



# Thermostat N321

## ELECTRONIC THERMOSTAT – OPERATION MANUAL – V1.3x

### 1. APPLICATION

The N321 is a digital electronic thermostat for heating and cooling applications. Input sensors available are: NTC Thermistor, Pt100, Pt1000 and J type thermocouple, with offset correction capability.

A SPDT relay is provided for the control output.

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

### 2. SPECIFICATIONS

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

- **NTC Thermistor**, 10k $\Omega$ @25°C;  
Measuring range: -50 to 120°C;  
Accuracy: 0,6°C (with original sensor);  
Sensor interchangeability: 0.75°C (this error can be compensated by the **offset** parameter in the thermostat).
- **Pt100**,  $\alpha= 0,00385$ ; according to IEC 60751(ITS-90);  
Measuring Range: -50 to 300°C  
Accuracy: 0,7°C;
- **Pt1000**,  $\alpha= 0,00385$ ; according to IEC 60751(ITS-90);  
Measuring Range: -200 to 530°C;  
Accuracy: 0,7°C;
- **Type J Thermocouple**;  
Measuring Range: 0 to 600°C (according to IEC60584 (ITS-90));  
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.

**MEASUREMENT RESOLUTION:**

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

**OUTPUT1:**

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

**POWER SUPPLY:**

85 to 250Vac; Mains frequency: 50/60 Hz; or 12 to 24Vdc  
Power consumption: 0,6VA

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

**DIMENSIONS:**

Width x Height x Depth: 75x33x75mm; Panel cut-out: 70x29mm  
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 4,0mm<sup>2</sup>

**Self-extinguishing polycarbonate case,**

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

### 3. ELECTRICAL WIRING

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

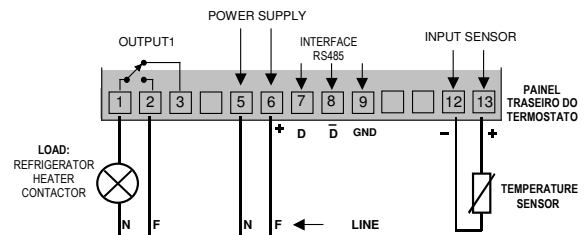


Figure 1 – N321 terminals

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 (47R 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.

### 4. 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 N321 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"** message shows up. Press **P** again to return to the initial screen (temperature display).

To access level 2 of parameters, press **P** for 10 seconds until the **"Pct"** 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**) parameters are available, alternating the names with their respective values. Adjust the desired temperature for each setpoint clicking on the **▲** and **▼** keys.

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

**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>Act</b><br>Action        | Control OUTPUT 1 action:<br><b>0</b> Reverse (heating)<br><b>1</b> Direct (cooling).  |
| <b>HYS</b><br>Hysteresis    | 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>oFS</b><br>Offset        | Offset value to be added to the measured temperature to compensate sensor error.  |
| <b>SPL</b><br>SP Low Limit  | Lower range for <b>SP</b> . <b>SPL</b> must be programmed with a lower value than <b>SPH</b> .  |
| <b>SPH</b><br>SP High Limit | Upper range for <b>SP</b> . <b>SPH</b> must be greater than <b>SPL</b> .  |
| <b>oFt</b><br>Off time      | 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>oFt</b> . For thermocouple inputs this parameter is not available.<br><br>This parameter is intended for refrigeration systems where longer compressor life is desired.<br><br>For heating systems, program <b>oFt</b> to zero.<br>Value in seconds, 0 to 999s. |
| <b>ont</b><br>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>ont</b> . For thermocouple inputs this parameter is not available.<br><br>This parameter is intended for refrigeration systems where increased compressor life is desired.<br><br>For heating systems, program <b>ont</b> to zero. Value in seconds, 0 to 999s.         |
| <b>dLY</b><br>Delay         | Delay time to start control. Upon power-on, control OUTPUT 1 is kept <b>off</b> until the time programmed in <b>dLY</b> is elapsed.<br><br>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>Addr</b><br>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><br>Calibration low  | Offset value of the input. It adjusts the lower measurement range of the sensor. |
| <b>cRH</b><br>Calibration High | Gain calibration. It adjusts the upper measurement range of the sensor.          |
| <b>Sn 1</b><br>Serial number   | First half of the thermostat electronic serial number.                           |
| <b>Sn 0</b><br>Serial number   | Second half of the thermostat electronic serial number.                          |

**5. CONTROL OUTPUT**

The N321 energizes the output relay such as to maintain the process temperature on the setpoint value defined by the user. The output status led **P1** signals when the control output is on.



Figure 2 – Frontal Panel

**6. 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:

|  |   |
|--|---|
|  | 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> |
|  | 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>      |