



N322 PID

TEMPERATURE CONTROLLER – USER GUIDE – V1.7x G

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's safety protections may not be effective.

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3. PRESENTATION

N322 PID is a temperature controller with PID control algorithm.

It can be configured for heating or cooling and has 2 independent outputs that can be used for control or alarm. It accepts input sensors NTC (thermistor), Pt100, or J, K, and T thermocouples.

The electrical features of each model are presented on the body of the controller, according to the purchase order.

4. SPECIFICATIONS

SENSOR INPUT: The choice of sensor is made at the time of purchase. The options are:

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

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.

Note: For the NTC thermistor option, the sensor is 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.

Pt100: Measurement range: -50 to 300 °C (-58 to 572 °F) | α = 0,00385 | 3-wire | Accuracy: 0.7 °C (1.3 °F) | According to standard NBR 13773/97.

Thermocouple type J: Measurement range: 0 to 600 °C (32 to 1112 °F) | Accuracy: 3 °C (5.4 °F).

Thermocouple type K: Measurement range: -50 to 1000 °C (-58 to 1832 °F) | Accuracy: 3 °C (5.4 °F).

Thermocouple type T: Measurement range: -50 to 400 °C (-58 to 752 °F) | Accuracy: 3 °C (5.4 °F).

Thermocouples according to standard NBR 12771/Jul 1999.

WARM-UP: 15 minutes.

MEASUREMENT RESOLUTION:

0.1 °C in the range -19.9 to 199.9 °C (-3.8 to 391.8 °F) with NTC and Pt100.

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: Relay: 16 A / 250 Vac, SPDT.

OUTPUT2: Relay: 3 A / 250 Vac, SPST.

Note: In the standard configuration, the 2 outputs share a single terminal (the relays are not isolated from each other, according to **Figure 1**).

Optionally, the controller can be supplied with 2 SPST relays isolated from each other.

POWER SUPPLY:

100–240 Vac (± 10 %).

Frequency: 50–60 Hz.

Consumption: 5 VA.

DIMENSIONS:

Width x Height x Depth: 74 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 % (non-condensed).

UL94 V-2 Polycarbonate housing.
 Protection: Front Panel: IP65 | Housing: IP42.
 Connections for wires up to 4.0 mm².
 Serial interface not isolated from input circuit.
 Certifications: CE, UKCA, UL.

5. ELECTRICAL CONNECTIONS

The following figure shows the connection terminals and a connection example:

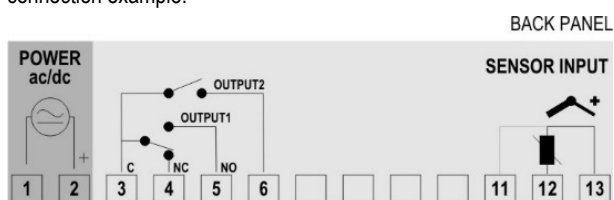


Figure 1 – Electrical connections

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	Configuration
3	PID control parameters
4	Calibration

Table 1 – Parameter 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 1** parameter is displayed. To return to level 0, press **P**.

To access level 2, press **P** for 2 seconds, until **Unit** 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.

6.1 LEVEL 1 – SETPOINT ADJUSTMENT LEVEL

This level displays only the Setpoint parameter (**SP 1** and **SP 2**). 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 1 <i>Setpoint 1</i>	Allows you to adjust the temperature of the OUTPUT1 control output. This adjustment is limited to the values programmed in SPL and SPH .
SP 2 <i>Setpoint 2</i>	Allows you to adjust the temperature of the OUTPUT2 control output. 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.

Unit <i>Unit</i>	Temperature unit. Allows you to choose the display unit of the measured temperature. <input type="checkbox"/> Temperature in Celsius. <input checked="" type="checkbox"/> 1 Temperature in Fahrenheit.
Typ <i>Type</i>	Type of temperature sensor to be used. <input type="checkbox"/> Thermocouple J. <input checked="" type="checkbox"/> 1 Thermocouple K. <input type="checkbox"/> 2 Thermocouple T. This parameter is only available on models for THERMOCOUPLE sensors.
oFS <i>Offset</i>	Value to correct temperature indication. Allows you to make small adjustments to the temperature indication to correct measurement errors that appear, for example, when replacing the NTC temperature sensor.
SPL <i>SP Low Limit</i>	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 <i>SP High Limit</i>	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 SPH .
HYS 1 <i>Hysteresis 1</i>	Control hysteresis for OUTPUT1. Differential between the on and off point of the control output relay. In degrees.
HYS 2 <i>Hysteresis 2</i>	Control hysteresis for OUTPUT2. Differential between the on and off point of the control output relay. In degrees.

Rc1 <i>Action 1</i>	<p>OUTPUT1 – Action type:</p> <ul style="list-style-type: none"> 0 Control with Reverse Action. Suitable for heating. Turns on the control output when the temperature is below SP. 1 Control with Direct Action. Suitable for refrigeration. Turns on the control output when the temperature is above SP.
Rc2 <i>Action 2</i>	<p>OUTPUT2 – Action type:</p> <ul style="list-style-type: none"> 0 Control with Reverse Action. Suitable for heating. 1 Control with Direct Action. Suitable for refrigeration. 2 Minimum temperature alarm. 3 Maximum temperature alarm. 4 Within-range alarm. 5 Out-of-range alarm. 6 Minimum temperature alarm with Initial Block. 7 Maximum temperature alarm with Initial Block. 8 Within-range alarm with Initial Block. 9 Out-of-range alarm with Initial Block. <p>The alarm functions are detailed in the WORKING WITH THE CONTROLLER section.</p>
In	<p>Output inversion. Inverts Setpoints and outputs.</p> <ul style="list-style-type: none"> 0 SP1 commands OUTPUT1. SP2 commands OUTPUT2. 1 SP1 commands OUTPUT2. SP2 commands OUTPUT1.

6.3 LEVEL 3 – PID CONTROL PARAMETERS

Aut <i>Auto-Tune</i>	<p>Allows you to enable the automatic tuning of PID parameters.</p> <ul style="list-style-type: none"> 0 The auto-tuning is turned off. 1 The auto-tuning is turned on.
Pb <i>Proportional Band</i>	<p>Proportional Band. Percentage of the maximum range of the input type. Select 0 to set ON/OFF control mode.</p>
Ir <i>Integral Rate</i>	<p>Constant integral rate in repetitions per minute (Reset). It is not used when the controller is configured in ON/OFF control mode (Pb=0).</p>
dT <i>Derivative Time</i>	<p>Constant integral rate in seconds. It is not used when the controller is configured in ON/OFF control mode (Pb=0).</p>
Ct <i>Cycle Time</i>	<p>PWM (Pulse Width Modulation) cycle period. In seconds. It is not used when the controller is configured in ON/OFF control mode (Pb=0).</p>

6.4 LEVEL 4 – CALIBRATION LEVEL

The controller leaves the factory calibrated. When necessary, recalibration should 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.

PA <i>Password</i>	Parameter to enter a password that will allow you to change other parameters.
CL <i>Calibration Low Input</i>	Offset calibration of the measuring scale. Allows you to adjust the lower value of the sensor measurement range.
CH <i>Calibration</i>	Calibration of the measure scale gain. Allows you to adjust the upper value of the sensor

High	measurement range.
CJL <i>Cold Junction Calibration</i>	Cold Junction Offset calibration. Only available for thermocouples.
FAC <i>Factory Calibration</i>	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.
Pr <i>Protection</i>	Allows you to set the parameter levels to be protected.
PAC <i>Password Change</i>	Allows to change the current password. You can set the password to a number between 1 and 999.
Sn2 <i>Serial Number 2</i>	Displays the first 2 two digits of the electronic serial number of the controller.
Sn1 <i>Serial Number 1</i>	Displays the middle 3 digits of electronic serial number of the controller.
Sn0 <i>Serial Number 0</i>	Displays the last 2 two digits of the electronic serial number of the controller.

7. WORKING WITH THE CONTROLLER

The multi-output controller has typical applications in control with alarms and multi-stage control.

In control application with alarms, OUTPUT1 is used with a temperature control output while OUTPUT2 is programmed to act as an alarm.

When configuring **Rc2** parameter, OUTPUT2 can be set to one of the following alarm functions:

- 2 Minimum temperature alarm. OUTPUT2 turns on when the measured temperature is **below** the value of **SP2**.
- 3 Maximum temperature alarm. OUTPUT2 turns on when the measured temperature is **above** the value of **SP2**.
- 4 Temperature alarm within range. OUTPUT2 turns on when the measured temperature is **within** the temperature range set by:
(SP 1 – SP2) and (SP 1 + SP2)
- 5 Temperature alarm outside the range. OUTPUT2 turns on when the measured temperature is **outside** the temperature range set by:
(SP 1 – SP2) and (SP 1 + SP2)

Functions **6**, **7**, **8**, and **9** are identical to the functions mentioned above, but feature the **Initial Alarm Block** function, which blocks the alarm (does not allow it to be triggered) when the controller starts control with an alarm situation.

In the multi-stage control application, **SP 1** and **SP2** Setpoints are programmed to act at different temperatures. This increases the cooling capacity as the temperature rises and reduces when the temperature approaches the **SP 1** temperature.

Another typical application for use with multiple outputs is the **automatic switching of the hot/cold cycle**, where one output is programmed with Reverse Action (and controls heating) and the other is programmed with Direct Action (and controls cooling).

On the front panel, the **P1** and **P2** flags light up when the outputs are switched on.

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:

- PRS** Parameter to enter a password that will allow you to change other parameters.
- PrL** 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**).
- PRC** Allows you to change the current password. You can set the password to a number between 1 and 999.

8.1 CONFIGURATION PROTECTION OPERATION

The **PRS** 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:

$$[1] + [\text{largest number of SN2}] + [\text{largest number of SN1}] + [\text{largest number of SN0}]$$

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

Example: $1 + \text{Sn}2 = 97; \text{Sn}1 = 123; \text{Sn}0 = 465 = 1 + 9 + 3 + 6$

9.1 HOW TO USE YOUR MASTER PASSWORD

1. In the **PRS** parameter, enter the master password.
2. In the **PRC** 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.

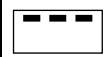

	The measured temperature has exceeded the upper limit of the sensor measurement range. Pt100 sensor or T/C sensor is broken. NTC sensor short-circuited.
	The measured temperature has exceeded the lower limit of the sensor measurement range. Pt100 sensor or T/C sensor short-circuited. Broken NTC sensor.

Table 2 – Error indications

11. WARRANTY

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