

### 1. SERIAL COMMUNICATION

#### RS485 Interface

- Compatible line signals with RS485 standard.
- 2 wire connection between master and up to 31 slave controllers in bus topology. With multiple output converters up to 247 knots.
- Maximum communication distance: 1000 meters.
- The RS485 signals are:

<b>D1</b>	<b>D</b>	<b>D+</b>	<b>B</b>	Bidirectional data line.
<b>D0</b>	<b>D̄</b>	<b>D-</b>	<b>A</b>	Inverted bidirectional data line.
<b>C</b>				Communication common. Interconnect between all network devices for protection.
<b>GND</b>				

#### General Characteristics

- Serial interface not isolated from input circuitry.
- Serial interface isolated from input circuitry, except in 24 V powered model.
- Baud rate: 9600 bps.
- Data Bits: 8.
- Parity: None.
- Stop Bits: 1.

#### Communication Protocol

Modbus RTU slave protocol is supported, available in most of the supervisory software found in the market.

The available Modbus commands are as follows:

03 - Read Holding Register (Record Readers)

06 - Preset Single Register (Written in Recorder)

The 03 Read Holding Register command accepts the reading of up to four consecutive registers.

#### 1.1 CONTROLLER CONFIGURATION

Controllers that have the built-in RS485 serial communication interface have the **Addr** parameter at their programming level. In this parameter the user defines a communication address for each element of the network. The address you set must be between 1 and 247.

<b>Addr</b>	Communication address of the controller. Each controller must have a unique address.
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#### 1.2 REGISTERS TABLE

The registers are the controller's internal parameters. Each table parameter is a 16-bit word with a signal represented by a complement of 2.

Holding Registers	Parameter	Registers Description
0000	Value T1	Reading: Measured temperature value T1. Writing: Not allowed. Range: According to the sensor type used.
0001	Value T2	Reading: Measured temperature value T2. Writing: Not allowed. Range: According to the sensor type used.
0002	<b>dIF</b>	Reading: Value of T1-T2. Writing: Not allowed.
0003	<b>dDn</b>	Reading: Differential setpoint for <b>activating</b> the pump. Writing: Differential setpoint for <b>activating</b> the pump. Range: Adjustable from <b>dDF</b> to 20 °C.
0004	<b>dDF</b>	Reading: Differential setpoint for <b>deactivating</b> the pump. Writing: Differential setpoint for <b>deactivating</b> the pump. Range: Adjustable between 1 °C and <b>dDn</b> .

0005	<b>Ind</b>	Reading: Temperature value exhibited on the display. Writing: <ul style="list-style-type: none"> <li><b>0</b> Temperature of the collectors (T1);</li> <li><b>1</b> Temperature of the storage tank (T2);</li> <li><b>2</b> Temperature difference between the sensors (T1 – T2);</li> <li><b>3</b> Alternates the indication of <b>T1, T2 and T1-T2 at every 3 seconds.</b></li> </ul>
0006	Serial Number High	Reading: First 3 digits of the controller serial number. Writing: Not allowed. Screen number format: XXXXh.
0007	Serial Number Low	Reading: Last 3 digits of the controller serial number. Writing: Not allowed. Screen number format: XXXXh.
0008	<b>ICE</b>	Reading: Anti-frost temperature setpoint. Writing: Low temperature setpoint. Range: Adjustable between <b>5PL</b> and <b>5PH</b> .
0009	<b>HE 1</b>	Reading: Temperature setpoint T1 overheating. Writing: Temperature setpoint T1 overheating. Range: Adjustable between <b>5PL</b> and <b>5PH</b> .
0010	<b>HE 2</b>	Reading: Temperature setpoint T2 critical maximum in the tank. Writing: Temperature setpoint T2 critical maximum in the tank. Range: Adjustable between <b>5PL</b> and <b>5PH</b> .
0011	<b>HY5</b>	Reading: Anti-frost temperature T1 hysteresis ( <b>ICE</b> ). In degrees. Range: Adjustable between 0.1 and 50.0 °C.
0012	<b>HY 1</b>	Reading: Hysteresis of the overheating temperature T1 ( <b>HE 1</b> ). In degrees. Range: Adjustable between 0.1 and 50.0 °C.
0013	<b>HY 2</b>	Reading: Hysteresis of the overheating temperature T2 ( <b>HE 2</b> ). In degrees. Range: Adjustable between 0.1 and 50.0 °C.
0014	<b>IHM</b> Status	Reading: IHM status. Writing: Not allowed. Value format: <ul style="list-style-type: none"> <li>bit 0 – Status P1 (OUT1);</li> <li>bit 1 – Status P2 (OUT2);</li> <li>bit 2 – True when PV is showing;</li> <li>bit 3 – True when command is received by the serial;</li> <li>bit 4 – Internal control;</li> <li>bit 5 – Status Led T1;</li> <li>bit 6 – Status Led defrost;</li> <li>bit 7 – Status Led T2;</li> <li>bit 8 – Internal control;</li> <li>bit 9 – Internal control;</li> <li>bit 10 – True if the Value has decimal point;</li> <li>bit 11 – Internal control;</li> <li>bit 12 – Internal control;</li> <li>bit 13 – Internal control;</li> <li>bit 14 – Internal control;</li> <li>bit 15 – Internal control.</li> </ul>
0015	Control Status	Reading: Measurement status. Writing: Not allowed.
0016	Value of Displayed Screen	Reading: Screen parameter value shown. Writing: Not allowed. Maximum range: -199 a 999. The range depends on the parameter being displayed on the screen.

0017	Version Screen N°	Reading: Version of the software implemented in the controller and number of the current screen. Writing: Not allowed. Screen number formation: XYYh, where: XX → Version and YY → Screen number.
0018	<b>oF 1</b>	Reading: Offset value for sensor 1 measurement. Writing: Offset value for sensor 1 measurement. Range: -10,0 to 10,0 °C.
0019	<b>oF 2</b>	Reading: Offset value for sensor 2 measurement. Writing: Offset value for sensor 2 measurement. Range: -10,0 to 10,0 °C.
0020	<b>ICE, HT 1 and HT 2 Status</b>	Reading: Status de ICE, HT1 e HT2. Writing: Not allowed. Value format: BIT 0 - ICE BIT 1 - HT1 BIT 2 - HT2
0021	<b>SP 1</b>	Support Setpoint Value.
0022	<b>b 1Y</b>	Support output hysteresis value.
0023	<b>RC 1</b>	Support output control action.

Table 01 – Registers Table

**Notes:** The SP, PV and Hysteresis values are always multiplied by 10 to account for the decimal point.

### 1.3 EXCEPTION RESPONSES – ERROR CONDITIONS

Upon receiving a command, the CRC check is performed on the received data block. If there is a CRC error at reception, no response will be sent to the master. For commands received without error, a consistency of the command and the requested registers is realized. If invalid, an exception response is sent with the corresponding error code. In exception responses, the field corresponding to the Modbus command in the response is summed as 80h.

If a value write command in a parameter has a value outside the allowed range, no value will be written to this parameter, returning error code 03 as a response.

Broadcast read commands are ignored by the controller and there is no response. You can only write in Broadcast mode.

Error Code	Error Description
01	Invalid or nonexistent command.
02	Invalid or out of range register number.
03	Invalid or out of range number of registers.

Table 02 - Error codes in exception response

### 1.4 ELECTRICAL CONNECTIONS

#### Characteristics of the Physical Environment

- Twisted pair cable, shielded, 3 x 24 AWG and grounded wire at both ends;
- 16 pF of capacitance every 30 m in length;
- 100 Ohms characteristic impedance;
- 1000 m maximum length.

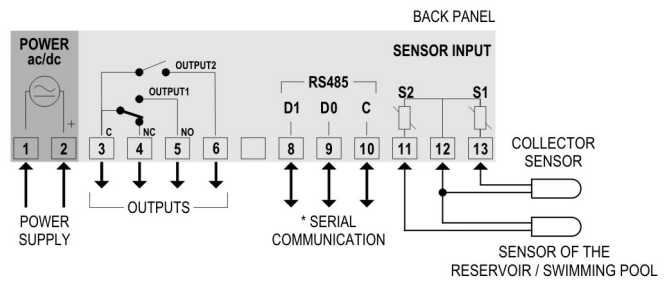


Fig. 02 – N322S model connections

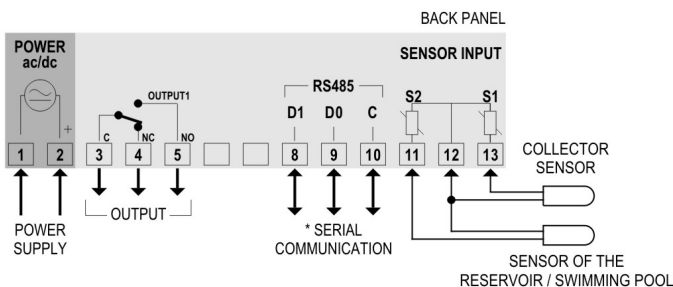


Fig. 01 – N321S model connections