaporator temperature.

6.1 LEVEL 1 – SETPOINT ADJUSTMENT LEVEL

This level displays the Setpoint (SP) parameter only. It defines the desired temperature value for the controlled environment. The current SP value is shown alternately.

To program the desired value, use the and keys.

SP Setpoint	Adjustment of the desired environment temperature. This adjustment is limited to the values programmed in SP.L and SP.H (see below).
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6.2 LEVEL 2 – GENERAL CONFIGURATION LEVEL

Displays the sequence of parameters to be set by the user. The parameters are shown alternately with their respective values.

To program the desired value, use the and keys.

Unit Unit	Temperature unit. It allows you to define the temperature unit for all parameters. 0 Temperature in Celsius degrees. 1 Temperature in Fahrenheit degrees.
OF 1 Offset 1	Correction value for the temperature measured by sensor 1. It allows you to make small adjustments to the environment temperature, seeking to correct measurement errors that appear, for example, when replacing a temperature sensor. In degrees. Adjustable between -10.0 and 10.0 degrees.
OF 2 Offset 2	Correction value for the temperature measured by sensor 2. It allows you to make small adjustments to the environment temperature, seeking to correct measurement errors that appear, for example, when replacing a temperature sensor. In degrees. Adjustable between -10.0 and 10.0 degrees.
SP.L SP Low Limit	Setpoint lower limit. It allows you to set a minimum value to adjust the Setpoint.
SP.H SP High Limit	Setpoint upper limit. It allows you to set a maximum value to adjust the Setpoint.
HYS Hysteresis	Control hysteresis. Differential between the on and off point of the refrigeration output relay. In degrees. Adjustable between 0.1 and 50.0 degrees.
Ctrl	It allows you to define a position for the refrigeration output (compressor). 0 Refrigeration in OUTPUT1 / Defrost in OUTPUT 2 (Standard).

	1 Refrigeration in OUTPUT2 / Defrost in OUTPUT1.
oF.t <i>Off time</i>	It allows you to set the minimum off time for the refrigeration output. Once the refrigeration output is turned on, it will stay in this condition for at least the time programmed in this parameter. Typically used to increase the lifespan of the compressor in a refrigeration system. Value in seconds (0 to 1999 seconds).
on.t <i>on time</i>	It allows you to set the minimum on time for the refrigeration output. Once the refrigeration output is turned on, it will stay in this condition for at least the time programmed in this parameter. Typically used to increase the lifespan of the compressor in a refrigeration system. Value in seconds (0 to 1999 seconds).
dL.y <i>Delay</i>	Delay time for the control start. After the controller is turned on, the refrigeration output will only be turned on after the time programmed in this parameter has elapsed. Used in large refrigeration systems to prevent simultaneous compressor starts when returning from a power failure. Value in seconds (0 to 250 seconds).
d i.b <i>Defrost Interval Base</i>	It allows you to set a time base for dF.i : 0 Minutes. 1 Hours.
d t.b <i>Defrost Time Base</i>	It allows you to set a time base for dF.t : 0 Minutes. 1 Hours.
dF.i <i>Defrost interval</i>	Interval between defrosts. Adjustable between 0 and 1999 minutes/hours, in which the defrost output will remain off. If set to 0 (zero), determines that no stops will happen for defrost.
dF.t <i>Defrost time</i>	Defrost duration. Time interval that the defrost output will stay on. If set to 0 (zero), determines that no defrost stops occur. Adjustable between 1 and 1999 minutes.
dF.C	Refrigeration output behavior during defrost. 0 The refrigeration output is turned off during defrost. 1 The refrigeration output is kept on during defrost. 2 The refrigeration output acts normally. It switches on and off as needed to maintain the temperature.
dF.S	Temperature to end defrost. Value of temperature measured in the evaporator by the S2 sensor that, when reached, determines the end of the defrost cycle, even if the defrost duration interval has not finished. Adjustable between -50 and 120 degrees. Important note: The defrost cycle does not start if the evaporator temperature is above the value defined in this parameter.
dF.H <i>Defrost hold</i>	It allows you to keep the temperature indication unchanged during the defrost time plus the time set in this parameter. 0 It keeps the indication unchanged only during the defrosting process.

1 to 250	Time interval beyond defrost in which the temperature indication will remain unchanged.
dd.t	Draining time. After defrost, it will still be necessary a time interval with the outputs turned off, since there can be accumulated water on the evaporator. This interval must be dimensioned so that the water drops are eliminated. Adjustable between 0 and 1999 minutes.
FR.5 <i>Fan Setpoint</i>	Fan blocking temperature. To prevent heated air from being blown into the refrigerated room, the system fan (OUTPUT3) will be turned off when the temperature in the evaporator (Sensor 2) rises to the value set in FR.5 . Situations with heated evaporator are common, for example, after defrost and draining processes. With the fall of evaporator temperature, the fan returns to enabled condition.
FR.t	Maximum time necessary for fan return after draining. For the safety of the stored products, if the temperature in the evaporator does not reach the adjusted value in FR.5 , the fan return will happen at the end of the time interval adjusted in this parameter. Adjustable between 0 and 1999 minutes.
FR.C	Fan behavior during refrigeration. 0 The fan stays on only as long as the compressor is on. 1 The fan stays on during the entire refrigeration cycle, even at times when the compressor shuts down.
FR.d	Fan behavior during defrost. 0 The fan stays off during defrost. 1 The fan stays on during defrost.
CP.P <i>Compress or Protect</i>	It allows you to define the behavior of the Control Output when the controller identifies a failure in the Temperature Sensor (Process Compressor). 0 Compressor turns off when sensor 1 malfunctions. 1 Compressor turns on when sensor 1 malfunctions.
Rdd <i>Address</i>	It allows you to define an address to use the controller in a communication network. The communication address must be set between 1 and 247. Exclusive for controllers that have the RS485 serial communication interface.
ba.u <i>Baud Rate</i>	It allows you to set the Baud Rate of the serial communication (in kbps): 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6 or 115.2.
PAR <i>Parity</i>	It allows you to set the serial communication parity: 0 No parity and 2 Stop Bits. 1 Even parity and 1 Stop Bit. 2 Odd parity and 1 Stop Bit.

6.3 LEVEL 3 – RESTRICTED CONFIGURATION LEVEL

The equipment leaves the factory already calibrated. When a recalibration is necessary, it must be performed by a specialized professional.

To access this level, press the **P** key for more than 3 seconds. At this level are also the parameters for protecting and formatting the

controller.

If you access this level by accident, step through all the parameters without changing them, until the controller returns to the Measurement Level.

P55 Password	It allows you to enter the Access Password. By entering it, you can change the configuration of the controller.
PrE Protection	It allows you to define the levels of parameters to be protected. - Only the Restricted Configuration level is protected. - The Restricted and General Configuration levels are protected. - The Restricted and General Configuration levels are protected. The General Configuration level is not displayed. - The Restricted and General Configuration and Setpoint levels are protected. The General Configuration level is not displayed. - All levels are protected and displayed.
dF.E Defrost Enable	Allows you to enable the Defrost function. Whenever it is enabled, its parameters will be displayed at the General Configuration level. - Defrost function disabled. The parameters will not be displayed. - Defrost function enabled. The parameters will be displayed.
P5.C Password Change	It allows you to change the current password. You can set the password to a number between 1 and 999.
CR.E Calibration Enable	It allows you to recalibrate the Temperature Sensor input. If enabled, the controller will display the respective parameters (CR.L , CR.H).
CL 1 Calibration Low	Declaration of the applied lower range calibration signal from the Temperature Sensor input 1.
CH 1 Calibration Hi 1	Declaration of the applied upper range calibration signal from the Temperature Sensor input 1.
CL 2 Calibration Low 2	Declaration of the applied lower range calibration signal from the Temperature Sensor input 2.
CH 2 Calibration Hi 2	Declaration of the applied upper range calibration signal from the Temperature Sensor input 2.
CR.H Calibration Hi	Declaration of the applied upper range calibration signal from the Temperature Sensor input.
CR.F Calibration Factory	It allows you to return to the original calibration of the controller. If you change this parameter from 0 to 1, the original calibration will be restored and any changes you have made to the calibration will be disregarded.
Sn.2 Serial Number 2	It displays the first 2 digits of the electronic serial number of the controller.
Sn. 1 Serial Number 1	It displays the middle 3 digits of the electronic serial number of the controller.
Sn.0 Serial Number 0	It displays the last 3 digits of the electronic serial number of the controller.

7. WORKING WITH THE CONTROLLER

The controller turns the refrigeration output on or off to bring the system temperature to the value set by the user in the Setpoint parameter.

On the controller front panel, the ❄ flag will light up when the refrigeration output is turned on.

7.1. DEFROST PROCESS

The defrost process has the objective of melting the ice accumulated on the evaporator, making the refrigeration process more efficient. The defrost happens periodically and has a defined duration. However, its execution can be prevented, and its end can be anticipated in function of the temperature measured directly on the evaporator (See **dF.5** parameter).

The defrost can occur because of a compressor stop, resistance heating or compressor cycle inversion:

- In defrost by **compressor stop**, the refrigeration output will be switched off at the beginning of the defrost cycle.
The defrost of the evaporator will happen naturally.
- In defrost by **resistance heating**, the defrost output will be used to turn on an electrical resistance, that will heat the evaporator to melt the accumulated ice.
In this mode, the refrigeration output will also be switched off.
- In defrost by **compressor cycle inversion**, the refrigeration output will not be turned off. The defrost output will be used to perform the compressor cycle inversion.

The parameters **dF. 1** and **dF.E** define, respectively, the interval between defrosts and the duration of this process.

On the front panel of the controller, the ⏸ flag will light up whenever the controller is in defrosting process.

Manual Defrost: When pressed, the ⏸ key allows you to start or stop the defrosting process. By pressing this key for 1 second, the controller will be forced into defrost. If it is already in progress, the process will be stopped immediately.

Set the evaporator temperature for defrost process:

- Wait for ice formation on the evaporator.
- Trigger a manual defrost.
- Monitor visually the evaporator until all ice disappears.
- Check the temperature measured by the sensor 2 at this moment (touch short on ⏸). This is the value used in parameter Temperature for End Defrost **dF.5**.

8. CONFIGURATION PROTECTION

The configuration protection system is intended to prevent undue changes to the parameters of the controller. Protection consists of limiting access to the parameter levels.

The **Calibration** level is always protected. To change its parameters, you must enter the Access Password in the **P55** parameter, which is the first parameter of the **Calibration** level. Without the correct password, you can see the other parameters of the level, but not change them.

P55 Parameter to enter the Access Password.

PrE It allows you to define the degree of protection to be adopted by the controller.

PR.C It allows you to change the Access Password. You can set the password to a number between 0 and 1999.

Important notes:

- The controller is supplied with the access password set to 111. In **PR.C** (Password Change) parameter, you can change it.
- The factory password is not sensitive information. You must set a new password to protect the controller configuration.

- 3. If you enter the incorrect password for **5** consecutive attempts, the controller will prevent further attempts for the next 10 minutes.
- 4. When you can't remember the access password, you can enter a Master Password, which will only allow you to set a new password. See [MASTER PASSWORD](#) section.

9. MASTER PASSWORD

The master password, which allows you to define a new password for the controller, is based in the serial number of the equipment (**Sn2**, **Sn 1** and **Sn0**) and calculated as following:

$$[1] + [\text{higher digit of } \mathbf{Sn2}] + [\text{higher digit of } \mathbf{Sn 1}] + [\text{higher digit of } \mathbf{Sn0}]$$

For example, the master password for a device with serial number 97123465 is: **1 9 3 6**

As follows: **Sn2** = 97; **Sn 1** = 123; **Sn0** = 465 = 1 + 9 + 3 + 6

9.1 HOW TO USE YOUR MASTER PASSWORD

- 1. In the **P55** parameter, enter the master password.
- 2. In the **PR.L** parameter, enter a new password, which must not be zero (0).
- 3. Use this new password.

10. ERROR INDICATION

On the display, the controller shows messages that correspond to problems related to the temperature measurement. Whenever they are displayed, the control output relay will be turned off.

	• The temperature has exceeded the upper limit of the sensor range. • Short-circuited NTC sensor.
	• The temperature has exceeded the lower limit of the sensor range. • Broken NTC sensor.

Table 2 – Error indications

11. WARRANTY

Warranty conditions are available on our website www.novusautomation.com/warranty.