NOVUS
We Measure, We Control, We Record

TEMPERATURE CONTROLLER
N321
OPERATING MANUAL - V1.8x M

N321 is a temperature controller for heating or cooling with input for **NTC**, **Pt100**, **Pt1000** or thermocouple (**J**, **K** or **T**) temperature sensors and can correct sensor errors (Offset). Each type of sensor has a specific temperature measurement range. The controller also has a **relay** control output with Common, NO and NC contacts available.

The characteristics of each controller are identified on the devices body, according to the purchase order.

SPECIFICATIONS

INPUT SENSOR: The sensor is chosen at the time of purchase and is presented on the upper side of the equipment 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 of the controller.

> **Note:** For the NTC thermistor option, the sensor comes with the equipment. Its operating range is limited to **-30** to **+105 °C** (**-222** to **+221 °F**). It has cable of 3 meters in length, 2 x 0.5 mm², and can be extended up to 200 meters.

- 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.
- Pt1000: Range: -200 to 530 °C (-328 to 986 °F); α = 0,00385; 3 wires; Accuracy: 0.7 °C (1.3 °F).
- 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° (see **Note 1** below)
.... 1° elsewhere

> **Note**: **1)** J, K and T thermocouples have no decimal indication in the measured temperature value.
> **2)** 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)
POWER SUPPLY: ....100~240 Vac/dc (± 10 %)
　　　　　　　　Optionally: .... 12~30 Vdc/ac
　　　　　　　　Frequency: ....50~60 Hz
　　　　　　　　Power consumption: .... 5 VA
DIMENSIONS:　Width x Height x Depth: ....74 x 32 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
Suitable wiring: Up to 4.0 mm².
Polycarbonate UL94 V-2 Housing; Protection Degree: Housing: IP42; Front panel: IP65.

ELECTRICAL WIRING

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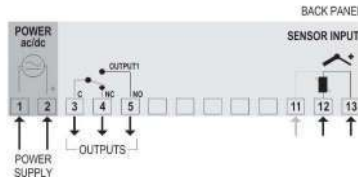

Figure 1 - Connections shown on controller label

Pt100 with 3-wire connection. For 2-wire connection, terminals 11 and 13 must be interconnected. To properly compensate the cable resistance, the conductors must have the same electrical resistance.

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 (47 Ω and 100 nF, series) in contactor coils, solenoids, etc.

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
2	Configuration
3	Calibration

When you turn on the controller, the display (front panel) shows the version of the equipment for 1 second. This information is important for eventual consultations with the manufacturer. The controller then starts presenting the temperature value measured by the sensor. This is level **0** or the Temperature Measurement level.

To access level **1**, press **P** until the **SP1** message shows up (**1 second**). Press **P** again to return to the temperature measurement level.

To access level **2**, press **P** until the **Unt** message shows up (**2 seconds**). Release **P** key to remain in this level. Press **P** to access the other parameters on this level. After the last parameter, the controller returns to the Temperature Measurement level.

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

Notes:　**1 -** The configuration will be saved by the controller when switching from one parameter to another, and only then will it be considered

valid. Even in the event of a power outage, the configuration is saved in permanent memory.

2 - If the keys are not used for longer than 20 seconds, the controller returns to the measurement level, ending and saving the configuration performed until then.

Level 1 – Setpoint Adjustment

This level displays the Setpoint (SP) parameter only. It defines the desired temperature value for the system. The current value of SP is shown alternately with the parameter. Use the ▲ and ▼ keys to set the desired value.

SP *Setpoint*	Control temperature or operating temperature adjustment. This adjustment is limited to the values programmed in **SPL** and **SPH** (see below).

Level 2 – Configuration Level

Displays the other parameters. The parameters and their respective values are shown alternately. Use the ▲ and ▼ keys to set the desired value.

Parameter	Description
Unt *Unit*	Temperature unit. Allows you to choose the display unit of 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 for models with THERMOCOUPLE sensors, where you can choose between J, K and T thermocouples: **0** Thermocouple **J** **1** Thermocouple **K** **2** Thermocouple **T**
oFS *Offset*	Correction value for temperature indication. Allows you to make small adjustments to the temperature display to correct measurement errors that appear, for example, when replacing an NTC temperature sensor.
SPL *SP Low Limit*	Setpoint lower limit. Minimum value to program the Setpoint. Must be programmed with a value lower than the one programmed in **SPH**.
SPH *SP High Limit*	Setpoint upper limit. Maximum value to program the Setpoint. Must be programmed with a value higher than the one programmed in **SPL**.
HYS *Hysteresis*	Control hysteresis. Differential between the point at which the control output is turned on and off. In degrees.
Act *Action*	Control action type: **0** Reverse action control. Suitable for **heating**. Turns on the control output when the temperature is below the SP value. **1** Direct action control. Suitable for **refrigeration**. Turns on the control output when the temperature is above the SP value.
oFt *Off time*	Once the control output is switched off, it will stay off for the time set in this parameter (at least). Typically used to increase the useful life of a compressor in a refrigeration system. For heating applications, set to 0. Value in seconds (0 to 999 seconds). Not available for Thermocouples.
ont *on time*	Once the control output is switched on, it will stay on for the time set in this parameter (at least).

	Typically used to increase the useful life of a compressor in a refrigeration system. For heating applications, set to 0. Value in seconds (0 to 999 seconds). Not available for thermocouples.
dLY *Delay*	Delay time to start control. After the controller is turned on, the control output will only be turned on when the time programmed in this parameter elapses. Used in large refrigeration systems to prevent simultaneous activations of compressors when returning from a power failure. Value in seconds (0 to 250 seconds).

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 **3 seconds** to access this level. This level also contains the parameters for configuration protection.

If you access the cycle by accident, simply step through all the parameters (without changing them) until you return to the measurement screen.

PAS	**Password**. Parameter to enter a password that allows you to change the other parameters.
CAL	**Calibration low**. Offset value of the input. It adjusts the lower measurement range of the sensor.
CAH	**Calibration high**. Gain calibration. It adjusts the upper measurement range of the sensor.
C JL	**Cold Junction Offset calibration**. This parameter is available only for thermocouple.
FAC	**Factory Calibration.** Allows to return the controller to the original calibration. When changed from **0** to **1**, the original calibration is restored, and any changes previously made to the calibration will be disregarded.
Prt	**Protection**. Defines the parameter levels to be protected.
PAC	**Password Change**. Parameter that allows changing the current password. Values from 1 to 999 are allowed.
Sn2	**Serial number**. First part of the controller electronic serial number.
Sn1	**Serial number**. Second part of the controller electronic serial number.
Sn0	**Serial number**. Third part of the controller electronic serial number.

WORKING WITH THE CONTROLLER

The controller drives the control output to raise the system temperature to the value set in the Setpoint parameter.

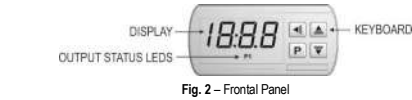On the controller front panel, the **P1** LED lights up when the control output is turned on.

Fig. 2 – Frontal Panel

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 to enter a password that allows you to change the other parameters.

Prt   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 **Setpoint**.

PAC   Parameter that allows changing the current password. Values from 1 to 999 are allowed.

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**.

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 a device with serial number 97123465 is: **1 9 3 6**

As follows: **1 + Sn2** = 9̲7;   **Sn1** = 1̲23;   **Sn0** = 4̲65 = 1 + 9 + 3 + 6

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.

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

▔ ▔ ▔ ▔	Indicates that: • The measured temperature has exceeded the upper limit of the sensor measurement range. • Broken **Pt100**, **Pt1000** or **J**. • Short-circuited **NTC** sensor.
▁ ▁ ▁ ▁	Indicates that: • The measured temperature has exceeded the lower limit of the sensor measurement range.

	• Short-circuited **Pt100**, **Pt1000** or **J**. • Broken **NTC** sensor.