



N321S

TEMPERATURE CONTROLLER – USER GUIDE – V2.0x E

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.

2. SUMMARY

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3. PRESENTATION

N321S is a controller for solar heating applications. It controls a water circulator pump through the temperature differential between the solar collector and the thermal storage tank (or pools).

The equipment has 2 inputs for an NTC temperature sensor and 1 control output for the water circulator pump. It has functions that prevent pipe damage during the winter and overheating.

4. SPECIFICATIONS

SENSOR INPUT:

Thermistor NTC: 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 equipment.

Note: 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.

Measurement resolution:..... 0.1 °C in the range -19.9 to 199.9 °C.
..... 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:..... SPDT Relay; 1 HP 250 Vac / 30 Vdc /
..... 1/3 HP 125 Vac (16 A Resistive)

POWER SUPPLY:

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

Dimensions:

Width x Height x Depth:75 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 % HR

UL94 V-2 Polycarbonate housing.


Protection index: Housing: IP42 | Front panel: IP65.

Connections for wires up to 4.0 mm².

Serial interface not isolated from input circuit.

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

Certifications: CE, UKCA, UL.

| | |
|---|--|
|  | <p>The RS485 interface (when available on the controller) is NOT electrically isolated from the input circuit.</p> <p>It is also NOT isolated from the power supply circuit in 24V power supply models (12~24 Vdc).</p> <p>It is electrically isolated from the supply circuit in models with a 100~240 Vac/dc power supply.</p> |
|---|--|

5. ELECTRICAL CONNECTIONS

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

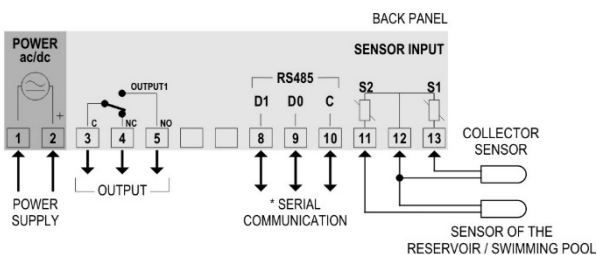


Figure 1 – Electrical connections

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

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.
- In control applications, it is essential to consider what can happen when any part of the system fails. The internal devices of the equipment do not guarantee full protection.

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 | Programming parameters |
| 3 | Calibration |

Table 1 – Parameter levels

When the controller is turned on, the display will show the version of the equipment for 1 second. The equipment 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 **d0n** parameter is displayed. Press **P** to move forward.

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 equipment 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 equipment returns to the measurement level, finishing and saving the configuration done so far.

6.1 LEVEL 1 – SETPOINT ADJUSTMENT LEVEL


This level displays the Setpoint parameters. They set the differential temperature value for control.

To set the desired value, use the and keys. 

| | |
|------------|---|
| d0n | <p>Differential Setpoint to turn on the pump.</p> <p>When the difference between S1 and S2 is higher than the value configured in d0n, the pump will be turned on.</p> <p>Adjustable from d0f to 20 °C.</p> |
| d0f | <p>Differential Setpoint to turn off the pump.</p> <p>When the difference between S1 and S2 is lower than the value configured in d0f, the pump will be turned on.</p> <p>Adjustable from 1 °C to D0n.</p> |

6.2 LEVEL 2 – PROGRAMMING LEVEL

Display the other parameters. The parameters are shown alternately with their values.

To set the desired values, use the and keys. 

| | |
|--|--|
| Unit <i>Unit</i> | <p>Temperature unit. Allows you to choose the display unit of the measured temperature.</p> <p>0 Temperature in Celsius degrees.</p> <p>1 Temperature in Fahrenheit degrees.</p> |
| ind <i>Indication</i> | <p>Temperature value displayed.</p> <p>0 Temperature of the collectors (S1).</p> <p>1 Temperature of the thermal storage tanks (S2).</p> <p>2 Temperature difference between sensors (S1 – S2).</p> <p>3 Alternates the display of (S1), (S2), and (S1-S2) every 3s.</p> |
| ICE <i>Ice</i> | <p>Low temperature Setpoint.</p> <p>When the temperature in the collectors is below the set value, the pump will be turned on. This prevents water from freezing in the pipe and damaging it.</p> <p>Adjustable between SPL and SPH.</p> |
| HT 1 <i>High Temperature 1</i> | <p>High temperature Setpoint at S1 (collector).</p> <p>When the temperature in the collectors is above the set value, the pump will be turned off. This prevents overheated water from damaging the pipe.</p> <p>Adjustable between SPL and SPH.</p> |

| | |
|---|--|
| Ht2 <i>High Temperature 2</i> | High temperature Setpoint at S1 (tank). When the temperature at sensor S2 is above the set value, 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> | Antifreeze 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 (Ht 1). In degrees. Adjustable between 0.1 and 50.0 °C. |
| HY2 <i>Hysteresis 2</i> | Overheating temperature hysteresis of sensor S2 (Ht 2). In degrees. Adjustable between 0.1 and 50.0 °C. |
| dLY <i>Delay</i> | Delay to the start of control. Once the controller is turned on, the control output will only be turned on after the time programmed in this parameter has elapsed. Value in seconds. From 0 to 250 seconds. |
| OF 1 <i>Offset Sensor 1</i> | Value to correct the temperature measured by Sensor 1. Allows you to make small adjustments to the ambient temperature indication to correct measurement errors that appear, for example, when replacing the temperature sensor. Adjustable between -10.0 and 10.0 °C. |
| OF2 <i>Offset Sensor 2</i> | Value to correct the temperature measured by Sensor 2. Allows you to make small adjustments to the evaporator to correct measurement errors that appear, for example, when replacing the temperature sensor. Adjustable between -10.0 and 10.0 °C. |
| SPL <i>SP Low Limit</i> | Setpoint lower limit. Allows you to set the minimum value to adjust the Setpoint. In degrees. Adjustable between -50 and 120 °C. |
| SPH <i>SP High Limit</i> | Setpoint upper limit. Allows you to set the maximum value to adjust the Setpoint. It must be programmed with a higher value than the one programmed in SPL . In degrees. Adjustable between -50 and 120 °C. |
| Rdr <i>Address</i> | Controllers with the RS485 serial communication interface have the Rdr parameter in their programming level. In this parameter, you can define 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 already calibrated. When a recalibration is necessary, it must be performed by a specialized professional.

To access this level, press the **P** key for more than 4 seconds. This level also contains the protection parameters of the configuration.

If you access it by accident, simply step through all parameters, until the controller returns to the measurement screen.

| | |
|--|--|
| PRS <i>Password</i> | Parameter to enter a password that will allow you to change other parameters. |
| CL 1 <i>Calibration Low Input 1</i> | Calibration of the input 1 measurement range Offset. Allows you to adjust the lower value of the sensor measurement range. |
| CH 1 <i>Calibration High Input 1</i> | Calibration of the input 1 measurement scale gain. Allows you to adjust the upper value of the sensor measurement range. |

| | |
|---|--|
| CL2 <i>Calibration Low Input 2</i> | Calibration of the input 2 measurement range Offset. Allows you to adjust the lower value of the sensor measurement range. |
| CH2 <i>Calibration High Input 2</i> | Calibration of the input 2 measurement scale gain. Allows you to adjust the upper value of the sensor measurement range. |
| 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 disregarded. |
| Pr t <i>Protection</i> | Allows you to set the parameter levels to be protected. |
| PRC <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. |
| Sn 1 <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

As the solar collector receives energy, the temperature at sensor S1 increases. When this temperature reaches a value higher than the temperature measured in S2, the pump is turned on and the heated water is circulated downwards and stored in the tank.

When the pump is on, the hot water circulates downwards and the cold water circulates upwards. Therefore, the temperature difference between S1 and S2 tends to decrease. When this difference drops to a determinable value, the pump is switched off and the water stops circulating.

On the front panel, the P1 flag lights up when the output is switched on.



Figure 2 – Front panel

| FLAG | INDICATION |
|---------|------------------------------------|
| T1 | Sensor 1 |
| T2 | Sensor 2 |
| T1 – T2 | S1 – S2 (Differential Temperature) |

Table 2 – Flags

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 Parameter to change the 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: **1 9 3 6**

Example: $1 + \mathbf{Sn2} = 97$; $\mathbf{Sn1} = 123$; $\mathbf{Sn0} = 465 = 1 + 9 + 3 + 6$

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.

If it is set to display the differential temperature, the value shown will be zero.


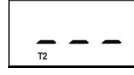

| | |
|---|--|
|  | The measured temperature has exceeded the upper limit of the sensor measurement range. NTC sensor short-circuited. Ind = 0 or 1 |
|  | The measured temperature has exceeded the lower limit of the sensor measurement range. Broken NTC sensor. Ind = 0 or 1 |
|  | If the temperature at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

Table 3 – Error indications

11. WARRANTY

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