

# N322 – ELECTRONIC THERMOSTAT OPERATING MANUAL



## SPECIFICATIONS

### INPUT SENSOR:

The input sensor type can be chosen from the 3 options below (specified when placing the order):

- **NTC** Thermistor, 10kΩ@25°C; Measuring range: -50 to 120°C; Accuracy: 1,0°C (with original sensor);  
Sensor interchangeability: 1°C (this error can be compensated by the **offset** parameter in the thermostat).
- **Pt100** (α= 0,00385); Range: -50 to 300°C; Accuracy: 0,7°C;
- **Pt1000** (α= 0,00385); Range: -200 to 530°C; Accuracy: 0,7°C;
- **Type J** Thermocouple; Range: 0 to 600°C; Accuracy: 3°C; Cold junction compensation

**Note:** The above figures are achieved after 15 minutes warm-up. In the thermostat with NTC input, a 3m-sensor cable is bundled with the instrument. The cable can be extended up to 200m.

**WARM-UP:** 15 min

### MEASUREMENT RESOLUTION:

0,1°C from -19.9 to 99.9°C With NTC; 1°C elsewhere.

### OUTPUT1:

Relay: 10A / 250Vac, SPDT (standard) or SPST 10A/250Vac  
Pulse: 5Vdc, 25mA max.

### OUTPUT2:

Relay: 3A / 250Vac, SPST

**NOTE:** In the standard configuration (1 SPDT + 1 SPST) both relays share a common terminal (no electrical isolation between the both relays – see Figure 1). Optionally, the thermostat can be supplied with 2 SPST relays, isolated from each other.

### POWER SUPPLY:

Voltage: 85-250Vac; 24Vdc/ac; Mains frequency: 50-60 Hz;  
Power consumption: 0,6VA

Caution: check the power supply specification before energizing the thermostat.

### DIMENSIONS:

Width x Height x Depth: 74x32x75mm  
Panel cut-out: 70,5x28,5mm; Weight: 100g

### OPERATING ENVIRONMENT:

Operating temperature: 0 to 50°C  
Storage temperature: -20 to 60°C  
Relative humidity: 20 to 85% non condensing

### CASE:

Self-extinguishing Polycarbonate; Protection: Front panel: IP65, Box:IP42  
Suitable wiring: Up to 4,0mm²

**RS-485 digital communication; RTU MODBUS protocol (optional)**

The N322 is a 2-output digital electronic thermostat for heating and cooling applications. It is available with NTC thermistor input sensor, Pt100, Pt1000 or J type thermocouple. Sensor offset correction is provided. The 2 independent outputs can be used as control or alarm.

The features of a particular model (input sensor type, sensor range, mains supply, etc) are identified by the label placed on the thermostat body.

## ELECTRICAL WIRING

Figure 1 below shows the thermostat connections to sensor, mains and outputs.

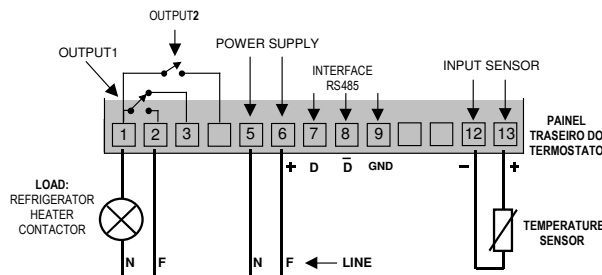


Figure 1 – N322 terminals

It is important to follow the recommendations below:

- Signal wires should be installed in grounded conduits and away from power or contactor wires.
- The instrument should have its own power supply wires that should not be shared with electrical motors, coils, contactors, etc.
- Installing RC filters (47Ω and 100nF, series combination) is strongly recommended at contactor coils or any other inductors.
- System failure should always be taken into account when designing a control panel to avoid irreversible damage to equipment or people.

## OPERATION

The thermostat requires the internal parameters to be configured according to the intended use for the instrument

The parameters are organized in 4 groups or levels:

Level	Protection	Function
0	-	Temperature measurement
1	2 seconds	Setpoint Adjustment
2	10 seconds	Programming (Parameter configuration)
3	18 seconds	Calibration

Upon power-up, the N322 display shows for 1 second its firmware version. This information is useful when consulting the factory.

Then, the temperature measured by the sensor is shown on the display. This is the parameter level 0 (temperature measurement level).

To access level 1, press **P** for 2 seconds until the “**SP 1**” message shows up. Pressing **P** again, the “**SP2**” parameter is presented. To go back to level 0, press **P** once more.

To access level 2 of parameters, press **P** for 10 seconds until the “**Rc 1**” message is shown. Release the **P** key to remain in this level. Each new pressing on the **P** key will advance to the next parameter in the cycle (level). At the end of the cycle, the thermostat returns to the first level (0). Use the **▲** and **▼** keys to alter a parameter value.

- Notes:
- 1 A parameter configuration is saved when the **P** key is pressed to advance to the next parameter in the cycle. The configuration is stored in a non-volatile memory, retaining its value when the thermostat is de-energized.
  - 2 If no keyboard activity is detected for over 20 seconds, the thermostat saves the current parameter value and returns to the measurement level.

### Level 1 –Setpoint Adjustment

In this level only the Setpoint (**SP 1** and **SP2**) parameters are available, alternating the names with their respective values. Adjust the desired temperature for each setpoint clicking on the **▲** and **▼** keys.

<b>SP 1</b> Set Point 1	Temperature adjustment for control OUTPUT 1. <b>SP 1</b> value is limited to the values programmed in <b>SPL</b> and <b>SPH</b> in the programming level (Parameter configuration, level 2).
<b>SP2</b> Set Point 2	Temperature adjustment for control OUTPUT 1. <b>SP2</b> value is limited to the values programmed in <b>SPL</b> and <b>SPH</b>

### Level 2 – Programming - Parameters configuration Level

Contains the configuration parameters to be defined by the user, according to the system's requirements. Use **▲** and **▼** keys to set the value. The display alternates the parameter name and respective value.

<b>Rc 1</b> Action 1	Control OUTPUT 1 action: <b>0</b> Reverse (heating) <b>1</b> Direct (cooling).
<b>Rc2</b> Action 2	Control OUTPUT 2 action or Alarm functions: <b>0</b> Reverse control action (heating). <b>1</b> Direct control action (cooling). <b>2</b> Low (minimum) temperature alarm. <b>3</b> High (maximum) temperature alarm. <b>4</b> Alarm for temperature inside the range <b>5</b> Alarm for temperature outside the range. <b>6</b> Low temperature alarm with initial blocking. <b>7</b> High temperature alarm with initial blocking. <b>8</b> Inside range alarm with initial blocking. <b>9</b> Outside range alarm with initial blocking. The section <b>Working with the Thermostat</b> describes how these functions work.

<b>Cnt</b> Control	Associates Setpoints and Outputs. <b>0</b> Setpoint 1 is assigned to OUTPUT1 and Setpoint 2 to OUTPUT2 (factory setting). <b>1</b> Setpoint 1 is assigned to OUTPUT2 where as Setpoint 2 is directed to OUTPUT1.
<b>HY 1</b> Hysteresis 1	OUTPUT 1 Hysteresis: defines the differential range between the temperature value at which the OUTPUT 1 is turned on and the value at which it is turned off. In degrees.
<b>HY2</b> Hysteresis 2	OUTPUT 2 Hysteresis: defines the differential range between the temperature value at which the OUTPUT 2 is turned on and the value at which it is turned off. In degrees.
<b>oFS</b> Offset	Offset value to be added to the measured temperature to compensate sensor error.
<b>SPL</b> SP Low Limit	Lower range for <b>SP 1</b> and <b>SP2</b> . <b>SPL</b> must be programmed with a lower value than <b>SPH</b> .
<b>SPH</b> SP High Limit	Upper range for <b>SP 1</b> and <b>SP2</b> . <b>SPH</b> must be greater than <b>SPL</b> .
<b>oF 1</b> Off time 1	Defines the minimum <b>off</b> time for control OUTPUT 1. Once OUTPUT 1 is turned off, it remains so for at least the time programmed in <b>oF 1</b> . For thermocouple inputs this parameter is not available. This parameter is intended for refrigeration systems where increased compressor life is desired. For heating systems, program <b>oF 1</b> to zero. Value in seconds, 0 to 999s.
<b>on 1</b> on time 1	Defines the minimum <b>on</b> time for control OUTPUT 1. Once turned on, OUTPUT 1 remains so for at least the time programmed in <b>on 1</b> . For thermocouple inputs this parameter is not available. This parameter is intended for refrigeration systems where increased compressor life is desired. For heating systems, program <b>on 1</b> to zero. Value in seconds, 0 to 999s.
<b>dL 1</b> Delay 1	Delay time to start control. Upon power-on, control OUTPUT 1 is kept <b>off</b> until the time programmed in <b>dL 1</b> is elapsed. Its usage is intended to prevent multiple compressors to start simultaneously after the turn-on of a system with several thermostats. Value in seconds, 0 to 250s.
<b>oF2</b> Off time 2	Defines the minimum <b>off</b> time for control OUTPUT 2. Once OUTPUT 2 is turned off, it remains so for at least the time programmed in <b>oF2</b> . For thermocouple inputs this parameter is not available. This parameter is intended for refrigeration systems where increased compressor life is desired. For heating systems, program <b>on2</b> to zero. Value in seconds, 0 to 999s.

<b>on2</b> on time 2	Defines the minimum <b>on</b> time for control OUTPUT 2. Once turned on, OUTPUT 2 remains so for at least the time programmed in <b>on2</b> . For thermocouple inputs this parameter is not available. This parameter is intended for refrigeration systems where increased compressor life is desired. For heating systems, program <b>oF2</b> to zero. Value in seconds, 0 to 999s.
<b>dL2</b> Delay 2	Delay time for OUTPUT 2 to turn on relative to OUTPUT 1. This parameter defines a particular working mode, typically used in multiple stage systems, where OUTPUT 2 is allowed to go <b>on</b> only if OUTPUT 1 is already on for at least <b>dL2</b> seconds. Also, OUTPUT 2 is driven <b>off</b> whenever OUTPUT 1 goes off. <b>dL2 = 0</b> disables this function. Value in seconds, 0 to 250s.
<b>Addr</b> Address	Thermostats with the optional RS485 Modbus RTU communication interface have the <b>Addr</b> parameter at the programming level. Set a unique Modbus address for each equipment connected to the network. Address range is from 1 to 247.

### Level 3 – Calibration level

The thermostat is factory calibrated. The following parameters should be accessed only by experienced personnel. To enter this cycle, the **P** key must be kept pressed for 18 seconds.

Don't press the **←** and **→** keys if you are not sure of the calibration procedures. Just press the **P** key a few times until the temperature measurement level is reached again.

<b>cAL</b> Calibration low	Offset value of the input. It adjusts the lower measurement range of the sensor.
<b>cAH</b> Calibration High	Gain calibration. It adjusts the upper measurement range of the sensor.
<b>Sn 1</b> Serial number	First half of the thermostat electronic serial number.
<b>Sn0</b> Serial number	Second half of the thermostat electronic serial number.

### WORKING WITH THE THERMOSTAT

Multiple output thermostats are suited for controlling multiple stage systems. Other applications require OUTPUT 1 to be the control output and OUTPUT 2 to be the alarm.  
There are eight distinct alarm functions implemented in OUTPUT 2, selected by the parameter **Rc2**, described below:

**2** - Low temperature alarm – OUTPUT 2 is turned on when the measured temperature falls **below** the **SP2** value.

**3** - High temperature alarm – OUTPUT 2 is turned on when the measured temperature exceeds the value programmed in **SP2**.

**4** - Inside range alarm – OUTPUT 2 is turned on when the measured temperature is within the range defined by:

**(SP 1 – SP2) and (SP 1 + SP2).**

**5** - Outside range alarm: OUTPUT 2 is turned on when the temperature falls outside the range defined by:

**(SP 1 – SP2) and (SP 1 + SP2).**

Functions **6**, **7**, **8** e **9** are identical to the above ones except that they incorporate the Initial Blocking feature, which inhibits the output if an alarm condition is present at start-up. The alarm will be unblocked after the process reaches a non-alarm condition for the first time.

In a multiple stage application, **SP 1** and **SP2** are configured to operate at different temperatures, creating a progressive sequence for turning on the outputs (compressors) in response to a system demand. The output delays for turning on the compressors (**dL 1** and **dL2**) cause the compressors to be turned on one by one, minimizing energy demand.

Another usage for multiple output thermostats is in systems that require automatic selection between cool and heat action. In these applications, one output is configured as reverse action (heating) and the other as direct action (refrigeration).

The output status led P1 and P2 in the thermostat panel, signals when the control output is on.



Figure 2 – N322 frontal panel

### ERROR MESSAGES

Sensor measurement errors force the thermostat outputs to be turned off. The cause for these errors may have origin in a bad connection, sensor defect (cable or element) or system temperature outside the sensor working range. The display signs related to measurement errors are shown below:

<b>---</b>	Indicates: <ul style="list-style-type: none"> <li>Measured temperature exceeded maximum allowed range for the sensor.</li> <li>Broken <b>Pt1000</b> or <b>T/C J</b>.</li> <li>Short circuited <b>NTC</b> sensor.</li> </ul>
<b>---</b>	Indicates: <ul style="list-style-type: none"> <li>Measured temperature is below minimum measurement range of the sensor.</li> <li>Short circuited <b>Pt1000</b> or <b>T/C J</b></li> <li>Broken <b>NTC</b>.</li> </ul>