N323TR

TEMPERATURE CONTROLLER – USER GUIDE – V1.8x L

1. SAFETY ALERTS

The symbols below are used in the device and throughout this manual to draw the user's attention to valuable information related to device safety and use.

⚠	⚡
CAUTION:	**CAUTION OR HAZARD:**
Read the manual fully before installing and operating the device.	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's safety protections may not be effective.

2. SUMMARY

3. PRESENTATION

N323TR is a temperature controller suitable for refrigeration, with functions designed for temperature control applications and optimization of the defrosting process.

Its internal clock allows you to program defrost times and days.

It has 2 input channels for temperature sensors (NTC thermistors) that measure the temperature of the monitored environment and the evaporator module.

It has 3 independent outputs to control the compressor (refrigeration output), the defrost module, and the fan.

The details of the controller are in accordance with the purchase order and are shown on the label attached to the controller.

4. SPECIFICATIONS

SENSOR INPUT:

2 NTC Thermistors: Type 10 kΩ @ 25 °C | Measurement range: -50 to 120 °C (-58 to 248 °F) | Accuracy: 0.6 °C (1.1 °F).

> **Note:** The sensors are supplied with the equipment.
>
> Its operating range is **-30 to 105 °C (-22 to 221 °F)**. It has a 3 m long cable (2 x 0.5 mm²), which can be extended up to 200 meters.
>
> Maximum error when interchanging original NTC sensors: 0.75 °C (33.35 °F). This error can be removed by using the **Offset** parameter of the controller.

Measurement resolution:........ 0.1 °C in the range -19.9 to 199.9 °C
....(-3.8 to 391.8 °F).
.... 1 °C: Elsewhere.

Note: The equipment maintains accuracy over the entire range, although the low resolution of the display in a portion of the range does not allow it to be visualized.

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

Optionally:.....................................Pulse, 5 Vdc, 25 mA maximum

OUTPUT 2:...SPST-NO relay, 3 A / 250 Vac

OUTPUT 3:...SPST-NO relay, 3 A / 250 Vac

POWER SUPPLY:

Voltage:... 100~240 Vac/dc (± 10 %)

Optionally:.. 24 V (12~30 Vdc) (*)

Frequency:..50~60 Hz

Consumption:...5 VA

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

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 cutout:..70 x 29 mm

Weight:.. 100 g

Operation conditions:

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

UL94 V-2 Polycarbonate housing.

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

Connections for wires up to 4.0 mm².

RS485 interface with Modbus protocol (optional).

Serial interface not isolated from input circuit.

Interface isolated from the power supply circuit, except for the model with 24 V power supply.

Certifications: CE.

5. ELECTRICAL CONNECTIONS

The following figure shows the connection, power supply, and output terminals of the controller:
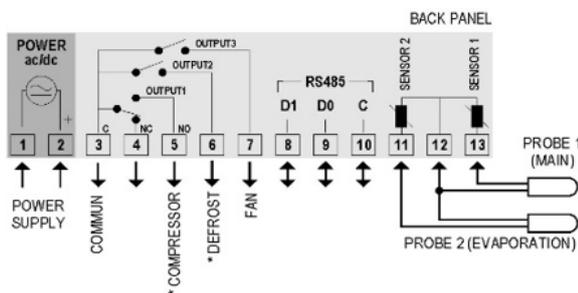

Figure 1 – Electrical connections

5.1 INSTALLATION RECOMMENDATIONS

- Input signal conductors should run through the plant separate from output and supply conductors. If possible, in grounded conduits.

- The power supply for electronic instruments must come from a network specific to the instrumentation.

- It is recommended to use RC FILTERS (noise suppressors) in contactor coils, solenoids, etc.

6. OPERATION

Before use, the controller must be configured. 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	Defrost Schedule
4	Calibration

Table 1 – Paramater levels

When the controller is turned on, the display will show the version of the internal software. The controller will then display the temperature value measured by the sensor. This is level **0** or the Temperature Measurement level.

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

To access level **2**, press **P** for **2 seconds**, until **Unt** parameter is displayed. Release the **P** key to remain at this level. To access the other parameters of this level, press **P** again. After the last

parameter, the controller will return to the temperature measurement level.

To change the parameter values, use the ⏶ and ⏷ keys.

Notes:

1. The controller saves the programming when you move from one parameter to another. Only then will it be considered valid. Even in the event of a power outage, the configuration is stored in permanent memory.

2. If the keys are not used for a time longer than 20 seconds, the controller returns to the measuring level, finishing and saving the configuration done so far.

3. When in temperature measurement mode, a short press of the ☀ key will cause the controller to temporarily display the temperature value measured by sensor 2 – Evaporator temperature.

6.1 LEVEL 1 – SETPOINT ADJUSTMENT LEVEL

This level displays the Setpoint parameters. It sets the desired temperature value for the system. The current SP value is shown alternating with the parameter value.

To change the parameter values, use the ⏶ and ⏷ keys.

SP *Setpoint*	Temperature control adjustment. This adjustment is limited to the values programmed in **SPL** and **SPH**.

6.2 LEVEL 2 – OPERATION MODE LEVEL

Display the other parameters. The parameters are shown alternately with their values.

To change the parameter values, use the ⏶ and ⏷ keys.

Unt *Unit*	Temperature unit. Allows you to define the display unit of the measured temperature: 　**0**　Temperature in Celsius degrees. 　**1**　Temperature in Fahrenheit degrees.
OF 1 *Offset Sensor 1*	Value to correct the temperature measured by Sensor 1. Allows you to make small adjustments to the ambient temperature indication to correct measurement errors that appear, for example, when replacing the temperature sensor. Adjustable from 0.1 to 10.0 degrees.
OF2 *Offset Sensor 2*	Value to correct the temperature measured by Sensor 2. Allows you to make small adjustments to the evaporator to correct measurement errors that appear, for example, when replacing the temperature sensor. Adjustable from -10.0 to 10.0 degrees.
SPL *SP Low Limit*	Setpoint lower limit. Minimum value that can be used when programming a Setpoint value. It must be programmed with a **lower** value than the one programmed in **SPH**.
SPH *SP High Limit*	Setpoint upper limit. Maximum value that can be used when programming a Setpoint value. It must be programmed with a **higher** value than the one programmed in **SPL**.
HYS *Hysteresis*	Hysteresis for the refrigeration output. Allows you to define the difference between the point at which the refrigeration output is switched on and off. Adjustable from 0.1 to 50.0 degrees.

Cnt *Control*	Allows you to define the position of the refrigeration output (compressor): **0** Refrigeration in OUTPUT1. Defrost in OUTPUT2. Factory default. **1** Refrigeration in OUTPUT2. Defrost in OUTPUT1.
dLY *Delay*	Delay to the start of control. Once the controller is turned on, the output will only be turned on after the time programmed in this parameter has elapsed. Used in large refrigeration systems to prevent compressors from being activated simultaneously during a power outage. Value in seconds. From 0 to 250 s.
Ont *on time*	Allows you to define the minimum on time for the refrigeration output. When the refrigeration output is turned on, it will remain in this condition for at least the time programmed in this parameter. Typically used to extend the lifespan of the compressor in a refrigeration system. Value in seconds. From 0 to 999 s.
OFt *Off time*	Allows you to define the minimum off time for the refrigeration output. When the refrigeration output is turned off, it will remain in this condition for at least the time programmed in this parameter. Typically used to extend the lifespan of the compressor in a refrigeration system. Value in seconds. From 0 to 999 s.
SCH *Schedule*	Allows you to define the start mode of the defrosting process: **0** The defrosting process starts as configured in **dFi**. **1** The defrosting process starts according to the schedule.
dFi *Defrost Interval*	Allows you to define the interval between defrosts. Adjustable time interval between 0 and 999 minutes in which the defrost output remains off. In 0, it determines that there will be no downtime for the defrosting process.
dFt *Defrost Time*	Allows you to set the duration of the defrost. Time interval that the defrost output remains on. Adjustable between 1 and 999 minutes.
dFC *Defrost Com-pressor*	Allows you to define the behavior of the refrigeration output during the defrosting process: **0** The refrigeration output is switched off during the defrosting process. **1** The refrigeration output remains on during the defrosting process. **2** The refrigeration output operates normally. It switches on and off as required to maintain the temperature.
dFS *Defrost Temperature*	Allows you to define the temperature for the end of the defrosting process. Temperature value measured in the evaporator by sensor 2 which, when reached, determines the end of the defrost cycle, even if the defrost duration interval has not ended. Adjustable from -50 to 120 degrees. **Important note:** The defrost cycle will not start if the evaporator temperature is above the value set in this parameter.

ddt *Defrost Drainage Time*	Allows you to define the draining time. After the defrosting process, the output still need to be switched off for a while, as water can accumulate on the evaporator. This interval must be dimensioned so that the water is eliminated. Adjustable between 0 and 999 minutes.
FrS *Fan Return Setpoint*	Evaporator temperature value for fan return. After defrosting and draining, the refrigeration will be switched on immediately, as the room temperature must be high. To prevent this heated air from circulating in the controlled environment, requiring more energy to lower the temperature, the controller prevents the ventilation output (OUTPUT3) from being switched on until the temperature in the evaporator has dropped to the value set in this parameter.
FdL *Fan Drainage Limit*	Maximum time for the fan to return after draining. For the safety of the stored products, if the temperature in the evaporator does not reach the value set in **FrS**, ventilation will resume at the end of the time interval set in this parameter. Adjustable between 0 and 999 minutes.
Foc *Fan Operation With Compressor*	Allows you to define the fan's behavior during refrigeration: **0** The fan only stays on as long as the compressor is on. **1** The fan remains on during the entire refrigeration cycle, even when the compressor is switched off.
Fod *Fan On Operation Defrost*	Allows you to define the fan's behavior during the defrosting process: **0** The fan remains off during defrost. **1** The fan remains on during defrost.
FSS *Fan Stop Setpoint*	Fan stops due to evaporator heating. It switches off the fan when the evaporator heats up, improving system efficiency and protecting the compressor. The fan will turn on again when the temperature drops by 2 degrees from the value set in this parameter.
CoE *Compressor Operation On Sensor Error*	Allows you to define the compressor's behavior when sensor 1 (ambient temperature) is disconnected. When sensor 1 is defective (disconnected, broken, etc.), the compressor will assume the condition defined in this parameter: **0** The compressor switches off when sensor 1 is defective. **1** The compressor switches on when sensor 1 is defective.
dFH *defrost hold*	This allows the temperature display to remain unchanged during the defrost time **plus** the time set in this parameter: **0** Allows you to update the display. **1** to **250** From the moment of defrosting, the temperature display will remain unchanged, showing the temperature measured at the start of the defrosting process. In seconds, minutes, or hour. For applications without defrost, set to 0.
Add *Address*	Controllers with RS485 serial communication interface display the **Add** parameter. In this parameter, you can define a communication address for each network element. The address defined must be between 1 and 247.

6.3 LEVEL 3 – DEFROST SCHEDULING LEVEL

CLc	Current time.
dAY	Day of the week. 1-7: Sunday to Saturday.
Pro	**0** Weekly schedule (seven days a week). **1** Weekday schedule (Monday-Friday). **2** Daily schedule (every day with the same schedule).
1:P1 1:P2 1:P3 … 7:P8	Defrosting schedule: 1:P1, 1:P2,..., 1:P8 → Sunday defrosting schedule. 2:P1, 2:P2,..., 2:P8 → Monday defrosting schedule. 3:P1, 3:P2,..., 3:P8 → Tuesday defrosting schedule. 4:P1, 4:P2,.... 4:P8 → Wednesday defrosting schedule. 5:P1, 5:P2,.... 5:P8 → Thursday defrosting schedule. 6:P1, 6:P2,..., 6:P8 → Friday defrosting schedule. 7:P1, 7:P2,..., 7:P8 → Saturday defrosting schedule. Day of the Week→ ─ :P_ ← Number Defrost Program 1 Sunday 1 – 1st program of the day 2 Monday 2 – 2nd program of the day 3 Tuesday 3 – 3rd program of the day 4 Wednesday 4 – 4th program of the day 5 Thursday 5 – 5th program of the day 6 Friday 6 – 6th program of the day 7 Saturday 7 – 7th program of the day 8 – 8th program of the day **Example: 2:P1 (Monday Program 1)**

6.4 LEVEL 4 – CALIBRATION LEVEL

The controller 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.

If you access it by accident, simply step through all the parameters, until the controller returns to the measurement screen.

PAS *Password*	Parameter to enter a password that will allow you to change other parameters.
CL1 *Calibration Low Input 1*	Calibration of the input 1 measurement range Offset. Allows you to adjust the lower value of the sensor measurement range.
CH1 *Calibration High Input 1*	Calibration of the input 1 measurement scale gain. Allows you to adjust the upper value of the sensor measurement range.
CL2 *Calibration Low Input 2*	Calibration of the input 2 measurement range Offset. Allows you to adjust the lower value of the sensor measurement range.
CH2 *Calibration High Input 2*	Calibration of the input 2 measurement scale gain. Allows you to adjust the upper value of the sensor measurement range.
FAC *Factory Calibration*	Allows you to return to the original calibration of the controller. When changing from 0 to 1, the original calibration will be restored, and the changes made during the calibration will be discarded.
Prt *Protection*	Allows you to set the parameter levels to be protected.
PAC *Password Change*	Allows to change the current password. You can set the password to a number between 1 and 999.
Sn2 *Serial Number 2*	Displays the first 2 two digits of the electronic serial number of the controller.
Sn1 *Serial Number 1*	Displays the middle 3 digits of electronic serial number of the controller.
Sn0 *Serial Number 0*	Displays the last 2 two digits of the electronic serial number of the controller.

7. WORKING WITH THE CONTROLLER

The controller switches the refrigeration output on or off to bring the system temperature up to the value set in the Setpoint parameter.

On the front panel, the ❄ flag lights up when the refrigeration output is switched on.

7.1 DEFROST PROCESS

The DEFROST process aims to melt the ice accumulated on the evaporator, making the refrigeration process more efficient.

The defrosting process occurs periodically and has a defined duration. However, its execution can be prevented, and its end can be anticipated depending on the temperature measured directly on the evaporator. See dFS parameter.

Defrosting can occur by compressor stop, resistance heating, or by reversing the compressor cycle:

- **Defrost by compressor stop:** At the start of the defrost cycle, the refrigeration output will be switched off and the evaporator will defrost naturally.
- **Defrost by resistance heating:** The defrosting output will be used to connect an electric resistance that will heat the evaporator to melt the accumulated ice. In this mode, the refrigeration output will also be switched off.
- **Defrost by reversing the compressor cycle:** The refrigeration output will not be switched off and the defrost output will be used to reverse the compressor cycle.

During defrost, the indicated room temperature can be prevented from being updated, depending on what is programmed in the dFh parameter.

The dF i and dFt parameters define, respectively, the interval between one defrost and another and the duration of the defrost. On the front panel of the controller, the ❅ flag will light up when the controller is in the defrosting process.

Manual defrost: The key allows you to start or stop defrosting immediately. By pressing this key for 3 seconds, the controller will be forced into defrost. If it is in defrosting process, its end will be forced.

Defining the evaporator temperature at the end of defrosting:

1. Wait for ice to form in the evaporator.
2. Trigger a manual defrost.
3. Visually monitor the evaporator until all the ice has disappeared.
4. Check the temperature measured by sensor 2 at that moment (short press on). This is the value used in the End Defrost Temperature parameter dFS.

8. CONFIGURATION PROTECTION

The configuration protection system prevents undue changes to the parameters of the controller and, consequently, its operating mode.

This system is composed of parameters that define the degree of protection to be adopted (full or partial).

Protection is defined by the following parameters:

PAS Parameter to enter a password that will allow you to change other parameters.

Prt Allows you to set the parameter levels to be 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 Allows to change the current password. You can set the password to a number between 1 and 999.

8.1 CONFIGURATION PROTECTION OPERATION

The PAS parameter appears at the beginning of the protected level. If you enter the password correctly, it is possible to change the parameters of the protected levels.

If you do not enter the password correctly or simply pass by this parameter, the parameters of the protected levels can only be viewed.

Important notes:
1. When you enter an incorrect password 5 consecutive times, the equipment will prevent new attempts for 10 minutes.

   If you do not remember the current password, you can enter a master password, which only allows you to set a new password.
2. The equipment leaves the factory with password **111**.

9. MASTER PASSWORD

The master password, which allows you to set a new password for the controller, uses the serial number of the equipment. It is composed as follows:

[1] + [largest number of SN2] + [largest number of SN1] + [largest number of SN0]

The master password for an equipment with serial number 97123465 is: **1936**

Example: 1 + Sn2 = 97; Sn 1 = 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 any new non-zero (0) password.
3. Use the new password.

10. ERROR INDICATION

On the display, the controller shows messages that correspond to problems related to temperature measurement.

Whenever they are displayed, the control output relay will be turned off immediately.

▬▬▬	The measured temperature has exceeded the upper limit of the sensor measurement range. **NTC** sensor short-circuited.
▬ ▬ ▬	The measured temperature has exceeded the lower limit of the sensor measurement range. Broken **NTC** sensor.

Table 2 – Error indications

11. WARRANTY

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