



TEMPERATURE CONTROLLER
N321S
OPERATING MANUAL – V2.0x C



N321S is a controller for solar water heating applications. It controls the water circulation system based on the difference of temperature between the solar collector and the storage tank (or swimming pool).

The equipment contains two NTC-type temperature sensors and a control output for activating the water circulation pump. It has functions that prevent pipe damage during the winter and overheating.

SPECIFICATIONS

INPUT SENSOR:

- 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 (33.35 °F). This error can be eliminated through the **offset** parameter of the equipment.

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.

Measurement Resolution:0.1° from -19.9 to 119.9°
..... 1 °C 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)

POWER SUPPLY: 100 to 240 Vac/dc ± 10 %
Optionally: 12 to 30 Vdc/ac
Mains Frequency: 50-60 Hz
Power Consumption: 5 VA

DIMENSIONS: Width x Height x Depth: 75 x 33 x 75 mm
Panel: 70 x 29 mm
Weight: 100 g

ENVIRONMENT: Operating:..... 0 to 40 °C (32 to 104 °F)
Storage temperature: -20 a 60 °C (-4 to 140 °F)
Relative humidity: 20 to 85 % RH

Housing: Polycarbonate UL94-2.

Protection: Front panel: IP65, Box: IP42.

Suitable wiring: Up to 4.0 mm².

Serial interface not isolated from input circuitry.

Serial interface isolated from power supply input, except in 24 V models.

ELECTRICAL WIRING

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

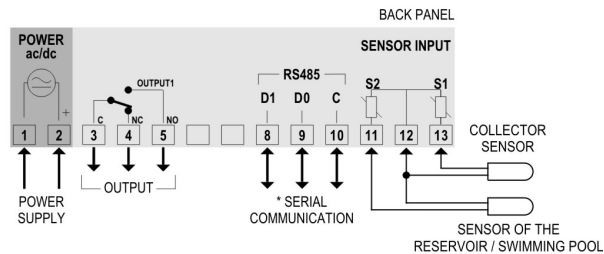


Figure 1 – Connections shown on controller label

* The serial communication interface is optional.

INSTALLATION RECOMENDATIONS

- 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 **N321S** display shows for 1 second its firmware version. 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 Temperature Measurement level.

To access level 1, press **P** for **2 seconds** until the **dOn** parameter appears. Press **P** to move forward.

To access level 2, press **P** for **10 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 temperature measurement level.

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 no keypad activity is detected within 20 seconds, the controller saves the current parameter value and returns to the measurement level.

Level 1 – Setpoint Adjustment

This level displays the Setpoint parameters. They define the differential temperatures values for the control. Use the and keys for setting the suitable values.

dOn	Differential Setpoint for activating the pump. When the difference between S1 and S2 is higher than the value configured in dOn , the pump will be turned on. Adjustable from dOF to 20 °C.
dOF	Differential Setpoint for deactivating the pump. When the difference between S1 and S2 is lower than the value configured in dOF , the pump will be turned off. Adjustable between 1 °C and dOn .

Level 2 – Programming Level

This level displays the remaining parameters. The parameters and their values are shown alternately. To program the desired values, use the and keys.

Unt <i>Unit</i>	Temperature unit. Allows you to choose the display unit of the measured temperature: 0 Temperature in Celsius degrees 1 Temperature in Fahrenheit degrees
Ind <i>Indication</i>	Temperature value exhibited on the display. 0 Collectors temperature (S1) 1 Storage tank temperature (S2) 2 Temperature difference between the sensors (S1 – S2) 3 Alternates the indication of (S1), (S2) and (S1-S2) at every 3s.
ICE <i>Ice</i>	Low temperature Setpoint. When the temperature in the solar collector is lower than the value here configured, the pump is turned on, preventing the water from freezing in the pipe system and causing damages to it. Adjustable between SPL and SPH .
Ht 1 <i>High Temperature 1</i>	S1 high temperature Setpoint (Collector). When the temperature in the collector is above the value here configured, the pump is turned off, avoiding the overheated water from damaging the pipe system. Adjustable between SPL and SPH .
Ht 2 <i>High Temperature 2</i>	S2 high temperature Setpoint (Storage tank). When the temperature at the sensor S2 is above the value here configured, the pump is turned off to avoid thermal discomfort. This function is used in pool heating systems that do not use a third sensor.

	Adjustable between SPL and SPH .
HYS <i>Hysteresis</i>	Antifreezing temperature hysteresis of sensor S1 (ICE). In degrees. Adjustable between 0.1 and 50.0 °C.
HY 1 <i>Hysteresis 1</i>	Overheating temperature hysteresis of sensor S1 (HE 1). In degrees. Adjustable between 0.1 and 50.0 °C.
HY2 <i>Hysteresis 2</i>	Overheating temperature hysteresis of sensor S2 (HE2). In degrees. Adjustable between 0.1 and 50.0 °C.
dLY <i>Delay</i>	Delay for control start. Once the controller is switched on, the control output will only be activated after the time programmed in this parameter has elapsed. Value in seconds. From 0 to 250 seconds.
DF 1 <i>Offset Sensor 1</i>	Value to correct the temperature measured by Sensor 1. It allows small adjustments to be made to the room temperature, seeking to correct measurement errors that appear, for example, when replacing a temperature sensor. Adjustable from -10.0 to 10.0 °C.
DF2 <i>Offset Sensor 2</i>	Value to correct the temperature measured by Sensor 2. It allows small adjustments to be made to the room temperature, seeking to correct measurement errors that appear, for example, when replacing a temperature sensor. Adjustable from -10.0 to 10.0 °C.
SPL <i>SP Low Limit</i>	Setpoint lower limit. Defines the minimum value for Setpoint adjustment. In degrees. Adjustable between -50 and 120 °C.
SPH <i>SP High Limit</i>	Setpoint upper limit. Defines the maximum value for Setpoint adjustment. Must be defined with a value necessarily higher than SPL . In degrees. Adjustable between -50 and 120 °C.
Rdd <i>Address</i>	Controllers that have the RS485 serial communication interface feature the Rdr parameter in their programming level. In this parameter you can define a communication address for each network element. The set address must be between 1 and 247.

Nivel 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 **10 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.

PRS	Password. Enter the correct password to unlock write operations in the following parameters.
CL 1	Calibration Low Input 1. Calibration of the input 1 measurement range offset. Adjustment of the lower value of the sensor measurement range.

CH 1	Calibration High Input 1. Input 1 gain adjustment (full scale value). Adjustment of the upper value of the sensor measurement range.
CL2	Calibration Low Input 2. Calibration of the input 2 measurement range offset. Adjustment of the lower value of the sensor measurement range.
CH2	Calibration High Input 2. Input 2 gain adjustment (full scale value). Adjustment of the upper value of the sensor measurement range.
FAC	Factory Calibration. Defines the parameter levels to be protected.
PrL	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 2. First part of the controller electronic serial number.
Sn 1	Serial number 1. Second part of the controller electronic serial number.
Sn0	Serial number 0. Third part of the controller electronic serial number.

WORKING WITH THE CONTROLLER

While the solar collector is receiving energy, the sensor S1 temperature increases. When T1 – T2 is higher than the value specified in **dDn**, the pump will be turned on, circulating the heated water down and storing it in the tank.

As the pump is operating, the hot water will circulate downwards, and the cold water goes upwards. Consequently, the temperature difference between S1 and S2 tends to diminish. When this difference goes under the value configured in **dDF**, the pump will be turned off and the water circulation will stop.

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



Figure 2 – Front panel

INDICATOR	FUNCTION
T1	Sensor 1 temperature
T2	Sensor 2 temperature
T1 T2	S1 – S2 (Differential Temperature)

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:

PRS: Parameter to enter a password that allows you to change other parameters.

PrL: 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.

How Configuration Protection Works

The **PRS** 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:

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

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

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

How to use the master password:

- 1 - In the **PRS** 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. If it is configured to show the differential temperature, the value shown will be zero:

	The measured temperature has exceeded the upper limit of the sensor measurement range. NTC sensor short-circuited. Ind = 0 or 1
	The measured temperature is below minimum of the sensor measurement range. Broken NTC. Ind = 0 or 1
	If the temperature in S1 or S2 exceeds the measurement limit Ind = 2 , the differential value displayed is 0 .

WARRANTY

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