

The N322S is a controller intended for solar water heating applications. It controls the water circulation system based on the difference of temperature between the solar collector and the thermal storage tank (or swimming pool).

The instrument has 2 NTC-type temperature sensors and 2 outputs: a control output (*output 1*) for activating the water circulation pump and a backup output (*output 2*). It prevents pipe damage during winter and overheating, preventing pipe damage and thermal discomfort.

SPECIFICATIONS

SENSOR INPUT:

- 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: 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 meters.

Measurement Resolution: 0.1° from -19.9 to 119.9°
 1° elsewhere

Note: The equipment keeps its accuracy all over the range, despite the lack of display resolution in a part of the range does not allow its visualization.

Circulation Output (OUTPUT1): Relay SPDT
 1 HP 250 Vac / 1/3 HP 125 Vac (16 A Resistive)

Backup Output (OUTPUT2): Relay: 3A / 250 Vac, SPST

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

DIMENSION: Width x Height x Depth: 75 x 34 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 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.

Installation recommendations:

The temperature sensor wires should be installed through the system layout separately from the control output and power supply wires. If possible, in grounded conduits.

The power supply to the controller should preferably come from a network proper for the instrumentation or from a different phase from the one used by the control output.

It is recommended to use RC FILTERS (47 and 100 nF, series) in contactor coils, solenoids, etc.

ELECTRICAL WIRING

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

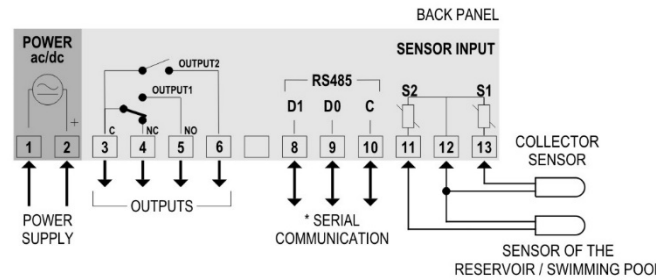


Fig. 1 – Connections shown on controller label

OUTPUT1 is the Circulation Output.

OUTPUT2 is the Backup Output.

* Serial communication feature is not always present in the controller.

OPERATION

Before use, the controller must be configured. To configure it, you must set values for the parameters that determine how the equipment will operate.

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

LEVEL	FUNCTION
0	Temperature Measurement
1	Setpoint Adjustment
2	Programming Parameters
3	Calibration

When you turn on the controller, the display (front panel) shows the version of the equipment for 1 second. This information is useful when consulting the manufacturer. The controller displays the measured temperature value. This is level 0 or the Temperature Measurement level.

To access level 1, press **P** and hold for **2 seconds** (until parameter **dOn** appears). Press **P** again to advance.

To access level 2, press **P** and hold for **4 seconds** (until the parameter **Unit** appears). Release the **P** key to remain on this level. Press **P** again to access the other parameters of this level. After the last parameter, the controller returns to the temperature measurement level.

To change the parameter values, press the **←** and **→** keys until you get the desired values.

- Notes:**
- The configuration is saved by the controller when it switches from one parameter to another and only then is it considered valid. Even in the event of a power failure, the configuration is saved in permanent memory.
 - 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.

Level 1 – Setpoint Level Adjustment

This level presents the setpoint parameters. They define the differential temperature value for control. To program the desired value, use the **←** and **→** keys.

dOn	Differential setpoint for turning on Circulation. When the temperature difference between S1 and S2 is above the value configured in dOn , circulation will be turned on. Adjustable from dOF to 20 °C (68 °F).
dOF	Differential setpoint for turning off Circulation. When the temperature difference between S1 and S2 is below the value configured in dOF , circulation will be turned off. Adjustable between 1 °C (33.8 °F) and dOn .
SP 1	Backup activation setpoint. It determines the minimum desired temperature for the water in the storage tank (measured by sensor 2). When this value is reached, the backup output is triggered, and an auxiliary heating system comes into operation. Adjustable between SPL and SPH .

Level 2 – Programming Level

This level displays the remaining parameters to be configured. The parameters are shown alternately and with their values. To program the desired value, use the **←** and **→** keys.

Unit <i>Unit</i>	Temperature Unit. Defines the temperature unit to be displayed. 0 Temperature in Celsius degrees. 1 Temperature in Fahrenheit degrees.
ind <i>Indication</i>	Temperature value showed on the display. 0 Temperature of the collectors (S1). 1 Temperature of the storage tank (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>	Setpoint of the minimum critical temperature in the collectors (anti-freezing). When the temperature in the solar collector is lower than the value here configured, the circulation output is turned on. This prevents the water from freezing in the pipe system. Adjustable between SPL and SPH .
HE 1 <i>High Temperature 1</i>	Setpoint of the maximum critical temperature in the collectors. When the temperature in the collectors exceeds this value, the circulation output stops operating. This prevents the overheated water from circulating and damaging the pipe system. Adjustable between SPL and SPH .
HE 2 <i>High Temperature 2</i>	Setpoint of the maximum critical temperature in the storage tank. Function that prevents the activation of the circulation output when the temperature in the storage tank (S2) is already high enough. Adjustable between SPL and SPH .
RC 1 <i>Action 1</i>	Determines the action type of the Backup Output: 0 Reverse action control. Proper for heating. Turns on the backup output when temperature is below SP1. 1 Direct action control. Proper for cooling. Turns on the backup output when temperature is higher than SP1.
HYS <i>Hysteresis</i>	Hysteresis for the minimum critical temperature setpoint in the collectors (ICE). In Celsius degrees. Adjustable between 0.1 and 50 °C (32.18 and 122 °F).
HY 1 <i>Hysteresis 1</i>	Hysteresis for the maximum critical temperature setpoint in the collectors (HE 1). In Celsius degrees. Adjustable between 0.1 and 50 °C (32.18 and 122 °F).
HY 2 <i>Hysteresis 2</i>	Hysteresis for the maximum critical temperature setpoint in the storage tank (HE 2). In Celsius degrees. Adjustable between 0.1 and 50 °C (32.18 and 122 °F).

b1Y Booster	Hysteresis for the Backup Output operation (SP I). Adjustable between 0.1 and 50.0 °C (32.18 and 122 °F).
dLY Delay	Delay for control start. After 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 Offset Sensor 1	Correction value for the temperature measured by Sensor 1. It allows performing small adjustments in the room temperature, seeking to correct measurement errors that appear, for example, when replacing temperature sensors. Adjustable from -10 to 10 °C (14 to 50 °F).
OF 2 Offset Sensor 2	Correction value of the temperature measured by Sensor 2. It allows performing small adjustments in the evaporator temperature, seeking to correct measurement errors that appear, for example, when replacing temperature sensors. Adjustable from -10 to 10 °C (14 to 50 °F).
SPL SP Low Limit	Setpoint lower limit: Defines the minimum value for the setpoint adjustment. In degrees. Adjustable between -50 and 120 °C (-58 and 248 °F).
SPH SP High Limit	Setpoint upper limit: Defines the maximum value for the setpoint adjustment. Must be defined to a value higher than SPL . In degrees. Adjustable between -50 and 120 °C (-58 and 248 °F).
Adr Address	Controllers with the RS485 serial communication interface shows the Adr parameter. In this parameter, it is possible to define a communication address for each network element. The set address must be between 1 and 247.

Level 3 – Calibration level

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

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

If accessed by accident, it is recommended to go through all the parameters without changing them until the controller returns to the measurement screen.

PRS	Password. In this parameter you must enter a password. This allows you to change the other parameters.
CL 1	Calibration Low Input 1. Calibration of the input measurement range offset 1. Adjustment of the lower value of the sensor measurement range.
CH 1	Calibration High Input 1. Gain calibration of the input measurement range 1. Adjustment of the upper value of the sensor measurement range.
CL 2	Calibration Low Input 2. Calibration of the input measurement range offset 2. Adjustment of the lower value of the sensor measurement range.
CH 2	Calibration High Input 2. Gain calibration of the input measurement range 2. Adjustment of the upper value of the sensor measurement range.
FAC	Factory Calibration. Allows to return to the controller's original calibration. Change from 0 to 1 to restore the calibration parameters with factory values.
Pr t	Protection. Allows you to define the parameter levels to be protected.
PAC	Password Change. Allows you to change the current password. You can set a number between 1 and 999 as the password.
Sn 2	Serial number 2. Displays the first two digits of the electronic serial number of the controller.
Sn 1	Serial number 1. Displays the middle three digits of the controller's electronic serial number.
Sn 0	Serial number 0. Displays the last three digits of the controller's electronic serial number.

OPERATION

As the solar collector receives energy, the temperature at sensor S1 increases. When this temperature reaches a value higher than the temperature measured at S2, the pump is turned on and circulates downward the heated water, storing it in the storage tank.

With the pump 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 falls below a certain minimum value, the pump is turned off and the water circulation stops.

On the controller's front panel, the **P1** LED lights up when the control output is turned on. The **P2** LED lights up when the backup output is turned on.



Fig. 2 – Front Panel

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

CONFIGURATION PROTECTION

The configuration protection system is designed to prevent undue changes to the controller's parameters and, consequently, to its operating mode. This system is composed of parameters that define the degree of protection adopted (whether total or only partial).

Parameters that define the protection:

- PRS:** Parameter to enter a **password**, which must allow changes in the other parameters.
- Pr t:** Defines the parameter levels to be protected:
 - 1 - Only the **calibration** level is protected (factory configuration).
 - 2 - **Calibration** and **configuration** levels are protected.
 - 3 - All levels are protected (**calibration**, **configuration** and **setpoints**).
- PAC:** Parameter that allows changing the current password. You can set a number between 0 and 1999 as the password.

Operation of the configuration protection

The **PRS** parameter appears at the beginning of the level that is protected. If you enter the password correctly, you can change the parameters of the protected levels. If you do not enter the password correctly or simply skip past this parameter, the parameters of the protected levels can only be viewed and not changed.

Important notes:

- 1 - If you enter an incorrect password **five** times in succession, the equipment prevents further attempts for 10 minutes. If you forget the current password, you can enter the **master password**, which allows you to set a new password only.
- 2 - The equipment leaves the factory with the password **111**.

MASTER PASSWORD

The master password, which allows you to set a new password for the controller, uses the serial number of this 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 an equipment 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 - Enter the master password in the **PRS** parameter.
- 2 - In the **PAC** parameter, enter a new password, which must be different from zero (**0**).
- 3 - Use the new password.

ERROR MESSAGES

In its display, the controller presents 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 configured to show the differential temperature, the value shown will be zero, according to the table below:

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

WARRANTY

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