NOVUS
We Measure, We Control, We Record

N321R

TEMPERATURE CONTROLLER – USER GUIDE – V2.1x A

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

3. INTRODUCTION

N321R is an electronic temperature controller suitable for refrigeration processes and has input for a **NTC** thermistor temperature sensor.

It has a wide Defrost control, correction of temperature indication errors (Offset), and control output with a **16 A relay** that has Common, NO, and NC contacts.

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

Temperature Sensor (SENSOR INPUT): ..... NTC Thermistor
Type: ..... 10 kΩ @ 25 °C; 1 %; β25/85 = 3435 K.
Measurement range: ..... -50 to 120 °C (-58 to 248 °F).
Measurement resolution: ..... 0.1° from -19.9 to 199.9°.
..... 1° elsewhere.
Measurement accuracy: .....0.6 °C between -19.9 and 99.9 °C.
..... 1 °C between -50 and -20 °C and 100 and 120 °C.

OUTPUT1: ..... SPDT relay.
Maximum Load: ..... 1 HP 250 Vac / 30 Vdc /
..... 1/3 HP 125 Vac (16 A Res.).

POWER SUPPLY:
Voltage: ..... 100 to 240 Vac/dc (± 10 %) / 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.

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

Housing: Polycarbonate UL04 V-2.
Protection index: Housing: IP43 | Frontal panel: IP65.
Suitable wiring: Up to 4.0 mm².
Certifications: UL, CE, and UKCA.

Notes for the NTC sensor that comes with the controller:

- Operation range: -50 to 120 °C (-58 to 248 °F).
- Water resistant.
- Maximum error when interchanging original NTC sensors: 0.7 °C (33.26 °F). This error can be eliminated through the **Offset** parameter.
- It has a 3 m long cable (2 x 0.5 mm²) that can be extended up to 200 meters.

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

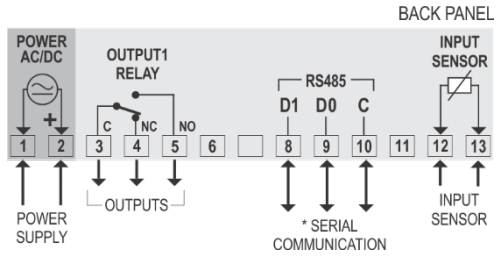

Figure 1 – Electrical connections

* 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 required 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.

RELATED FUNCTIONS
Temperature measurement
Setpoint
General Configuration
Restricted Configuration

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 go into operation and display the temperature value measured by the sensor connected to the INPUT SENSOR terminals. This is the Temperature Measurement level.

To access the Setpoint Level, press [P] for **1 second**, until the parameter SP is displayed. To return to the Temperature Measurement level, press [P].

To access the other configuration levels, press and hold [P] until unt and then PSS parameters are displayed. These are the initial parameters for the General and Restricted Configuration levels, respectively. Release the key at the desired level parameter.

To change the parameter values, use the [▲] and [▼] keys.

Notes: **1** 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.

2 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.

6.1 LEVEL 1 – SETPOINT ADJUSTMENT LEVEL

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

To program the desired value, use the [▲] and [▼] keys.

SP *Setpoint*	Adjustment of the control temperature or operating temperature. This adjustment is limited to the values programmed in SP.L and SP.H (see below).

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.

unt *Unit*	Temperature unit. It allows you to define the display unit of the measured temperature. 0 Temperature in Celsius degrees. 1 Temperature in Fahrenheit degrees.
oFS *Offset*	Correction value for the temperature display. It allows you to make small adjustments to the temperature display, seeking to correct measurement errors that appear, for example, when replacing a NTC temperature sensor. In degrees. Adjustable from -10.0 to 10.0 degrees.
SP.L *SP Low Limit*	Setpoint lower limit. Minimum value that can be used to program the Setpoint. It should be programmed with a lower value than the one programmed in SPH.
SP.H *SP High Limit*	Setpoint upper limit. Maximum value that can be used to program the Setpoint. It should be programmed with a higher value than the one programmed in SPL.
HYS *Hysteresis*	Control hysteresis. Differential between the on and off point of the control output relay. In degrees. Adjustable from 0.1 to 50.0 degrees.
oF.t *Off time*	It allows you to set the minimum off time for the control output. Once the control output is turned off, 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. For heating applications, set to zero. Value in seconds (0 to 1999 seconds).
on.t *on time*	It allows you to set the minimum on time for the control output. Once the control 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. For heating applications, set to zero. Value in seconds (0 to 1999 seconds).
dLY *Delay*	Delay time for the control start. After the controller is turned on, the control 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 *Defrost Interval Base*	It allows you to set a time base for dF. i (see **Note 3**): 0 Minutes. 1 Hours.
dt.b *Defrost Time Base*	It allows you to set a time base for dF.t: 0 Minutes. 1 Hours.
dF. i *Defrost Interval*	Interval between defrosts. Adjustable between 0 and 1999 minutes/hours, according to the time base specified in d i.b.
dF.t *Defrost time*	Defrost duration. Adjustable between 1 and 1999 minutes/hours, according to the time base specified in dt.b.
dF.H *Defrost hold*	It allows you to keep the temperature indication unchanged during the defrost time plus the time set in this parameter. Adopt the time base specified in dt.b. 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.
CP.P *Compressor Protect*	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 stays off when Sensor fails. 1 Compressor stays on when Sensor fails.
Add *Address*	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 has the RS485 serial communication interface.
bAu *Baud Rate*	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 *Parity*	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.

Note 3: The Defrost related parameters are only available when this function is enabled in parameter dF.E (in the Restricted Configuration Level).

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.

PSS *Password*	It allows you to enter the Access Password. By entering it, you can change the configuration of the controller.
Prt *Protection*	It allows you to define the levels of parameters to be protected. 1 Only the Restricted Configuration level is protected. 2 The Restricted and General Configuration levels are protected. 3 The Restricted and General Configuration levels are protected. The General Configuration level is not displayed. 4 The Restricted and General Configuration and Setpoint levels are protected. The General Configuration level is not displayed. 5 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. 0 Defrost function disabled. The parameters will not be displayed. 1 Defrost function enabled. The parameters will be displayed.
PS.C *Password Change*	It allows you to change the current password. You can set the password to a number between 1 and 999.
CA.E *Calibration Enable*	It allows you to recalibrate the Temperature Sensor input. If enabled, the controller will display the respective parameters (CA.L, CA.H).
CA.L *Calibration Low*	Declaration of the applied lower range calibration signal from the Temperature Sensor input.
CA.H *Calibration Hi*	Declaration of the applied upper range calibration signal from the Temperature Sensor input.
CA.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 measures the process temperature value through the Temperature Sensor (INPUT SENSOR). It then compares the measured value with the value set in the Setpoint (SP) and acts on the Control Output to bring the process temperature to the desired SP value.

On the front panel of the controller, the ❄ flag will light up whenever the control output is turned on.

In this controller, the DEFROS/DF process occurs via "Compressor Stop". At regular time intervals, the controller will switch off the Control Output that controls the process compressor, starting the defrost process.

The Control Output will remain off for the time defined in the configuration.

During defrosting, the indicated temperature can be prevented from updating, according to the configuration of parameter **dF.H**.

The parameters **dF.i** and **dF.t** 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.

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 Restricted Configuration level is always protected. To change its parameters, you must enter the access password in the **PSS** parameter, which is the first parameter of the Restricted Configuration level. Without the correct password, you can see the other parameters of the level, but not change them.

- **PSS** Parameter to enter the access password.
- **Prt** It allows you to define the degree of protection to be adopted by the controller.
- **PA.C** It allows you to change the access password. You can set the password to a number between 0 and 999.

Important notes:

1. The controller is supplied with the access password set to 111. In **PA.C** (Password Change) parameter, you can change it.
2. 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. You cannot set an access password with 0 (zero).
5. 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**, **Sn1** and **Sn0**) and calculated as following:

[1] + [higher digit of **SN2**] + [higher digit of **SN1**] + [higher digit of **SN0**]

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

As follows: **Sn2** = 97; **Sn1** = 123; **Sn0** = 465 = 1 + 9 + 3 + 6

9.1 HOW TO USE YOUR MASTER PASSWORD

1. In the **PAS** parameter, enter the master password.
2. In the **PAC** 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.