

N323TR is a temperature controller for cooling systems that has a number of specially developed functions for applications in temperature control and defrosts optimization. It presents an internal clock for defrost schedule, with weekly schedule, daily or days or working days. It has two input channels for temperature sensors, NTC thermistors, to measure the temperature of the supervised environment and the evaporator module. It has three independent outputs for the control of the compressor (cooling output), defrost module and fan.

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

SPECIFICATIONS

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

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 °C in the range of -19.9 to 119.9 °C
 1 °C in the rest of the range

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 Res.)
 Optionally: Pulse, 5 Vdc, 25 mA max.

OUTPUT2: Relay SPST-NA, 3 A / 250 Vac

OUTPUT3: Relay SPST-NA, 3 A / 250 Vac

POWER SUPPLY: Voltage: 100 to 240 Vca/cc ±10 %
 Optionally: 12 to 30 Vdc
 Frequency: 50-60 Hz
 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: Operation temperature: 0 to 40 °C (32 to 104 °F)
 Storage temperature: -20 to 60 °C (-4 to 140 °F)
 Relative Humidity: 20 to 85 % UR

**Case in Polycarbonate UL94 V-2; Protection: box IP42, front panel IP65;
 Suitable wiring 4.0 mm²; Interface RS485 MODBUS protocol (optional);
 Non-isolated serial interface input circuit. Isolated interface from the supply circuit except in the 24 V supply model.**

Recommendations for the Installation

The cables of the temperature sensors must be separated from the control and power supply cables, if possible, in grounded conduits.

The controller power supply should preferably come from an exclusive power network for the instruments or in a different circuit from that used by the control output stage.

It is recommended to use RC filters (47 R and 100 nF, series) in coils of contactors, solenoids, etc.

ELECTRICAL WIRING

Figure 01 shows the connection terminals for power supply, sensors and outputs.

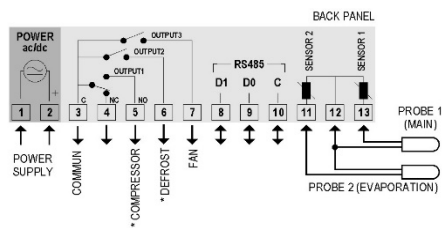


Figure 01 – Connections shown in the label on the controller case.

OPERATION

Before using the controller, it must be configured by the user. This setting is to set the values for the various parameters that determine the operation mode of the equipment. These configuration parameters are organized into groups or levels, called level parameters.

Level	Function
0	Temperature measurement
1	Setpoint Adjustment
2	Operation Mode
3	Defrost Schedule
4	Calibration

Upon power-up, the N323TR display shows for 1 second its firmware version. This information is useful when consulting the factory.

The controller then starts to display the value of the environment temperature measured by sensor 1. This is the 0 level or Temperature Measurement level. To access the level 1, press [P] for 1 second until the "SP" parameter appears. Release the key [P] to stay at this level. Press again [P] to return to the level of temperature measurement. To access the second level, press [P] for 2 seconds until the "Unt" parameter appears. Release the key [P] to stay at this level. Press again [P] to access the other parameters in this level. After the last parameter the controller back to the level of temperature measurement.

Use the [▲] and [▼] keys to alter a parameter value:

- Notes:**
- 1 The parameters are saved by the controller when it passes from a parameter to another and only then it will be considered valid. The configuration is stored in a permanent memory, even in the lack of electrical power.
 - 2 If the keys are not used for more than 20 seconds, the controller returns to the level of measurement, finalizing and saving the programming previously made.
 - 3 While in the temperature measurement level, a momentary pressing on the [▲] key will show the sensor 2 temperature (evaporator temperature).

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.

SP Set Point	Case of coldroom temperate adjustment. SP value is limited to the values programmed in SPL and SPH in the programming level (Parameter configuration, Level 2).
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Level 2 – Level of Operation Mode

Show other parameters that must be set by the user. The parameters are shown alternately with their respective values.

Unt Unit	Temperature Unit. Allows the user to select the temperature unit for all parameters of the controller. <input type="checkbox"/> Temperature Celsius; <input type="checkbox"/> Temperature Fahrenheit.
oF 1 Offset Sensor 1	Offset value to be added to the sensor 1 measured temperature such as to perform fine adjustments to the value showed on the display (after sensor replacement, for instance, if required). In degrees, adjustable from 0.1 to 10.0 degrees.
oF 2 Offset Sensor 2	Offset value to be added to the sensor 2 measured temperature to perform fine adjustments to the value showed on the display (after sensor replacement, for instance, if required). Adjustable from -10.0 to 10.0 degrees.
SPL SP Low Limit	Setpoint low limit: set a minimum value for the setpoint.
SPH SP High Limit	Setpoint high limit: set a maximum value for the setpoint. Must be set to a value greater than SPL .
HYS Hysteresis	Hysteresis for output cooling: Difference between ON and OFF for the cooling output. Adjustable from 0.1 to 50.0 degrees.
Ont Control	Defines the output position for the refrigeration (compressor). <input type="checkbox"/> Refrigeration in OUTPUT1 / Defrost in OUTPUT2. (factory default) <input type="checkbox"/> Refrigeration in OUTPUT2 / Defrost in OUTPUT1.

dLY Delay	Time delay to start cooling. After the controller is turned on, the cooling output will only be triggered when the elapsed time set in this parameter. Used in large refrigeration systems to prevent simultaneous starts for compressors in the return of power failure. Value in seconds, 0 to 250 s.
Ont On Time	Sets the minimum time to be turned ON the cooling output. Once the cooling output is activated, it will remain so for at least the time set in this parameter. Typically used to increase the service life of the compressor in the refrigeration system. Value in seconds, 0 to 999 s.
OFFt Off Time	Sets the minimum time to be turned OFF the cooling output. Once the cooling output is activated, it will remain so for at least the time set in this parameter. Typically used to increase the service life of the compressor in the refrigeration system. Value in seconds, 0 to 999 s. Value in seconds, 0 to 999 s.
ScH Schedule	<input type="checkbox"/> Defrost starts as configured in dF i . <input type="checkbox"/> Defrost starts as schedule.
dF i Defrost Interval	Interval between defrost. Adjustable from 0 to 999 minutes. During this time, the defrost output remains off. <input type="checkbox"/> (zero), determines no stops in the defrost process.
dFt Defrost Time	Defrost duration. Interval time during which the defrost output remains on. Value in minutes, 1 to 999.
dFC Defrost Compressor	Compressor output behavior during the defrost cycle. <input type="checkbox"/> Cooling output is OFF during defrost; <input type="checkbox"/> Cooling output is ON during defrost; <input type="checkbox"/> Compressor output works normally, turning on and off to maintain the temperature.
dFS Defrost Temperature	Temperature for finalizing the defrost – Value of the evaporator temperature measured by the sensor 2 which, when reached determines the end of the defrost cycle, even if the interval of defrost duration has not ended. Adjustable between -50 and 120 degrees. Important note: The defrost cycle will not initiate if the evaporator temperature is the value defined in this parameter.
ddd Defrost Drainage Time	Drain down time – After defrost is still necessary a time interval with outputs in OFF; this is because may there be water accumulated on the evaporator. This interval must be rated so that these drops of water are eliminated. Adjustable between 0 and 999 minutes.
FrS Fan Return Set Point	Evaporator temperature for liberating the fan – After defrost and the draining, refrigeration is turned ON immediately because the ambient temperature should be high. To prevent this hot air circulate in a controlled environment, requiring more energy to lower the temperature, the controller prevents the ventilation output (OUTPUT3) is turned ON until the evaporator temperature drops to the value defined in this parameter.
FdL Fan Drainage Limit	Fan maximum delay after draining – For the safety of products stored, if the evaporator temperature does not reach the set value in FrS , the return of ventilation will happen at the end of the time interval set in this parameter. Adjustable between 0 and 999 minutes.
Foc Fan Operation With Compressor	Fan behavior during refrigeration. <input type="checkbox"/> Fan is active only when the compressor is on. <input type="checkbox"/> Fan is active during the complete refrigeration cycle, even when the compressor is turned off.
Fod Fan On Operation Defrost	Fan behavior during defrost. <input type="checkbox"/> Fan is off during the defrost cycle. <input type="checkbox"/> Fan is active during the defrost cycle.
FSS Fan Stop Set Point	Fan deactivation due to evaporator heating – Turn OFF the fan when the evaporator heats up, improving system efficiency and protecting the compressor. The fan is allowed to turn on again when the temperature drops 2 degrees below the value defined in this parameter.
coE Compressor Operation On Sensor Error	Sets the behavior of the compressor with sensor 1 (room temperature) disconnected - When sensor 1 is with issues (disconnected, broken, etc.) the compressor assumes the condition defined in this parameter. <input type="checkbox"/> Compressor is deactivated when sensor 1 is in error. <input type="checkbox"/> Compressor is activated when sensor 1 is in error.

dFh <i>Defrost Hold</i>	<p>Lock the indication of the room temperature during defrosts - Allows to maintain unchanged the display of the room temperature during defrosting, plus the time set in this parameter.</p> <p>0 Allows updating the display.</p> <p>1 to 250 Time in which, starting in defrost, the temperature display remains unchanged, showing the temperature measured at the beginning of defrost in minutes.</p> <p>Applications without defrost set to 0.</p>
Rdd <i>Address</i>	<p>The controllers that have embedded a serial communication interface RS485 presents the Rdd parameter in their programming level. In this parameter the user defines a communication address for each network element. The address must be set between 1 and 247.</p> <p>For complete information refer to Table of Registers for Serial Communication, available for download on the web site page of N323TR - www.novus.com.br.</p>

Level 3 – Level of Frost Schedule

cLc	Current time																
dRy	Day of week. 1-7: Sunday to Saturday																
Pro	<p>0 Weekly schedule (seven days a week).</p> <p>1 Scheduling of working days (Sunday, Monday-Friday and Saturday).</p> <p>2 Daily schedule (every day with the same schedule).</p>																
1:P1 1:P2 1:P3 ... 7:PB	<p>Defrost Schedule:</p> <p>1:P1, 1:P2, ..., 1:P8 - Scheduling defrost on Sunday</p> <p>2:P1, 2:P2, ..., 2:P8 - Scheduling defrost on Monday</p> <p>3:P1, 3:P2, ..., 3:P8 - Scheduling defrost on Tuesday</p> <p>4:P1, 4:P2, ..., 4:P8 - Scheduling defrost on Wednesday</p> <p>5:P1, 5:P2, ..., 5:P8 - Scheduling defrost on Thursday</p> <p>6:P1, 6:P2, ..., 6:P8 - Scheduling defrost on Friday</p> <p>7:P1, 7:P2, ..., 7:P8 - Scheduling defrost on Saturday</p>																
<p>Day of the Week → — :P— ← Number Defrost Program</p> <table border="0"> <tr> <td>1 Sunday</td> <td>1 – 1° Schedule of the day</td> </tr> <tr> <td>2 Monday</td> <td>2 – 2° Schedule of the day</td> </tr> <tr> <td>3 Tuesday</td> <td>3 – 3° Schedule of the day</td> </tr> <tr> <td>4 Wednesday</td> <td>4 – 4° Schedule of the day</td> </tr> <tr> <td>5 Thursday</td> <td>5 – 5° Schedule of the day</td> </tr> <tr> <td>6 Friday</td> <td>6 – 6° Schedule of the day</td> </tr> <tr> <td>7 Saturday</td> <td>7 – 7° Schedule of the day</td> </tr> <tr> <td></td> <td>8 – 8° Schedule of the day</td> </tr> </table> <p>Example: 2:P1 (Monday Schedule 1)</p>		1 Sunday	1 – 1° Schedule of the day	2 Monday	2 – 2° Schedule of the day	3 Tuesday	3 – 3° Schedule of the day	4 Wednesday	4 – 4° Schedule of the day	5 Thursday	5 – 5° Schedule of the day	6 Friday	6 – 6° Schedule of the day	7 Saturday	7 – 7° Schedule of the day		8 – 8° Schedule of the day
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Level 4 – Calibration Level


The controller is factory calibrated. When required a new calibration it should be performed by qualified personnel. To access this level a key **[P]** must be pressed for more than 3 seconds.

If accidentally accessed this level, the keys **[▲] and **[▼]** should not be pressured; simply pass all parameters with the help of key **[P]** until the display returns to the measurement screen.**

PR5	Password – Enter the correct password to unlock write operations for the parameters in the following levels.
CL1	Calibration low input 1 – Offset for measuring input 1. Sets the lower measuring range of the sensor.
CH1	Calibration High input 1 – Gain for input 1. Sets the upper measurement range of the sensor.
CL2	Calibration low input 2 – Offset for measuring input 2. Sets the lower measuring range of the sensor.

CH2	Calibration High input 2 – Gain for input 2. Sets the upper measurement range of the sensor.
FAC	Factory Calibration – Restores the original calibration parameters of the controller. If changed from 0 to 1 the original calibration set will be restored and the changes made will be overwritten.
PrL	Protection - Defines the levels of parameters that will be password protected.
PAC	Password Change – Parameter that allows you to change the current password. Allows you to set password as a number between 1 and 999.
Sn2	Serial number – Shows the first two digits of the electronic serial number of the controller.
Sn1	Serial number – Shows the three central digits of the electronic serial number of the controller.
Sn0	Serial number – Shows the last three digits of the electronic serial number of the controller.

OPERATION

The controller turns on or off the output cooling to bring the temperature of the system to the user-defined value in the Setpoint. On the front panel of the controller the indicator led  lights up when the output cooling is ON.

Defrost Process

The defrost process aims to melt accumulated ice on the evaporator making the cooling process more efficient. Defrosting happens regularly and has defined duration. However, its execution can be prevented and its end early due to the temperature measured directly on the evaporator. See **dF5** parameter.


The defrost can be achieved by: compressor deactivation, electrical heater or heat pump inversion.

On defrost by **stopping the compressor**, at the beginning of the defrost cycle the cooling output is turned off and the defrosting of the evaporator happens naturally.

On defrost by **resistance heating** the defrost output is used to activate an electrical resistance that heats the evaporator to melt the accumulated ice. In this mode the output cooling is switched off.

On defrost by **inversion of the compressor cycle** the cooling output is not turned off and a defrost output is used to perform the inversion of the compressor cycle.

During defrost the room temperature indicated may be prevented from suffering update according to the parameter settings **dFh**.

The **dF1** and **dF2** 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 **[F]** key allows that a defrost cycle be initiated or terminated immediately. Pressing this key for 3 seconds will toggle the current defrost status.

Definition of the evaporator temperature that terminates the defrost:

- Wait for ice building on the evaporator;
- Start a defrost cycle manually;
- Visually monitor the evaporator until there is no more ice on it;
- Check the Probe 2 temperature (momentary press on the **[F]** key). This is the value used in parameter Temperature for End of Defrost **dF5**.

CONFIGURATION PROTECTION

The protection system configuration aims to prevent unwanted changes in the controller parameter and, consequently, in their mode of operation. This system is composed of parameters that define what degree of protection will be adopted, full or partial. The parameters that define the protection are:

- PR5:** Parameter where a password must be entered before changes are allowed to the other parameters
- 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 that enables to change the current password. It must be a number between 1 and 999.

Operation of the protection for the configuration

The **PR5** parameter is displayed before entering a protected level. If the user enters the password correctly may make changes in the parameters of protected levels. If the user do not enter the password correctly or simply pass through this parameter, the parameters of protected levels may be viewed only but not changed.

Important notes:

1. If the user enters an incorrect password five consecutive times, the device prevents retries for 10 minutes. When the user does not remember the current password, you can enter a **master password** that allows **only** set a new password.
2. The factory default password is 111.

MASTER PASSWORD

The master password allows user to define a new password for the controller, uses the serial number of this equipment. It is composed as follows:

$$[1] + [\text{higher digit of SN2}] + [\text{higher digit of SN1}] + [\text{higher digit of SN0}]$$

For example the master password for the device with serial number 97123465 is: **1936**



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

How to use the master password:

- 1- Enter the master password value at **PR5** parameter.
- 2- Go to **PAC** parameter and enter the new password, which must not be zero (**0**).
- 3- Use this new password.

ERROR MESSAGES

The controller display shows the messages that correspond to problems related to temperature measurement. Whenever presented, immediately, the control output relay is turned off.

	<ul style="list-style-type: none"> • The measured temperature exceeded the upper limit of the measuring range of the sensor. NTC sensor is short circuit.
	<ul style="list-style-type: none"> • The measured temperature exceeded the lower limit of the measuring range of the sensor. NTC sensor is broken.

WARRANTY

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