INSTRUCTION MANUAL

NT311

1MN0197 REV. 0

operates with ISO9001 certified quality system

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R. 1.1 26/11/2020

ENGLISH

"Translations of the original instructions"

INTRODUCTION

Firstly, we would like to thank you for choosing to use a **TECSYSTEM** product, and we strongly suggest that you read this instruction manual carefully: It will allow you to understand use of the appliance and to take full advantage of all its features.

ATTENTION! THIS MANUAL IS VALID AND COMPLETE FOR THE MODEL NT311 BASIC AND NT311 D CONTROL UNITS. THE NEW NT311 IS A TECSYSTEM DEVICE DESIGNED FOR THE ENVIRONMENTAL MONITORING OF PANELS AND TRANSFORMATION CABINS. THE NT311 DEVICE HAS BEEN DESIGNED TO ALLOW THE MAINTENANCE TECHNICIAN TO MONITOR TEMPERATURE, HUMIDITY, DUST DEPOSIT AND DOOR OPENING IN THE CABINS / PANELS. A USEFUL TOOL FOR PLANNING AND MANAGING MAINTENANCE INTERVENTIONS ON YOUR SYSTEM.

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SAFETY REGULATIONS

ATTENTION:

Read the manual carefully before starting to use the control unit. Keep the instructions for future reference.

 Do not open the device. Touching any internal components can cause electric shock. Contact with a voltage over 50 Volts can be fatal. To reduce the risk of electric shock, do not dismantle the back of the device for any reason. Moreover its opening would void the warranty.

Before connecting the device to the power supply, make sure that all the connections are correct.
Always disconnect the unit from the supply before any cabling modification.

 Any work on the equipment must be entrusted to a qualified engineer.

Failure to comply with these instructions can cause damage, fires or electric shock, and possible serious injuries!

POWER SUPPLY
The NT311 control unit can be supplied by 85 to 260 VDC-VAC, irrespectively of the polarities in Vdc.
Before using it, make sure the power cable is not damaged, knotted or pinched. Do not tamper with the power cable. Never disconnect the unit by pulling the cable and avoid touching the pins. Do not carry out any operations of connecting/disconnecting with wet hands. To disconnect the device, do not use objects such as levers. Immediately disconnect the device if you smell burning or see any smoke: contact assistance.

LIQUIDS
Do not expose the equipment to splashes or drops, do not position it in places with humidity exceeding 90% and never touch with wet or damp hands. If any liquid penetrates the control unit, disconnect it immediately and contact technical assistance.

CLEANING
Disconnect the power cable before cleaning the control unit, use a dry cloth to dust it, without any solvent or detergents, and compressed air.

OBJECTS
Never insert any objects into the cracks of the control unit. If this happens, disconnect the control unit and contact an engineer.

USE RESERVED TO QUALIFIED PERSONNEL
The purchased goods are a sophisticated electronic device that is completely unsuitable to be used by non-qualified personnel. Any work must be carried out by a specialist engineer.

ACCESSORIES
The use of non-original accessories or spare parts can damage the unit and endanger users' safety. In the event of faults, contact technical service.

LOCATION
Install the control unit indoors, in a place protected from water splashes and from the sun's rays. Do not place near heat sources exceeding the parameters stated in this manual. Position on a stable surface, far away from any possible vibrations. Position the unit as far as possible from any intense magnetic fields.

REPAIRS
Do not open the control unit. For any fault, always use qualified personnel. The opening of the control unit and/or the removal of the series identifying label entails the automatic forfeiture of the warranty. The Warranty seal is applied to all devices, any attempt to open the unit would break the seal and cause the consequent automatic forfeiture of the warranty.

TECHNICAL INFORMATION OR REPORTING INFORMATION

Mail: ufficiotecnico@tecsystem.it — tel: 02/4581861

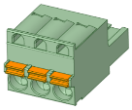
ACCESSORIES

The following objects are present inside the box:

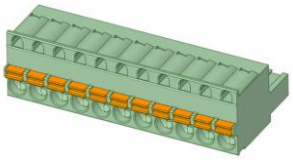
Control unit

Start guide and QR code

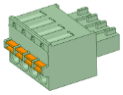
1 terminal 3 poles pitch 5 supply
Code: 2PL0524



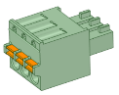
1 terminal 11 poles pitch 5 relays
Code: 2PL0528



1 terminal 4 poles pitch 3.81 TPU input
Code: 2PL0527



1/2 (*) 3-pole terminal(s) pitch 3.81 RS485 and doors input
Code: 2PL0523



(*) Only for version D

ATTENTION: always install the device using the terminals included in the pack.
The use of terminals other than those included with the control unit could cause malfunctions.

TECHNICAL SPECIFICATIONS	NT311 BASIC	NT311 D
POWER SUPPLY		
Supply rated values	85-260 VDC-VAC 50/60Hz	85-260 VDC-VAC 50/60Hz
VDC with invertible polarities	•	•
INPUTS AND SENSORS		
1 TPU sensor input (temperature, dust and humidity)	•	•
2 inputs for NC door opening alarm contacts	•	•
Connections on removable terminal boards	•	•
OUTPUTS		
1 alarm relay (ALARM) SPDT	•	•
1 relay for sensor fault or SPDT operating anomaly (FAULT)	•	•
1 SPST FAN ventilation management relay	•	•
1 SPDT HEATER heating management relay	•	•
Output relays with 10A-250Vca-res COSΦ=1 contacts	•	•
RS485 Modbus RTU output	NO	•
DIMENSIONS		
106.60x122x53.50mm	DIN rail	DIN rail
TESTS AND PERFORMANCE		
Construction in compliance with the EC regulations	•	•
Protection from electrical interferences EN 61000-4-4	•	•
Dielectric strength 1500 Vac for a min. between relay and TPU signal, relay and power supply, power supply and TPU signal	•	•
Ambient operating temperature from –20°C to +60°C	•	•
Permitted humidity 90% without condensate	•	•
Degree of protection IP20	•	•
UL 94V0 self-extinguishing PC/ABS Blend housing	•	•
3VA absorption	•	•
Self-diagnostic circuit	•	•
Electronic part protective treatment	Optional	Optional

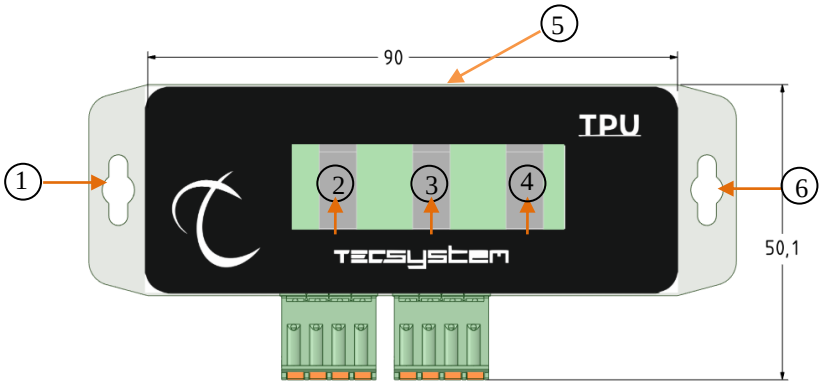
TECHNICAL SPECIFICATIONS	NT311 BASIC	NT311 D
DISPLAY AND DATA MANAGEMENT		
2 x 13 mm displays with 3 digits to display measured values, messages and channels	•	•
2 LEDs to display the state of the alarms (ALARM-FAULT)	•	•
2 LEDS selection of display mode (SCAN-MAN)	•	•
1 LEDs to display the state of FAN	•	•
1 LED to display the state of HEATER	•	•
1 high room temperature threshold HI TEMP (FAN)	From 10°C to 60 °C	From 10°C to 60 °C
1 low room temperature threshold TEMP.LO (HEATER)	From -25°C to 10°C	From -25°C to 10°C
1 RH high humidity threshold (HEATER or FAN)	From 10%RH to 90%RH	From 10%RH to 90%RH
1 DST high dust deposit threshold	From 10 dSt to 25dSt	From 10 dSt to 25 dSt
Door 1-Door 2 door alarm activation selection	•	•
Sensor failure diagnostics	•	•
Data memory diagnostics (Ech)	•	•
Access to programming through front keyboard	•	•
Automatic exit from programming, display and relay test after 1 minute of inactivity	•	•
Selection of display mode for scanning or manual	•	•
FAULT relay Fail Safe function	•	•

TECHNICAL SPECIFICATIONS	TPU SENSOR
1 NT311 digital BUS input	TPU IN
1 sensor digital BUS output	TPU OUT
Internal temperature sensor	Reading range from -40°C to 70°C Tolerance 1% +/-1°C
Internal relative humidity sensor	Reading range from 0% RH to 90% RH tolerance +/-5%
3 Internal sensors for depositing of dust	Reading range from 6 dSt to 30 dSt offset +/-2 dSt
Temperature of work environment	From -40°C to 70°C
Permitted humidity 90% without condensate	•
Protection IP20	•
Housing PC UL 94 HB	•
Electronic part protective treatment	Optional
DIMENSIONS	
110x50.1x35mm	Fixing holes Ø 5mm 100mm
TPU sensor fixing bracket	Optional

TPU SENSOR

The TPU sensor has been designed with the aim of monitoring the environmental conditions of: t**emperature, dust deposit and humidity.** Place the sensor in an area protected from air flows, typically 2/3 of the total height of the environment to be monitored (choice of installer according to the characteristics of the system). The area above the dust sensors should be kept clear up to a distance of approximately 30cm.

Fix the TPU sensor on a flat surface using the appropriate anchoring holes, M4 screws with washer.



1) Fixing hole
2) P1 sensor
3) P2 sensor
4) P3 sensor
5) Left side of TU sensor hole
6) Fixing hole

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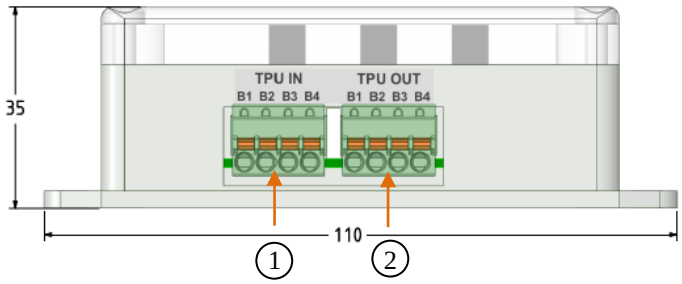
TPU SENSOR NOTES: do not fix the sensor upside down and do not cover the P1-2-3 dust detection sensors. Never block the sensor TU input. Do not place near strong magnetic fields or excessive heat sources (higher than the product specifications). Remove the dust with a brush and clean the sensor only with a dry cloth.



1) NT311 digital TPU IN input
2) TPU sensors digital TPU OUT output (*)

(*) TPU sensors digital TPU OUT output not available, planned for future developments

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Connections:

Connect the TPU IN input to the NT311 control unit, respecting the numbering **B1-B2-B3-B4 ,** info on pages 12 and 13.

POWDER DEPOSIT IDENTIFICATION NOTES:

The response of the dust sensor depends on the characteristics of the dust deposit, such as: thickness, colouring and material. It should be noted that: coarse deposits, dark colours (carbon black type) or the formation of condensation can alter reading of the dust deposit sensors.

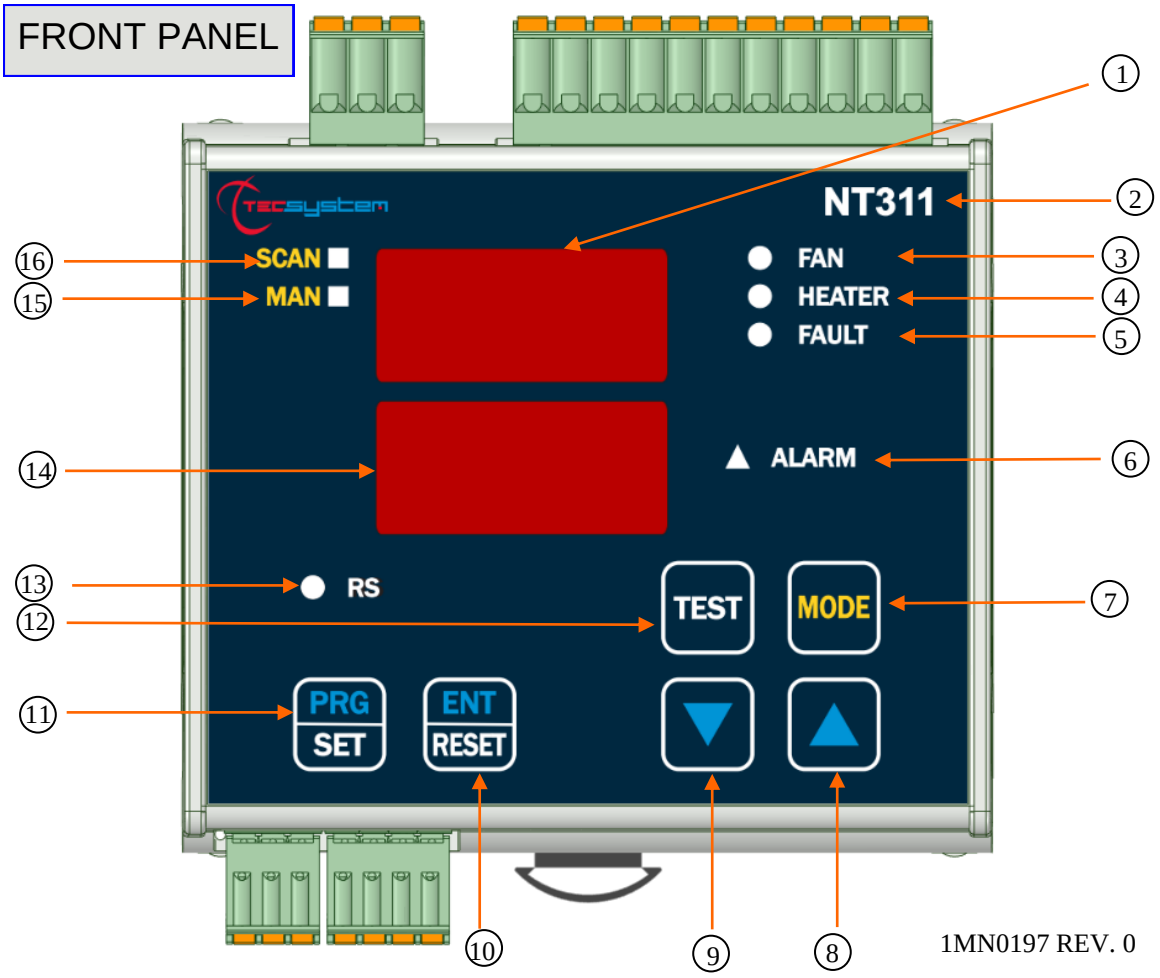
TPU SENSOR CONNECTION NOTES

The TPU sensor must be connected to the control unit using the appropriate cable; the electrical connections are shown on page 12/13.

Note: All the signal transportation cables must strictly:

- be separated from those of power
- be created with shielded cable with twisted conductors
- have a section of at least 0.25 mm²
- be twisted if the shield does not exist
- be firmly fixed in the terminal blocks
- have tin-plated or silver-plated conductors

FRONT PANEL



1)	3-digit display for values measured	9)	DOWN key
2)	Control unit series	10)	Enter/Reset button
3)	FAN signalling (red) LED	11)	Programming/Setting key
4)	HEATER signalling (yellow) LED	12)	Led/relay test key
5)	FAULT (red) LED	13)	Modbus communication RS (green) LED (NT311 D ONLY)
6)	ALARM signalling (yellow) LED	14)	3-digit display viewing of parameters
7)	MODE display mode selection key	15)	Man mode selection (green) LED
8)	UP key	16)	Scan mode selection (yellow) LED

DISPLAY

The first display is dedicated to viewing of the measured values and the status of the doors (OPE-CLO).

The second display shows the monitored value: temperature (°C), humidity (rh), dust (dst), D1-D2 door inputs.

When the device is turned on or after a reset, the following always appear on the display: the model of the NT311 control unit, VER "00" (firmware version), BAS (without options) or 485 (D-digital).

Pressing the MODE key, the display modes can be set:

- *SCAN*: the control unit displays in scan (every 2 seconds) all the enabled parameters, disabled parameters (NO).
- *MAN*: manual reading of the enabled parameters using the up/down keys ▲▼ , parameters disabled (NO).

NOTE: in case of keyboard inactivity, after approximately 1 minute, the control unit will automatically set itself in **SCAN** mode**.**

OPERATING PROGRAM CONTROL

To check the programmed protection levels, press the PRG key to enter the **VIS** program viewing mode.

Repeatedly pressing the **PRG** key, it is possible to scroll through all the previously loaded values in sequence.

After 1 minute's keyboard inactivity, the programming display procedure is automatically abandoned.

To stop the display, press the ENT key.

NOTES ON SCAN AND MAN FUNCTIONS

During the SCAN and MAN modes, the operation of the NT311 can be displayed.

1) RUN cPU:
This message appears when the unit is operating regularly without any system error.
2) cPU Err:
This message appears when the device detects an operating anomaly. By pressing the MODE key and selecting the MAN mode, it is possible to view the error message encountered by the device.
Using the arrow ▲ (UP) anomalies with the following priority will be visible:

a) **Ech Err**: This message appears when damage in the EEPROM memory is detected. Pressing Reset will cancel the message and restore the original default parameters listed in the programming paragraph on pages 15-16. Return the control unit to TECSYSTEM for repairs.

This message appears when it is found that one or more sensors are not working properly:

b) FLT-TEC TPU sensor communication failure
c) FLT-°C temperature sensor failure
d) FLT-rH humidity sensor failure
e) FLT-dSt dust sensor failure

In case of **Err** the FAULT relay will be de-energised (fail safe function active).

NOTES: In the case of ERR-TEC, TPU errors will not be visible as information from the sensors is missing. The next step is the values. Pressing the key ▼ (DOWN) will display the temperature.

LED TEST

It is advisable to regularly test the control unit LEDs.

For this operation, press the TEST key briefly; all the displays turn on for 2 seconds.

If one of the LEDS does not work, please return the control unit to TECSYSTEM for repair.

ALARM RELAY TEST

This function allows you to carry out a test of the relay operation without having to use further devices. To start the test procedure, press and hold the TEST button for approximately 5 seconds: the **TST** indication appears for 2 seconds confirming entry into the Relays Test mode.

The lit LED indicates the relay to be tested, use the cursors ▲▼ to select the desired relay.

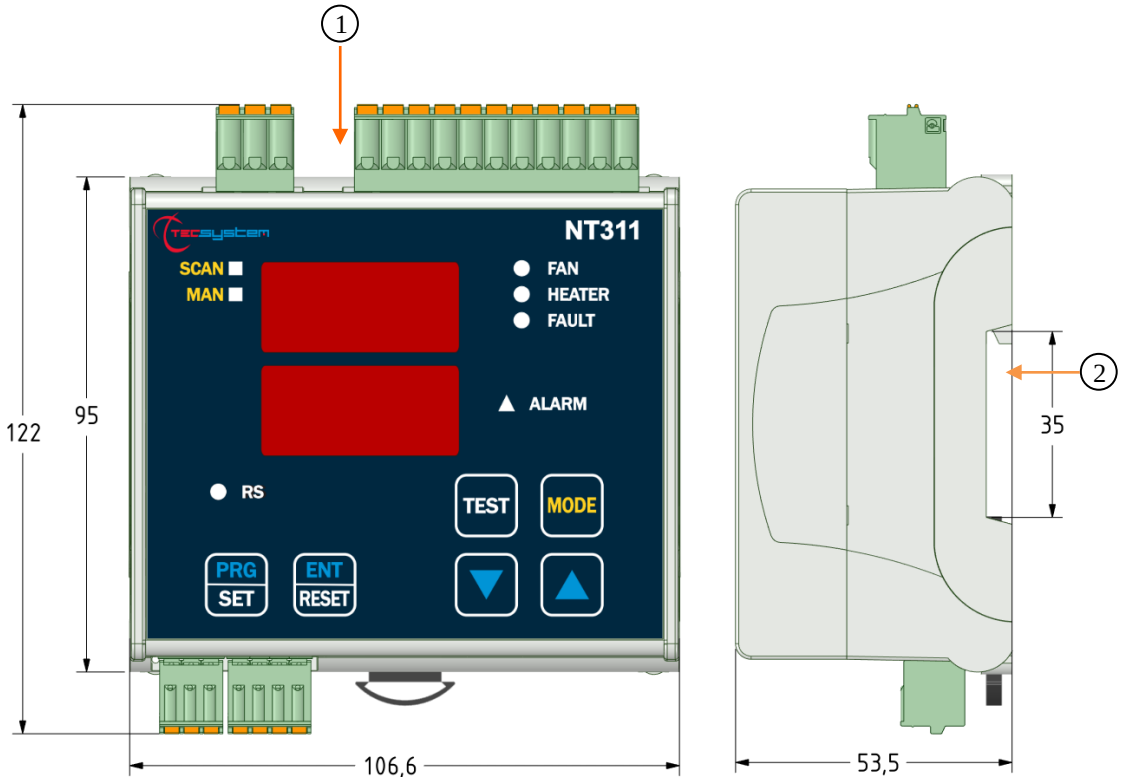
Press the SET and RESET keys to energise and de-energise the relay to be tested; the display will show ON-OFF.

After 1 minute's keyboard inactivity, the RELAY TEST procedure will be automatically abandoned.

To stop the RELAY TEST procedure, press the TEST key.

ASSEMBLY

Attach the device to the DIN rail and make the connections to the removable terminal blocks.



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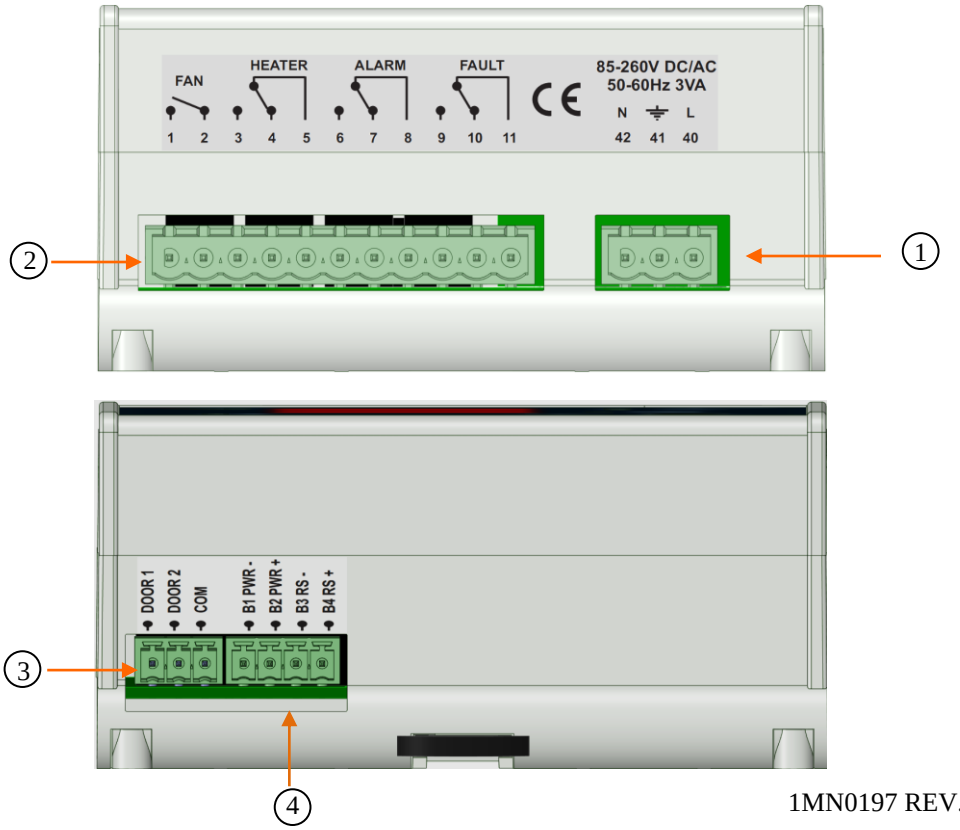
1)	Control unit	2)	DIN rail assembly

ELECTRICAL CONNECTIONS

NT311 BASIC



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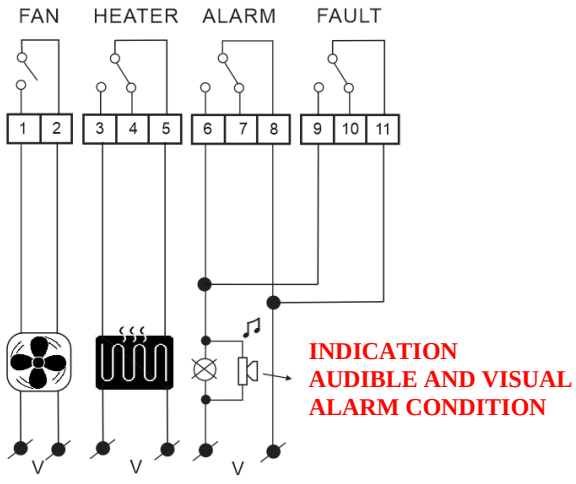
1)	85-260Vcc-ca 50/60Hz power supply.	3)	Door contact input Door1 and Door2
2)	Relays (FAN-HEATER-ALARM-FAULT)	4)	Sensor digital input TPU B1-B2-B3-B4

Note: image of relay contacts in non-alarm condition except for the FAULT relay, which switches: contacts 9-11 closed (NO) contacts 10-11 open (NC). Read the alarms paragraph p. 14 and see image fault contact switching.

RELAYS CONNECTION EXAMPLE



Output relay with contacts of 10A-250Vca-res COSΦ=1.

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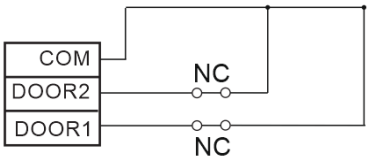
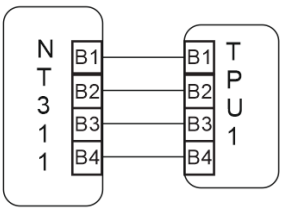
***EXAMPLE DOORS* CONNECTION**



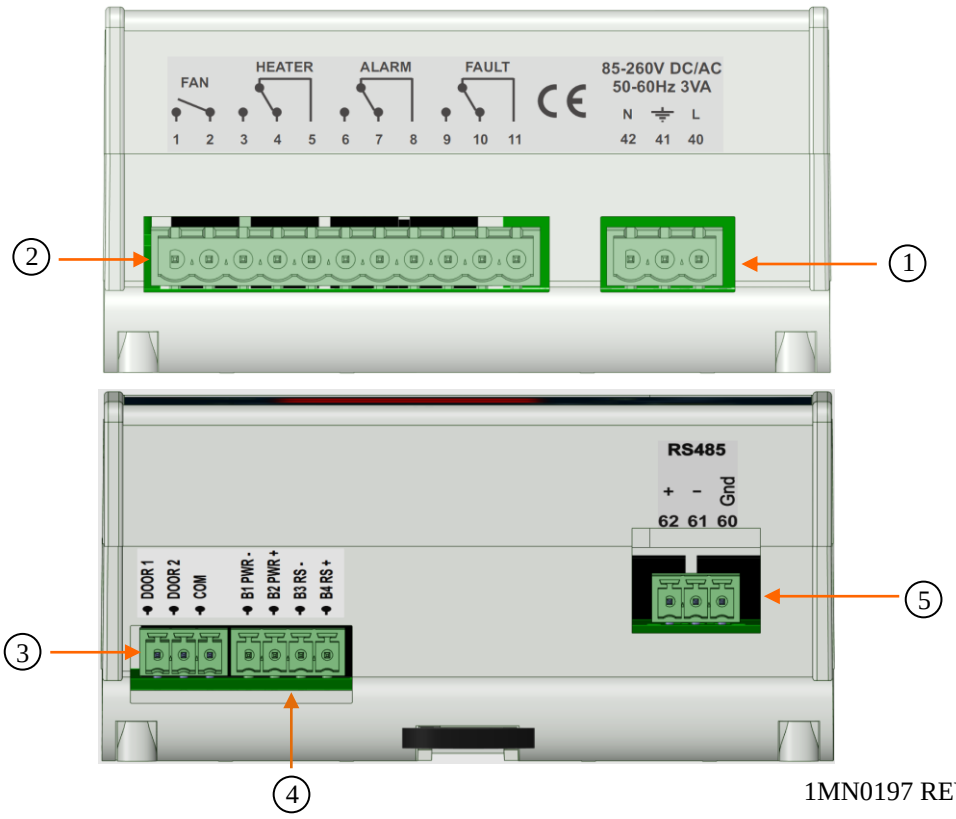
TPU SENSOR *CONNECTION EXAMPLE*



Attention!
For the TPU sensor control unit connection, see the notes: TPU sensor connection on page 9.

ELECTRICAL CONNECTIONS

NT311 D



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1)	Relays (AUX-ALARM-TRIP-FAULT)	4)	Sensor digital input TPU B1-B2-B3-B4
2)	85-260Vcc-ca 50/60Hz power supply.	5)	RS485 Modbus RTU output
3)	Door contact input Door1 and Door2		

Note: image of relay contacts in non-alarm condition except for the FAULT relay, which switches: contacts 9-11 closed (NO) contact 10-11 open (NC). Read the alarms paragraph p. 14 and see image fault contact switching.

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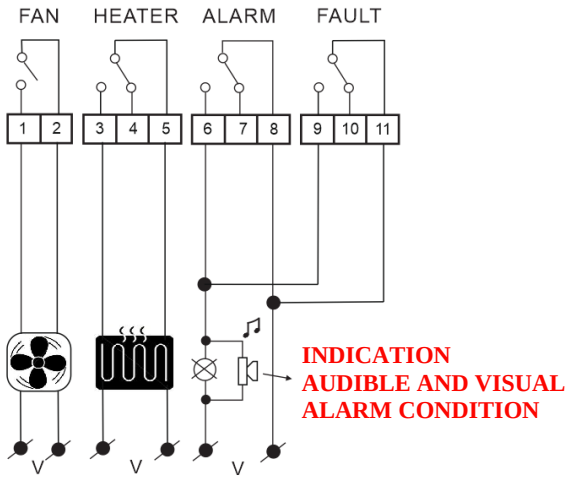

Output relay with contacts of 10A-250Vca-res COSΦ=1.

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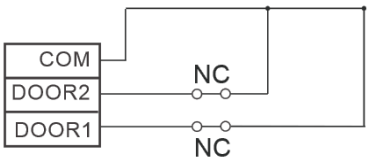
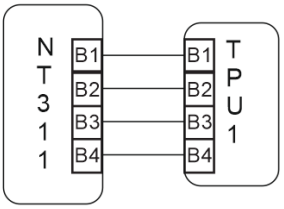
***EXAMPLE DOORS* CONNECTION**



TPU SENSOR *CONNECTION EXAMPLE*



Attention!
For the TPU sensor control unit connection, see the notes: TPU sensor connection on page 9.

POWER SUPPLY

The NT311 can be supplied by 85 to 260 Vac-Vdc, 50/60 Hz irrespectively of polarity in Vdc (terminals 40 - 42).

This particularity is obtained thanks to the use of a tested power supply, of new conception and realisation, which frees the installer from any uncertainty regarding the correct Vac or Vdc power supply.

The earthing cable must always be connected to terminal 41.

To protect the control unit against line overvoltages, the PT-73-220 electronic arrester, designed by TECSYSTEM S.r.l. for this specific purpose, is recommended. Alternatively, it is advisable to use 110 V AC supply voltages or, even better, 110 VDC.

If an existing control unit must be replaced with a new one, to guarantee its correct and safe operation, the sensor TPU/relay/supply connecting terminals must be replaced with the new terminals supplied.

ALARMS

Carry out the electrical connections on the removable terminal blocks only after disconnecting them from the unit.
When the control unit is in one of the following modes, it does not perform any monitoring, moreover the relays will all be disabled, the fault contact switches and the fault LED will flash.

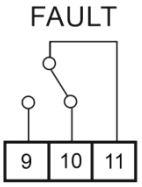
- Programming viewing display.
- PRG programming.
- Relay test.

The ALARM, FAN and HEATER relays only switch when the set limits are exceeded, see paragraph on the monitored value diagnostics.

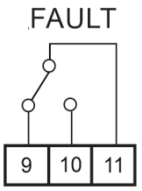
The FAULT (fault) contact, programmed in active failsafe mode (default YES), opens when the appliance is powered, only if during the access phase the control unit does not detect anomalies, and keeps the switching until when one of the following events occurs:

- Data memory fault (Ech message).
- TEC sensor fault -°C -dSt - rH.
- Insufficient supply voltage.
- During the power on reset after programming (PRG), displaying of the data (VIS) and relay test.

FAULT CONTACT OPERATION (YES FAILSAFE)



FAULT 10-11 NC: ALARM FAULT OR POWER OFF



FAULT 10-11 NO: POWER ON OR NO FAULT

FAULT FAILSAFE

By setting YES (Fail safe), contact 9-11 is positioned as normally open and switches (closed) when a fault condition is identified. Setting NO (NO Fail safe) the contact 10-11 is positioned as normally closed and switches (open) when a fault condition is identified.

If the failsafe function is disabled on the fault contact, the control unit will no longer be able to signal the fault due to power failure.

NOTE: always disconnect the unit before performing any electrical connections.

FAULT AND RESET MESSAGE SEQUENCE

Find below the sequence of fault messages and RESET function condition.

1) ECH	eeprom fault	resettable message
2) ERR TEC	sensor communication fault	non-resettable condition
3) ERR °C	sensor fault	non-resettable condition
4) ERR dSt	sensor fault	non-resettable condition
5) ERR rH	sensor fault	non-resettable condition

PROGRAMMING

NT311 BASIC/D

PITCH	PRESS	EFFECT	PRESS	NOTES
1	PRG SET	Press and hold the PRG button until the display shows SET PRG		PRG
2		Select PRG SET to proceed with programming or PRG 1 to load the default values	▼ ▲	PRG 1 default data
3	PRG SET	High environment temperature management **Thi**		Default YES
4		Select YES or NO	▼ ▲	
5	PRG SET	Maximum room temperature programming **Thi**		
6		Set the desired threshold	▼ ▲	Default 40°C
7	PRG SET	Enable ventilation management relay (FAN)		FAN LED flashes
8		Select YES or NO	▼ ▲	Default YES
9	PRG SET	Enabling of **alr alarm relay**		ALARM LED flashes
10		Select YES or NO	▼ ▲	Default YES
11	PRG SET	Low ambient temperature management **Tlo**		Default YES
12		Select YES or NO	▼ ▲	
13	PRG SET	Minimum ambient temperature programming **Tlo**		
14		Set the desired threshold	▼ ▲	Default 5°C
15	PRG SET	Enabling of heater management relay (HEATER)		HEATER LED flashes
16		Select YES or NO	▼ ▲	Default YES
17	PRG SET	Enabling of **alr alarm relay**		ALARM LED flashes
18		Select YES or NO	▼ ▲	Default YES
19	PRG SET	High ambient humidity management **rH**		
20		Select YES or NO	▼ ▲	Default YES
21	PRG SET	Maximum ambient humidity programming **rH**		
22		Set the desired threshold	▼ ▲	Default 70rH
23	PRG SET	Enabling of heater or ventilation relay		no LED HEATER LED flashes FAN LED flashes
24		Set NO-HEATER (HTR)- FAN	▼ ▲	Default HTR

25	PRG SET	Enabling of **alr alarm relay**		ALARM LED flashes
26		Select YES or NO		Default YES
27	PRG SET	Dust presence management **dst**		
28		Select YES or NO		Default YES
29	PRG SET	Dust maximum threshold programming **dst**		
30		Set the desired threshold		Default dst 16
31	PRG SET	Enabling of **alr alarm relay**		ALARM LED flashes
32		Select YES or NO		Default YES
33	PRG SET	Enabling of input door 1 **D1**		
34		Select YES or NO		Default YES
35	PRG SET	Enabling of **alr alarm relay**		ALARM LED flashes
36		Select YES or NO		Default YES
37	PRG SET	Enabling of input door 2 **D2**		
38		Select YES or NO		Default YES
39	PRG SET	Enabling of **alr alarm relay**		ALARM LED flashes
40		Select YES or NO		Default YES
41	PRG SET	FLS (FAULT) is displayed Blinking FAULT LED		
42		Select YES or NO		Default YES
		For version NT311 (BAS) skip to step 49		
43	PRG SET	ADR <> "datum" is displayed		Modbus address Default 001
44		Set the address		1 to 255
45	PRG SET	BDR <> "datum" is displayed		Modbus transmission speed Default 19.2 Kb/s
46		Set the desired speed		From 2.4 Kb/s to 38.4 Kb/s
47	PRG SET	PAR <> "datum" is displayed		Parity bit selection EVE Default
48		Set the desired parity bit		None (N-1 or N-2), Even (EVE), Odd (ODD) See frame DATA on page 20.
49	PRG SET	END is displayed		End of programming
50	ENT RESET	Press ENT to save the set data and exit programming		
51	PRG SET	Return to step 1		See programming notes p.17

ATTENTION:

We recommend you check the device's programming before starting the device.
The default parameters set by TECSYSTEM might not match your requirements.

Programming the device is the end user's responsibility. The settings of the alarm thresholds and enabling of the functions described in this manual must be checked (by a specialist engineer) according to the application and features of the system the control unit is installed on.

PROGRAMMING NOTES

1) The MODE key allows reversing of the programming steps.
2) The TEST key allows exiting programming without saving the modified data.
3) After 1 minute's keyboard inactivity programming is abandoned without saving the data.
4) During programming the control unit does not control/protect the monitored machine.
5) At the end of programming the control unit is restarted and the FAULT relay is disabled until the unit is fully restarted.
6) When a parameter is disabled, "NO" skips the programming step.

SENSOR DIAGNOSTICS

In the event of a fault or if the maximum full scale value of one of the sensors is exceeded, the FAULT relay switches instantly, with the relative indication of a faulty sensor.

FAULT TEC (FLT TEC) TPU sensor disconnected, it is advisable to check the connection between the sensor and the control unit.

NOTE: any disturbances on the sensor line can generate incorrect readings or communication problems between the devices. Data transmission is not guaranteed.

FAULT °C (FLT °C) in case of a breakage or readings beyond the full scale (110°C) there is instantaneous switching of the relay of FAULT, with the relative indication of the faulty temperature sensor (FLT°C).

FAULT rH (FLT rH) in the event of breakage or readings beyond the full scale (97% RH) there is instantaneous switching of the FAULT relay, with the relative indication of the faulty humidity sensor (FLT rH).

FAULT dSt (FLT dSt) in the event of breakage or readings beyond the full scale (30) there is instantaneous switching of the FAULT relay, with the relative indication of the faulty dust deposit sensor (FLT dSt).

NOTE: the TPU sensor diagnostics is reported: in the modbus register 14 CPU ERROR. Furthermore, by pressing the MODE key and selecting the MAN mode, it is possible to display the error message encountered by the device. By pressing the arrow ▲ (UP) the anomalies will be visible.

To eliminate the message and to restore the Fault switching, check the connections and replace the faulty sensor if necessary. In case the maximum full scale value has been reached, make sure that the environmental conditions correspond to what is indicated by the control unit.

PROGRAMMED DATA DIAGNOSTICS

In case of failure of the internal memory or corruption of programmed data, just after switching on, **Ech** appears with the relevant Fault contact signal.

In this case, for safety reasons, the default parameters are loaded automatically (see programming table on pages 15 to 16).

Eliminate the **Ech** indication by pressing RESET and run programming to enter the desired values.

Finally switch the unit off and back on to check the memory works correctly, if it is damaged **Ech** will be displayed again (send the control unit to TECSYSTEM srl for repairs).

MONITORED VALUES DIAGNOSTIC

The alarm parameters must be configured by programming see programming table on pages 15-16.

THi temperature

The alarms relating to the THi temperature parameter can be programmed with a range between 10°C and 60°C, with steps of 1°C. The THi parameter can be enabled **"YES**" and disabled "**NO**". With NO programming, the THi parameter is not considered, with YES the following takes place:
When the sensor detects a temperature higher than 1°C, compared to the pre-set value as Thi limit **(THi +1°C)**, the FAN relay switches and the FAN LED lights up. With temperature higher than 6°C, compared to the pre-set value as Thi limit **(THi +6°C)**, The ALARM relay switches and the ALARM LED flashes. Association of the relays with the THi parameter occurs during programming:

- **FAN** extraction fans enabling (YES enabled-NO disabled)
- **ALARM** high temperature **WARNING** signal (YES enabled-NO disabled)

As soon as the measured temperature returns to values that are lower than the pre-set limit, the relays switch and the LEDs **FAN (TH1-1°C) and ALARM (THi +4°C) turn off. NOTE: temperature monitoring every 2 seconds.**

Example of alarm activation with THi = 45 ° C

	ON		OFF	
FAN	46°C	THi + 1°C	44°C	THi - 1°C
ALARM	51°C	THi + 6°C	49°C	THi + 4°C

Tlo temperature

The alarms relating to the Tlo temperature parameter can be programmed with a range between -25°C and 10°C, with steps of 1°C. The Tlo parameter can be enabled **"YES**" and disabled "**NO**". With NO programming, the Tlo parameter is not considered, with YES the following takes place:
When the sensor detects a temperature lower than 1°C, compared to the pre-set value as Tlo limit **(Tlo -1°C)**, the HEATER relay switches and the HEATER LED lights up. With temperature lower than 6°C, compared to the pre-set value as Tlo limit **(Tlo -6°C)**, The ALARM relay switches and the ALARM LED flashes. Association of the relays with the Tlo parameter occurs during programming:

- **HEATER** "panel / cabin heating element" heater enabling (YES enabled-NO disabled)
- **ALARM** low temperature **WARNING** signal (YES enabled - NO disabled)

As soon as the measured temperature returns to values that are greater than the pre-set limit, the relays switch and the LEDs **HEATER (Tlo+1°C) and ALARM (Tlo-4°C)** turn off. **NOTE: temperature monitoring every 2 seconds.**

Example of alarm activation with TLo = 5 ° C

	ON		OFF	
HEATER	4°C	Tlo - 1°C	6°C	Tlo + 1°C
ALARM	-1°C	Tlo - 6°C	1°C	Tlo - 4°C

Humidity RH

The alarms relating to the humidity parameter rH can be programmed with a range between 10 - 90% RH, with steps of 1%. The rH parameter can be enabled **"YES**" or disabled "**NO**". With NO programming, the RH parameter is not considered, with YES the following takes place:
When the sensor detects a humidity rate higher than 1% compared to the pre-set value as the limit of RH **(RH +1%)**, the **FAN / HEATER** relays switch and the **FAN / HEATER** LEDs light up. With humidity rate higher than 6%, with respect to the pre-set value as limit RH **(RH +6%)**, the ALARM relay is switched and the ALARM LED flashes. Association of the relays with the rH parameter occurs during programming:

- **FAN / HEATER** enabling of extraction fans or heaters (panel / cabin heating element) (NO disabled-HEATER "hTr enabled heater" - FAN enabled fan)
- **ALARM WARNING** humidity (YES-NO enabled disabled)

The switching off of the FAN / HEATER and ALARM alarms occurs as soon as the humidity detected returns to -4% below the pre-set limit RH, in which case the relays are switched and the LEDs FAN / HEATER (RH - 4%) and ALARM (RH + 1%) turn off. **NOTE: humidity monitoring every 2 seconds. Maximum value for switching the ALARM relay rH 97%.**

Example of alarm activation with rH = 60%

	ON		OFF	
HEATER/FAN	61%	RH + 1%	56%	RH -4 %
ALARM	66%	RH + 6%	61%	RH +1 %

Dust deposit dSt

The alarms relating to the dust parameter dSt can be programmed with a range between 10 to 25 dSt, with steps of 1 dSt. The dSt parameter can be enabled **"YES**" or disabled "**NO**". With NO programming, the dSt parameter is not considered, with YES the following takes place:

When the sensor detects a value greater than 1 dSt with respect to the value set as the limit of dSt (dSt +1), the relay ALARM switches and the ALARM LED flashes. The association of the relay to the parameter dSt occur during programming:

- **ALARM WARNING** dust deposit (YES enabled-NO disabled)

As soon as the conditions of dust deposit detected return to values equal to or lower than the pre-set limit, the relays are switched and the LEDs **ALARM (dSt-1)** turns off. In the case of **ALARM dSt,**,the cleaning of the cabin is recommended.
NOTE: monitoring of dust conditions every 24 hours, starting from the last activation of the TPU sensor (first reading).

Example of alarm activation dst = 16

	ON		OFF	
ALARM	17	dSt + 1	15	dSt -1

Door inputs D1-D2

The NT311 control unit has two door inputs D1 and D2, Door 1 – Door 2- Com connections. Enabling of the D1 and D2 inputs allows monitoring of the status of the door contacts (NC), see example of connection on page 13 or 14.

With the enabled parameter, D1 or D2 YES, opening of the contact connected follows the switching of the ALARM relay and ALARM LED flashes. The association of the relay to the D1 / D2 parameter occur during programming:

- **ALARM** door **WARNING** signal (YES enabled-NO disabled)

Display view

- OPE = open contact (alarm condition)
- CLO = contact closed (non-alarm condition)

FAN & HEATER MANAGEMENT

The NT311 control unit has two relays: FAN and HEATER that are used to manage the temperature of the cabin / panel in which it is installed.

FAN (THi)

If appropriately programmed, through the **THi** threshold, it can control the ON-OFF of the cabin / panel extraction fans.

e.g. THi = 30°C (FAN "YES") when the THI threshold is exceeded by 1°C, example (31°C), the FAN LED lights up and the FAN relay switches. When the temperature goes below the programmed threshold of (-1°C) THi, example (29°C), the relative relay switches and the FAN LED turns off.

The high flexibility of the NT311 control unit allows the enabling of contact management:

By selecting **FAN "YES"** the function will be disabled.

By selecting **FAN "NO"** the function will be disabled.

The THi threshold can be programmed in the programming steps 5-6 on page 15.

HEATER (Tlo)

If appropriately programmed, through the **Tlo** threshold, it can control the ON-OFF of the heating system (heating element) of the cabin / panel.

e.g. Tlo = 5°C (HEATER "YES") when the temperature goes below the threshold of (-1°C) Tlo, example (4°C), the HEATER LED lights up and the relay switches HEATER. When the temperature exceeds (1°C) the programmed Tlo threshold, example 6°C, the relative relay switches and the HEATER LED turns off.

The high flexibility of the NT311 control unit allows the enabling of contact management:

By selecting **HEATER "YES"** the function will be disabled.

By selecting **HEATER "NO"** the function will be disabled.

The Tlo threshold can be programmed in the programming steps 13-14 on page 15.

FAN & HEATER (RH)

If appropriately programmed, through the **rH** threshold**,** it can control the ON / OFF of the cabin / panel heater (heating element) or the ON / OFF of the cabin / panel extraction system.

ES: RH = 80% (HEATER "hTR") when the control unit detects a humidity level that is 1% higher than the pre-set value RH, example (81% RH), the HEATER LED lights up and the HEATER relay switches. When the control unit detects a humidity rate that is 4% lower than the pre-set value, example 76%, the relative relay switches and the HEATER LED turns off.

ES: RH = 80% (FAN "FAN") when the control unit detects a humidity rate that is 1% higher than the pre-set value RH example (81% RH), the FAN LED lights up and the FAN relay switches. When the control unit detects a humidity rate that is -4% lower than the pre-set value, example 76%, the relative relay switches and the FAN LED turns off.

The high flexibility of the NT311 control unit allows the enabling of contact management:

By selecting **HEATER "hTR"** the function will be enabled on the relative HEATER contact.

By selecting **FAN "FAN"** the function will be enabled on the relative FAN contact

By selecting **"NO"** the function will be disabled.

The rH threshold can be programmed in steps 21-22 of the programming on page 15.

IMPORTANT INFORMATION

Before carrying out the insulation test of the electrical panel, on which the control unit is installed, it must be disconnected from the power supply line and the sensors disconnected, in order to prevent them from being seriously damaged.

OUTPUT RS485 MODBUS (NT311 D VERSION ONLY)

INTRODUCTION TO THE MODBUS INSIDE MODULE

The MODBUS INSIDE expansion module is built in the monitoring unit and allows data transfer on a RS485 line with MODBUS RTU protocol, maximum 32 devices.

OPERATING NOTES

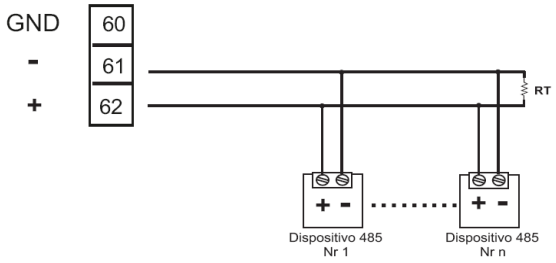
For the module to work correctly, it is necessary to set the RS485 network set-up parameters: address, baud rate, parity bit.
See programming steps 43 to 48 on page 16.
The serial communication of the temperature control monitoring unit is active only when the NT311 D is in temperature control mode in one of the intended modes (Scan, Man).
When other functions such as programming, programming display and relay test are activated, the ModBus communication is temporarily deactivated.

DATA TRANSMISSION ON MODBUS NETWORK

The internal MODBUS INSIDE module is used to connect the NT311 D control unit to an RS485 network with Modbus RTU protocol in order to read the data indicated in the modbus table, page. 23, and to be able to write those indicated in the notes section for remote programming, the module is always in slave mode.
The NT311 D control unit is in communication with the network only when it is in temperature reading mode, while it is inactive when in the following modes: display, programming and test relays.

RS485 ELECTRICAL CONNECTIONS

As far as the signal cable to be used in order to ensure the correct network operation is concerned, we recommend you follow the provisions of the EIA RS485 standard which suggests using a 24AWG twisted pair.
The twisted pair that connects units in RS485 might need a 120ohm end resistor on the last unit of the series.
Connect the twisted pair paying attention to polarities and lay the network avoiding to make sharp bends or ring windings in order not to modify line impedance. If necessary, the GND terminal for grounding is also available.
Always position the RS485 twisted pair far from power cables.



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DATA FRAME

The frame in asynchronous transmission consists of: 1 start bit, 8 data bits, 1 parity bit (even or odd, if the parity has been set) and 1 stop bit.
With parity NO (none) it is possible to select N-1 (1 stop bit) or N-2 (2 stop bit).
The permitted baud rates are: 2400, 4800, 9600, 19200 and 38400.
If not otherwise specified, the word length (DATA) is 16 bits.

DATA PACKET

A complete request/response sequence is composed as follows:

Master's request:

SLAVE ADDRESS	- 1 byte
FUNCTION CODE	- 1 byte
DATA	- variable, depends on the function code
CRC	- 2 byte

Slave response:

SLAVE ADDRESS	- 1 byte
FUNCTION CODE	- 1 byte
DATA	- variable, depends on the function code
CRC	- 2 byte

FUNCTION CODE

The ModBus module supports the following function codes:

$3_{(10)}$: - holding register reading

$16_{(10)}$: - multiple registers writing

If ModBus receives a message and a CRC error is detected, no answer is given.

CODE $3_{(10)}$.

Request:
Slave address, code $3_{(10)}$, Starting address HI, Starting address LO, Number of Point HI, Number of Point LO, Crc LO, Crc HI.

Response:
Slave address, code $3_{(10)}$, Byte count, Data HI, Data LO., Crc LO, Crc HI.

CODE $16_{(10)}$.

Request:
Slave address, code $16_{(10)}$, Starting address HI, Starting address LO, Number of Point HI, Number of Point LO, Byte count, Data HI, Data LO……., Crc LO, Crc HI.

Response:
Slave address, code $16_{(10)}$, Starting address HI, Starting address LO, Number of Register HI, Number of register LO, Crc LO, Crc HI.

NOTES FOR REMOTE PROGRAMMING

The writeable registers are shown in TABLE MODBUS MAPPING referred to as W or RW (**write or read/write**). max number of registers 56, see table page 23.

In the case in which a parameter is not enabled and / or the information is not provided we have the following answers:

1. **Measured value = 0000**
2. **Value AL = Value written in E2PROM**
3. **Channel status = 0000**
4. **Channel setting = %00000000; %xxxxxxx0 (x=n.d.)**

In case you try to set these thresholds incorrectly, the control unit NT311 D will not proceed with the programming and storage of data, therefore in subsequent readings will read the data from the previous schedule.

After having sent a request for writing the control unit will take a time of approximately 1 " to store the data in eeprom, during the step of storing the module ModBus will not be able to process additional requests. If the demand for programming is successful, the unit automatically resets and loads the new values set.

Note_1: HUMIDITY commands from ModBus - Simultaneous programming of both actuators is not permitted; in this case the default value is stored.

In the event that information is sent in writing to a register can't be written (only READ) data will be trashed without affecting the received message.

The information "RELAY STATUS" indicates the state of excitation of the coils of the relays, so it will be subject to the commands of "FAIL SAFE".

At the end of the write command (Write) is carried out a check of compatibility data:

1. **If you have a non-compatibility "exception" for an answer and the data packet is rejected in its entirety. The code of the first erroneous data can be obtained by reading the log "Error received data". (NB: this code is lost during RESET or new power or writing data in E2PROM);**
2. **If the data are correct, they are transferred to the non-volatile memory (E2PROM), the historical data is reset and a reset of the system is subsequently forced**
3. **If the WRITE command implies only writing "COMMANDS" it will be implemented autonomously and without RESET, i.e. without affecting the data of the control unit.**

ERROR CODES (exception codes)

In case of a wrong request, ModBus will answer with modified codes and codified errors according to the following:

1: - Unsupported function code
2: - Wrong data address
3: - Incorrect data (for instance length)

In the event that all the relays: ALARM - FAN - HEATER are disabled the relay test will not take place.

ILLEGAL DATA

On the other hand, some combinations are programming errors because they are wrong settings; in this case the error code is ILLEGAL_DATA , This information is accessible to ModBus reading the register 7.

NO ERROR	No error 00
THi (HIGH) temperature programming out of range (10°C/60°C)	Code error 01
Tlo temperature programming. (LOW) out of range (-25°C / 10°C)	Code error 02
Humidity programming out of range (10% rH / 90% rH)	Code error 03
Dust programming out of range (10-25)	Code error 04
Data structure error BIT 0-6 (DATA) BIT 7-15 (SIGN)	Code error 05

Note; in case the values programmed from ModBus are out of range, a date "exception" error response will be generated.

POLLING FREQUENCY.

It is advisable to adopt polling frequencies greater than or equal to 1 second.
Pollings can frequently overload the system, without bringing any benefit. In multi-device RS485 lines, interrogated in sequence, it may be useful to enter a delay between polls in relation to: the number of connected devices, the communication speed and the number of registers read.

MODBUS MAPPING TABLE

HEADER (information and commands):

Address LO (10)	Data HI	Data LO	RS485 Modbus W:write RW: read/write
1	Model – MSD (ASCII)	Model - 3° Digit (ASCII)	R
2	Model - 2° Digit (ASCII)	Model – LSD (ASCII)	R
3	Space (20H)	Vers. Fw – MSD(ASCII)	R
4	Vers. Fw - 2° Digit (ASCII)	Vers. Fw – LSD(ASCII)	R
5	00	00	00
6	00	00	-
7	00	Incorrect datum received	R-see tab.
8	00	Info various causes	R-see tab.
9	00	Controls	W-see tab.

SYSTEM: Setting and Status

Address LO (10)	Data HI	Data LO	Notes 1	Notes 2	R: read W:write RW: read/write
10	00	00			-
11	00	00			-
12	00	00			-
13	00	CPU Setting	See Note		RW
14	00	CPU Error	See Note		R
15	00	Relays Status	See Note		R
16	00	00	--		R

Address LO (10)	Data HI	Data LO	Notes 1	Notes 2	R: read W:write RW: read/write
17	00	Address	Modbus address	1255	R
18	00	Bdr	Modbus baud rate	0=2400 1=4800 2=9600 3=19200 4=38400	R
19	00	Parity	Modbus parity bit + Stop	0=No+1stop 1=Even 2=Odd =No+2stop	R
20	00	00	00		-
21	00	00	00		-
22	00	Sensor status	See Note		R
23	00	00	00		
24	00	00	00		
25	00	00	00		
26	00	00	00		
27	00	00	00		
28	00	00	00		
29	00	00	00		

Address LO (10)	Data HI	Data LO	Notes 1	Notes 2	R: read W:write RW: read/write
30	00	2'compl temper_1 measured	MSB=sign	--	R
31	00	2'compl. temper_1 max set point	See Progr. Temp.THi	MSB = sign	RW
32	00	Commands temper_1 max	--	--	RW
33	00	2'compl. temper_1 measured max (historical from E2PROM)	MSB=Sign	ModBus only	R
34	00	00	--	--	--
35	00	2'compl. temper. 2 min set point	See Progr. Temp.Tlo	MSB=Sign	RW
36	00	Temperature controls 2 min	--.	--	RW
37	00	2'compl. temper. 2 measured min (historic from E2PROM)	MSB=Sign	ModBus only	R
38	00	Measured humidity value	MSB=Sign	--	R
39	00	Max humidity Set point	See Progr. Humid.rH	--	RW
40	00	Humidity controls	See Note 1	--	RW
41	00	Max measured humidity (historic from E2PROM)	MSB=Sign	ModBus only	R
42	00	Dust level measured	MSB=Sign	--	R
43	00	Dust – set point	See Progr. Dust dSt	--	RW
44	00	Dust controls	--	--	RW
45	00	00	--.	--	--
46	00	Digital Input 1	Bit_0: 1=ON	--	R
47	00	Digital Input Controls 1	--	--	RW
48	00	Digital Input 2	Bit_0: 1=ON	--	R
49	00	Digital Input Controls 2	--	--	RW
50	00	00	00		
51	00	00	00		
52	00	00	00		
53	00	00	00		
54	00	00	00		
55	00	00	00		
56	00	00	00		

REGISTERS NOTES

INFO various causes (Read)

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	--	--	--	RESET has taken place

COMMANDS (Write)

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	--	Reset Reg. CPU_Error	Reset historical data	Reset BIT: RESET has taken place

RELAY STATUS (coil energising status)

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	FAULT Relay 1=No Fault	--	Relay ALARMS 1=ON	Relay Actuator_2 1=ON	Relay Actuator_1 1=ON

CPU SETTING

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	Failsafe fault	--	--	--	--

CPU ERROR

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	Tecsybus Error TEC	Sens. Dust Error dSt	Sens. Humid. Error rH	Temp Sens. Error °C	ECH error

SENSOR STATUS

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	In P. D2 = All	In P. D1 = All	Dusts=All	Humidity=All	Temp_2 = All	Temp_1 = All

TEMPERATURE CONTROLS 1 - MAX

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	Enabl. Alarm	--	Enabl. FAN	Enabl. Measurement

TEMPERATURE CONTROLS 2 - MIN

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	Enabl. Alarm	Enabl. HEATER	--	Enabl. Measurement

HUMIDITY COMMANDS

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	Enabl. Alarm	Enabl. HEATER	Enabl. FAN	Enabl. Measurement

DUST CONTROLS

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	Enabl. Alarm	--	--	Enabl. Measurement

DIGITAL INPUT CONTROLS (1; 2)

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	Enabl. Alarm	--	--	Enabl. Sensor

WARRANTY REGULATIONS

The purchased Product is covered by the manufacturer's or seller's warranty under the terms and conditions indicated in the "Tecsystem s.r.l. General Sales Conditions", which can be consulted on the website www.tecsystem.it and/or in the stipulated purchase contract.

The warranty is considered valid only when the product is damaged by causes attributable to TECSYSTEM srl, such as manufacturing or components defects.

The warranty is invalid if the Product proves to have been tampered with/modified or incorrectly connected and causing voltages outside the set limits and does not comply with the technical data for use and assembly, as described in this instruction manual.

The warranty is always ex Corsico as stated in the "General Conditions of Sale".

TROUBLESHOOTING	**CAUSES AND *SOLUTIONS***
The control unit does not switch on and the supply to terminals 40-42 is correct.	Check that: the connector is firmly inserted in its place, the connection wires are tight and that there are no obvious signs of burns on the connectors. Turn off the power supply and carry out the above instructions, restore the voltage.
Fault with indication "ECH"	A strong disturbance has damaged the memory data. See the paragraph for programmed data diagnostics on page 17.
Fault with TEC indication	TPU sensor disconnected. It is advisable to check the connection between the sensor and the control unit.
Fault with indication FLT°C	Check the connections and if necessary replace the faulty sensor. In case the minimum/maximum full scale value has been reached, make sure that the environmental conditions correspond to what is indicated by the control unit.
Fault with dSt indication	Check the connections and if necessary replace the faulty sensor. In case the minimum/maximum full scale value has been reached, make sure that the environmental conditions correspond to what is indicated by the control unit.
Fault with indication rH	Check the connections and if necessary replace the faulty sensor. In case the minimum/maximum full scale value has been reached, make sure that the environmental conditions correspond to what is indicated by the control unit.
The control unit displays Door 1 or Door 2 door alarm but the doors are closed	Check the engagement of the terminals and tightening of the screws on the Door1-Door2-Com inputs
Contact the *TECSYSTEM* Technical Department if the problem persists.	

EQUIPMENT DISPOSAL

The European directive 2012/19/EU (WEEE) has been approved to reduce the waste of electrical and electronic appliances and to encourage the recycling and reuse of materials and components of these appliances, thereby reducing the disposal of harmful residues and compounds originating from electrical and electronic material.

All the electrical and electronic equipment supplied after 13 August 2005 is marked with this symbol, pursuant to European directive 2012/19/EU on electrical and electronic waste (WEEE). Any electrical or electronic equipment marked with this symbol must be disposed of separately from normal domestic waste.

Returning of used electrical appliances: contact TECSYSTEM or the TECSYSTEM agent to receive information on correct disposal of the appliances.

TECSYSTEM is aware of the impact its products have on the environment and asks its customers active support in the correct and environmentally-friendly disposal of its devices.

USEFUL CONTACTS

TECHNICAL INFORMATION: ufficiotecnico@tecsystem.it

SALES INFORMATION: info@tecsystem.it