N322T

TEMPERATURE CONTROLLER

USER GUIDE – V1.8x I

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: Read the manual fully before installing and operating the device.	**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. PRESENTATION

N322T is a 2-output digital electronic controller for heating and cooling applications. It has an input for temperature sensors such as NTC thermistors, Pt100 or J, K, or T thermocouples. It allows sensor errors (Offset) to be corrected.

Each type of sensor has a specific temperature measurement range. The controller has 2 outputs, which can act as a control output or timer output.

Displays the **Compressor Protection Function by Supply Voltage Monitoring**, important to protect compressors in refrigeration systems.

4. SPECIFICATIONS

INPUT SENSOR: The sensor is chosen at the time of purchase and is presented on the upper side of the box. The options are:

- Thermistor **NTC**: 10 kΩ @ 25 °C | Range: -50 to 120 °C (-58 to 248 °F) | Accuracy: 0.6 °C (1.1 °F).

  Maximum error in the interchangeability of original NTC sensors: 0.75 °C (1.35 °F). This error can be eliminated through the **Offset** parameter.

> **Note:** For the NTC thermistor option, the sensor comes with the equipment. Its operating range is limited to **-30 to 105 °C** (-22 to 221 °F).
>
> It has cable of 3 m in length, 2 x 0.5 mm², and can be extended up to 200 m.

- Pt100: Range: -50 to 300 °C (-58 to 572 °F) | α = 0.00385 | 3 wires | Accuracy: 0.7 °C (1.3 °F); according to IEC-751 standards.
- Thermocouple type **J**: Range: 0 to 600 °C (32 to 1112 °F) | Accuracy: 3 °C (5.4 °F).
- Thermocouple type **K**: Range: -50 to 1000 °C (-58 to 1832 °F) | Accuracy: 3 °C (5.4 °F).
- Thermocouple type **T**: Range: -50 to 400 °C (-58 to 752 °F) | Accuracy: 3 °C (5.4 °F).

  Thermocouples according to IEC-584 standards.

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.

OUTPUT2:.....Relay: 3 A / 250 Vac, SPST-NO

POWER SUPPLY:

Voltage:..... 100~240 Vac/dc (± 10 %)
Optionally: ..... 24 V (12~30 Vdc) (*)
Mains frequency: .....50~60 Hz
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.

DIMENSION:

Width x Height x Depth: .....75 x 33 x 75 mm

Panel:.....70 x 29 mm

Weight: ..... 100 g

OPERATION CONDITIONS:

Operation temperature:.....0 to 40 °C (32 to 104 °F)

Storage temperature:.....-20 a 60 °C (-4 to 140 °F)

Relative humidity: .20 to 85 % RH (non-condensing)

Housing in polycarbonate UL94-2.

Protection: Housing: IP42 | Front panel: IP65.

Suitable wiring: Up to 4.0 mm².

RS485 interface with MODBUS protocol (optional).

Serial interface not isolated from the input circuit.

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

Certifications: CE, UKCA, UL.

5. ELECTRICAL CONNECTIONS

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

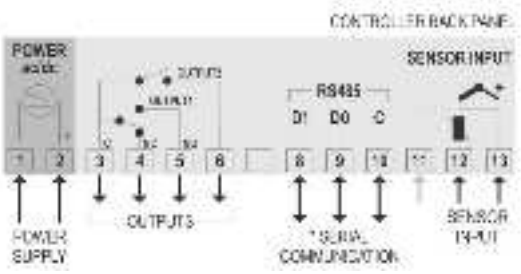

Figure 1 – Electrical connections

* The serial communication feature is not always present in the controller.

Pt100 with 3-wire connection. For a 2-wire connection, connect terminals 11 and 13. For proper cable resistance compensation, the conductors must have the same electrical resistance values (same cross-section).

5.1 INSTALLATION RECOMMENDATIONS

- The temperature sensor wires should run through the system plant **separately** from the control output and power supply wires. If possible, in grounded conduits.
- The controller power supply should preferably come from a network suitable for instrumentation or from a different phase from that used by the control output.
- It is recommended to use RC FILTERS (noise suppressors) in contactor coils, solenoids, etc.

6. OPERATION

Before use, the controller must be configured. That is, you must set values for the parameters that determine how the equipment operates.

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

LEVEL	FUNCTION
0	Temperature Measurement
1	Setpoint Adjustment / Voltage Indication
2	Configuration
3	Calibration

Table 1 – Parameter level

When you turn on the controller, the display shows its firmware version for 1 second. This information is useful when consulting the manufacturer. The controller then starts displaying the temperature value measured by the sensor. This is level **0** or the Measurement level.

To access level 1, press P for **1 second** until the SP parameter appears. To go back to level 0, press P once more.

To acess level 2, press P for **2 seconds** until the Unt parameter appears. Release P to remain on this level. Press P again to access the other parameters of this level. After reaching the last parameter, the controller will return to the first level (0).

Use the ▲ and ▼ keys to alter a parameter value.

Notes:

1. The configuration will be saved by the controller upon advancing to the next parameter in a level. Even in the event of a power outage, the configuration will be saved in permanent memory.
2. If the keys are not used for more than 20 seconds, the controller returns to the measuring level, ending and saving the configuration made so far.

6.1 LEVEL 1 – SETPOINT ADJUSTMENT LEVEL

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

Use the ▲ and ▼ keys for setting the suitable values.

U *Voltage*	The screen voltage measurement. For values lower than 150 Vac and higher than 254 Vac, it presents the message 0. Function available for N322T-NTC-LVD.
SP *Setpoint*	Temperature adjustment for control. SP value is limited to the values programmed in SPL and SPH.

6.2 LEVEL 2 – PROGRAMMING LEVEL

This level displays the remaining parameters. The parameters and their values are shown alternately.

Use the ▲ and ▼ keys for setting the suitable values.

UnE *Unit*	Temperature unit. Allows you to select the display unit for the measured temperature. 0 Temperature in Celsius degrees. 1 Temperature in Fahrenheit degrees.
tYP *Type*	Type of temperature sensor to be used. This parameter is only available on models with THERMOCOUPLE sensors. 0 Thermocouple **J**. 1 Thermocouple **K**. 2 Thermocouple **T**.
oFS *Offset*	Value to correct the temperature indication. Allows you to make small adjustments to the temperature display to correct measurement errors that appear, for example, when replacing NTC-type temperature sensors.
SPL *SP Low Limit*	Setpoint lower limit. Allows you to set the **minimum** value for the Setpoint adjustment. It must be defined to a value **lower** than **SPH**.
SPH *SP High Limit*	Setpoint upper limit. Allows you to set the **maximum** value for the Setpoint adjustment. It must be defined to a value **higher** than **SPL**.
HYS *Hysteresis*	Control hysteresis. Differential between the on and off point of the control output relay. In degrees.
ALE *Alarm Enable*	Allows you to enable the alarm. 0 Disabled alarm. 1 Audible alarm and flashing output 2 (1 second). 2 Audible alarm and constant output 2. 3 Flashing output 2 (1 second). 4 Constant output 2. Function available for N322T-NTC and N322TB-NTC. For N322T-NTC, parameters 1 and 2 work as parameters 3 ad 4, respectively. The alarm function works only for **FoE** = 2 parameter.
ALt *Alarm Time*	Allows you to set the time for which the alarm will be activated. From 1 to 255 seconds. To turn off the alarm before the set time, simply press the key ⏲ for 1 second. For N322T-NTC, parameters 1 and 2 work as parameters 3 ad 4, respectively. The alarm function works only for **FoE** = 2 parameter.
Act *Action*	Control action assigned to OUTPUT1: 0 Reverse action for heating. 1 Direct action for cooling.
Cnt *Control*	Output inversion. Inverts Setpoints and outputs. 0 Setpoint commands OUTPUT1. Timer output on OUTPUT2. Factory setting. 1 Promotes inversion. Setpoint controls OUTPUT2. Timer output on OUTPUT1. When the **FoE** parameter is set to 2, **cnt** is automatically changed to 0.
OFt *Off time*	Allows you to set the minimum off time for the control output. Once the control output is switched off, it will remain in this status for at least the time programmed in this parameter. Typically used to extend compressor life in refrigeration systems. For heating applications, set to 0. Value in seconds (from 0 to 999 s).
Ont *on time*	Allows you to set the minimum on time for the control output. Once the control output is switched on, it will remain in this status for at least the time programmed in this parameter. Typically used to extend compressor life in refrigeration systems. For heating applications, set to 0. Value in seconds (from 0 to 999 s).
dly *Delay*	Delay time to start control. After the controller is switched on, the control output will only be switched on when the time programmed in this parameter has elapsed. Used in large refrigeration systems to prevent simultaneous compressor start-ups in the event of a power outage. Value in seconds (from 0 to 250 s).
t1b *T1 Base*	Time base for **t1**: 0 Seconds. 1 Minutes. 2 Hours.
t2b *T 2 Base*	Time base for **t2**: 0 Seconds. 1 Minutes. 2 Hours.
t1 *Timer 1*	Interval between timer output activations. Ajustable bewteen 0 and 999 units of **t1b**. It will automatically be blocked, and its value will be set to zero when the **FoE** parameter is 2.
t2 *Timer 2*	Timer output activation duration. Ajustable bewteen 1 and 999 units of **t2b**.

FoE *Force Timer*	0 The timer respects the interval and duration programmed in t1 and t2. 1 The timer output is switched on with the control output. When the control output is switched off, the timer output returns to the programming of t1 and t2, starting with t2. 2 The process will only start when the key is pressed for more than 1 second, thus flashing the **P3** flag. If the key is pressed again for more than 1 second, the process will be switched off. This will be indicated by a beep and the **P1** and **P2** flags. When the temperature reaches the programmed Setpoint for the first time, the **P3** flag will flash, indicating that the timer has been activated. When the programmed time is reached, output 1 will be disabled, turning off **P3** flag and triggering the alarm, according to parameter ALE. When this function is enabled, t1 and cnt are automatically set to zero and must remain at zero. In applications **with** defrosting, set to 0. The function 2 is available for N322T-NTC and N322TB-NTC.
dFH *defrost hold*	Allows the temperature display to remain unchanged during the defrost time plus the time set in this parameter. 0 The indication can be updated. 1 to 250 The temperature display will remain unchanged from the defrost, showing the temperature measured at the start of the defrosting process. In seconds, minutes, or hours. In applications **without** defrosting, set to 0.
dFC *defrost Compressor*	Behavior of the control output (OUTPUT1), where the compressor is connected, during the defrosting process: 0 OUTPUT1 is switched off during defrost. 1 OUTPUT1 remains on during defrost. 2 OUTPUT1 operates normally. Turns on and off as required to maintain temperature. In refrigeration systems, OUTPUT1 normally controls the system's compressor. In applications **without** defrosting, set to 2.
CPE *Compressor Protect*	Enables compressor protection by monitoring electrical voltage. If the mains voltage is not set between the CPL and CPH Setpoints. 0 Disables compressor protection. 1 Enables compressor protection. Function available for N322T-NTC-LVD.

CPt *Compressor Protect Time*	Allows you to set a compressor shutdown delay when the compressor protection is activated while voltage monitoring is being performed. Time interval adjustable between 5 and 30 seconds. Function available for N322T-NTC-LVD.
CPL *CP Low Limit*	Lower electrical voltage limit used by the compressor protection. Minimum electrical voltage value that the compressor can operate at. Parameter adjustable between 150 and 254 Vac, which must be 10 Vac lower than the value set in the upper limit (CPH). Function available for N322T-NTC-LVD.
CPH *CP High Limit*	Higher electrical voltage limit used by the compressor protection. Maximum electrical voltage value that the compressor can operate at. Parameter adjustable between 150 and 254 Vac, which must be 10 Vac higher than the value set in the upper limit (CPL). Function available for N322T-NTC-LVD.
Add *Address*	Controllers with an RS485 serial communication interface have the Add parameter. In this parameter, you can set a communication address for each network element. The address defined must be between 1 and 247.

6.3 LEVEL 3 – CALIBRATION LEVEL

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

Press the P key for **4 seconds** to access this level. This level also contains the parameters for configuration protection.

If you have entered this level by accident, go through all the parameters without making any changes until the controller returns to the measurement level.

PAS *Password*	Parameter for entering a password to change the other parameters.
CAL *Calibration Low*	Calibration of the measuring range offset. Adjustment of the lower value of the sensor's measuring range.
CAH *Calibration High*	Calibration of the measuring scale gain. Adjustment of the upper value of the sensor's measuring range.
UoL *Voltage Calibration*	Offset adjustment for voltage indication calibration. Parameter only available for N322T-NTC-LVD.
CJL *Cold Junction Calibration*	Offset calibration of the Cold Junction. Only available for thermocouples.
FAC *Factory Calibration*	Allows you to return to the controller's original calibration. When changed from 0 to 1, the original calibration is restored and any changes made to the calibration will be disregarded.
Prt *Protection*	Allows you to set the levels of parameters to be protected.
PAC *Password Change*	Allows you to change the current password. You can set a number between 1 and 999.
Sn2 *Serial Number 2*	Displays the first 2 digits of the controller's electronic serial number.

Sn1 *Serial Number 1*	Displays the central 3 digits of the controller's electronic serial number.
Sn0 *Serial Number 0*	Displays the last 3 digits of the controller's electronic serial number.

7. OPERATION

The controller triggers the control output to bring the system temperature up to the value set in the Setpoint parameter. On the controller's front panel, the **P1** flag lights up when the control output is switched on.

The timer output is typically used to defrost the system. The tE1 and tE2 parameters define the interval between defrosts and the duration of the defrost, respectively.

Manual defrost: The key allows you to start or stop a timer or defrosting process. Pressing this key for at least 1 second inverts the status of the timer output.

Example: If it was on, it will be turned off. If it was off, it will be turned on, starting a new timer.

On the front panel, the **P2** flag lights up when the timer output is switched on. Other functions can be given to the timer output: Mixer, fan, etc.

8. CONFIGURATION PROTECTION

The purpose of the configuration protection system is to prevent undue changes to the controller parameters and, consequently, to its operating mode. This system is composed of parameters that define the degree of protection to be adopted (full or partial).

Parameters that define the protection:

PAS Parameter for defining the parameter levels to be protected.

PrE Parameter for defining 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 **Setpoints**.

PAC Parameter for changing the current password. You can set the password to a number between 0 and 1999.

8.1 HOW CONFIGURATION PROTECTION WORKS

The PAS parameter appears at the beginning of the protected level. By entering the correct password, you can change the parameters of the protected levels.

If you do not enter the correct password or if you just pass this parameter, the parameters of the protected levels can only be viewed and not changed.

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 factory default password is **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] + [higher digit of SN2] + [higher digit of SN1] + [higher digit of SN0]

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

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

9.1 HOW TO USE THE MASTER PASSWORD

1. In the PAS parameter, enter the master password.
2. In the PAC parameter, enter the new password, which must not be zero (**0**).
3. Use the new password.

10. ERROR MESSAGES

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.

If it is configured to show the differential temperature, the value shown will be zero.

----	Measured temperature exceeded **maximum** allowed range for the sensor. Broken **Pt100**. Short circuited **NTC**.
____	Measured temperature is below **minimum** measurement range of the sensor. Short circuited **Pt100**. Broken **NTC**.

Table 2 – Error messages

11. COMPRESSOR PROTECTION (N322T-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 controller starts to signal on this occurrence on its display. It switches the indication of voltage value measured with the temperature value.

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

12. WARRANTY

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