INSTRUCTION MANUAL

NT935BH

1MN0189 REV. 0

operates with ISO9001 certified quality system

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R. 1.4 10/10/25

ENGLISH

"Translations of the original instructions"

INTRODUCTION

First of all we wish to thank you for choosing to use a **TECSYSTEM** product and we strongly suggest that you read this instruction manual carefully: You will understand the use of the equipment and therefore be able to take advantage of all its functions.

ATTENTION! THIS MANUAL IS VALID AND COMPLETE FOR THE NT935BH-D CONTROL UNIT.

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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 damages, fires or electric shock, and possible serious injuries!

POWER SUPPLY
The NT935BH control unit can be supplied from 85 to 260 Vac-Vdc, without respecting the polarity 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, 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. Disconnect the power supply immediately if you notice that the device gives off a burning smell or smoke: contact the 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 service.

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 totally 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.

POSITIONING
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 from any possible vibrations. Position the control unit as far away 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.

FUNCTIONS
To control the transformer correctly from a temperature point of view, enabling the VOTING function is allowed where the load distributed between the phases of the transformer is adequately balanced.

TECHNICAL INFORMATION

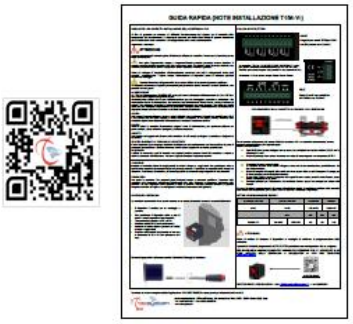
Mail: support@tecsystem.it tel: 02/4581861

ACCESSORIES

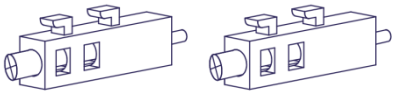
The following objects are present inside the box:

Control unit

Start guide and QR code

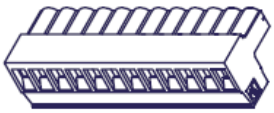


2 blocks for panel fixing
Screw tightening torque 0.29Nm

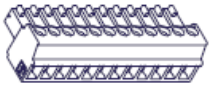


1 Terminal 3 pitch poles 5 supply
Code: 2PL0367 - Screws tightening torque 0.5Nm

1 relay terminal 12 poles pitch 5
Code: 2PL0361 - Screw tightening torque 0.5Nm



1 Terminal 12 poles pitch 3.81 sensors Pt100
Code: 2PL0420 - Screw tightening torque 0.25Nm



1 Terminal 4 pitch poles 3.81 for BLDC output
Code: 2PL0368 - Screws tightening torque 0.25Nm

1 Terminal 3 pitch poles 3.81 RS485
Code: 2PL0366 - Screws tightening torque 0.25Nm

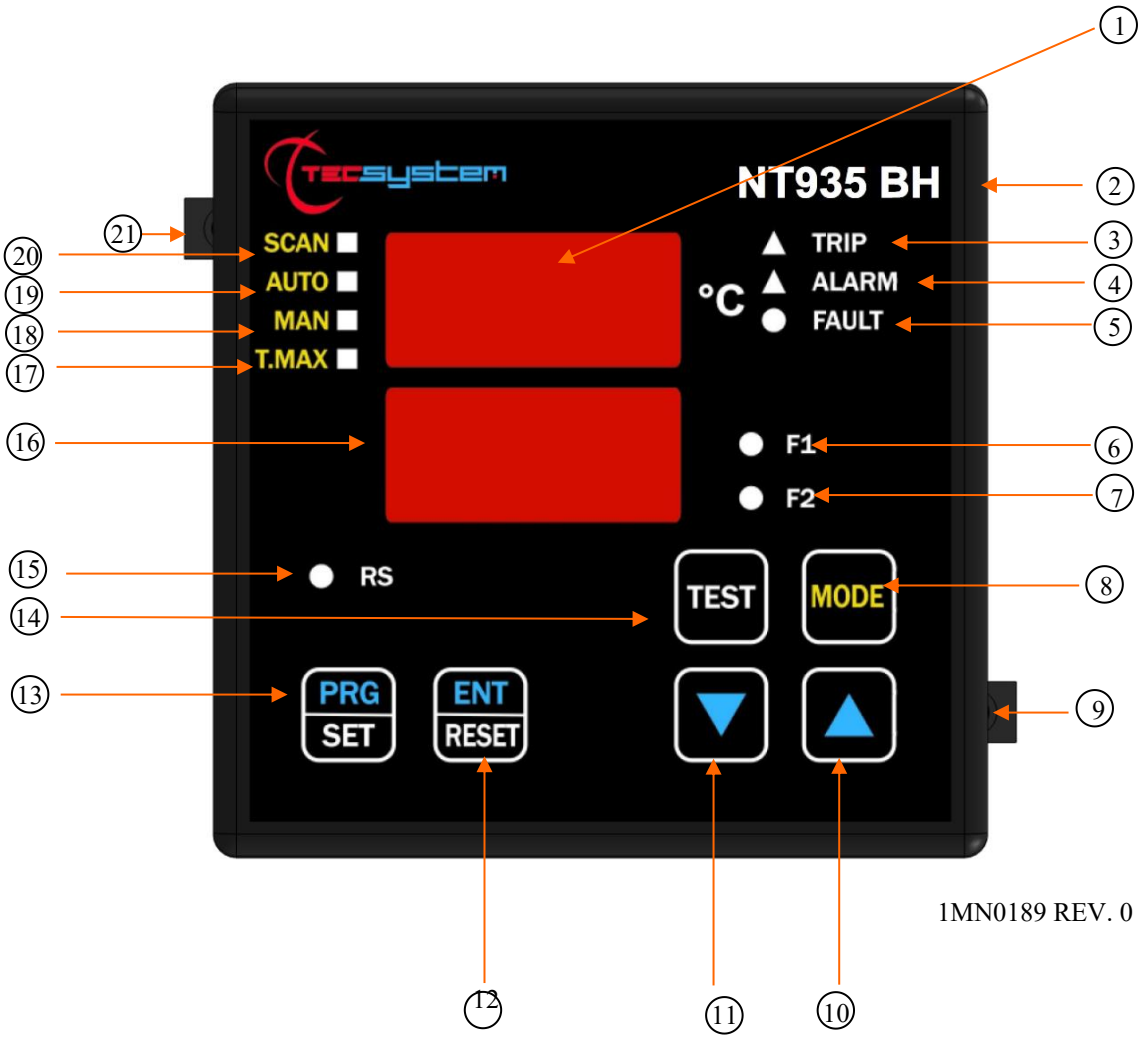
ATTENTION: always install the device using the terminals included in the pack.
The use of terminals other than those included with the control unit might cause malfunctions.

TECHNICAL SPECIFICATIONS	NT935BH-D
POWER SUPPLY	
Supply rated values	85-260 Vac-Vdc 50/60HZ
Vdc with invertible polarities	•
INPUTS	
4 inputs for three-wire Pt100 RTD sensors (max section 1.5mm²)	•
Connections on removable terminal boards	•
Input channels protected against electromagnetic interference	•
Thermoresistances cable compensations	500 m (1 mm²)
OUTPUTS	
2 alarm relays (ALARM AND TRIP) SPDT	•
1 sensor or operating failure (FAULT) relay SPST	•
1 ventilation management relay SPST FAN 2	•
Output relays with 10A-250Vac-res COSΦ=1 contacts.	•
TRBH output controls FANS	•
RS485 output Modbus RTU	•
DIMENSIONS	
100x100 mm– din43700-prof .131mm (including terminal block)	Hole 92 x 92 mm
TESTS AND PERFORMANCE	
Construction in compliance with CE regulations	•
Protection from electrical interference EN 61000-4-4	•
Dielectric strength 1500 Vac for a min. between output relays and sensors, relay and power supply, power supply and sensors	•
Accuracy ±1% full scale value, ±1 digit	•
Ambient operating temperature from –20°C to +60°C	•
Humidity 90% non-condensing	•
Polycarbonate frontal film IP65	•
Housing NORYL 94 _V0	•
Absorption 7.5VA	•

TECHNICAL SPECIFICATIONS	NT935BH-D
Digital linearity of sensor signal	•
Self-diagnostic circuit	•
Protection treatment of the electronic part	Optional
DISPLAY AND DATA MANAGEMENT	
2 x 13 mm displays with 3 digits to display temperatures, messages and channels	•
3 LEDs to display the state of the alarms of the selected channel (ALARM-TRIP-FAULT)	•
4 leds selection of display mode (SCAN-AUTO-MAN-T-MAX)	•
2 LEDs to display the state of FAN1 and FAN2	•
Temperature control from 0°C to 240°C (*)	•
2 alarm thresholds for channels 1-2-3	•
2 alarm channels for channel 4	•
1 activation threshold FAN1 ON TRBH	•
1 activation threshold FAN2 ON TRBH/RELAY	•
FAN1/2 TRBH fan speed adjustment 10 steps	•
Sensor diagnostics (Fcc-Foc-Fcd)	•
Data memory diagnostics (Ech)	•
Fan fault diagnostics (RS1-RS2-RSE- EST-B1-B2-B1.2)	•
Access to programming through front keyboard	•
Automatic exit from programming, display and relay test after 1 minute of inactivity	•
Incorrect programming warning	•
Selection between channels automatic scanning, hottest channel or manual scanning	•
Storage of maximum temperatures reached by channels and alarm status	•
Front key to reset the alarms	•
Voting Function	•
Fail Safe Function	•

(*) On request, reading version -40°C to 200°C with alarm temperature control from 0°C to 200°C

FRONT PANEL



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1)	3-digit temperature display	12)	Enter/Reset button
2)	Control unit series	13)	Programming/Setting key
3)	TRIP (red) LED	14)	Led/relay test key
4)	ALARM (yellow) LED	15)	Led (green) RS Modbus communication
5)	FAULT (red) LED	16)	3-digit channel display
6)	FAN 1 TRBH signalling (yellow)	17)	T-max mode selection (red) LED
7)	FAN 2 (yellow) LED TRBH/RELAY	18)	Man mode selection (yellow) LED
8)	Display mode selection key	19)	Auto mode selection (green) LED
9)	Fixing blocks	20)	Scan mode selection (yellow) LED
10)	UP key	21)	Fixing blocks
11)	DOWN key		

DISPLAY

The first display is dedicated to temperatures.

The second display to the monitored channel.

When the device is switched on or after a reset, the model of the control unit, the type of sensors, VER "00" (firmware version) and the temperature range of the device and the identification abbreviation are always shown on the display.

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

- *SCAN*: the control unit shows in scanning (every 2 seconds) all the enabled (°C) and disabled (NO) channels.
- *AUTO*: the control unit displays the hottest channel automatically.
- *MAN*: manual reading of the channel temperature using the up/down keys▲▼
- *T.MAX*: The display shows the maximum temperature of the channel selected with the cursor keys. In the event of a fault, the Tmax value is replaced with the type of fault stored (fcc-foc). Turning on the Trip Alarm-Fault LED warns of any events that have occurred. The recordings are always successive to the moment in which the T.Max is reset (by pressing RESET).

OPERATING PROGRAM CONTROL

To control the protection levels programmed, press the PRG key twice to access the **VIS** programme. Repeatedly pressing the PRG key, you can 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.

SCAN AND MAN FUNCTION NOTES
During the SCAN and MAN modes, the operation of the NT935 can be displayed.

1) RUN cPU:
RUN cPU: This message appears upon ignition of the device.
2) 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 13-14. Return the control unit to TECSYSTEM for repairs.
3) CAL Err:
This message appears when damage is found in the measurement circuit.
The temperature values displayed might be incorrect. Return the control unit to TECSYSTEM for repairs.
4) Pt Err :
This message appears when it is detected that one or more PT100 sensors are not working correctly, FOC, FCC and FCD indications in the temperature sensor diagnostics paragraph on page 16.
5) BH Err:
This message appears when damage is found in the measurement circuit.

FLT RS1 or RSE: communication failure with the B1 control box or extractor control box (RSE)
FLT RS2: communication failure with the B2 control box
FLT B1 or EST: failure of at least one motor on the B1 bar or of an extractor (EST)
FLT B2: failure of at least one motor on the bar B2
FLT B1-B2: failure of at least one motor on the B1 bar and B2 bar

The above messages will be displayed following the 1-2-3-4-5 priority stated.
In case of **Err** the FAULT relay will be de-energised.

NOTE: in any display mode in the event of a fault, the control unit will automatically set itself in **SCAN mode (PRIVILEGED SCAN)**, thus allowing the immediate display of the fault condition on the relevant **CH** channel or on the fans (the **Mode** button will be disabled).

LED TEST

We suggest carrying out the control unit LED test regularly.
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 LED that is lit shows 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.
Alternatively it is possible to use the PT100 model simulator: SIM PT100.

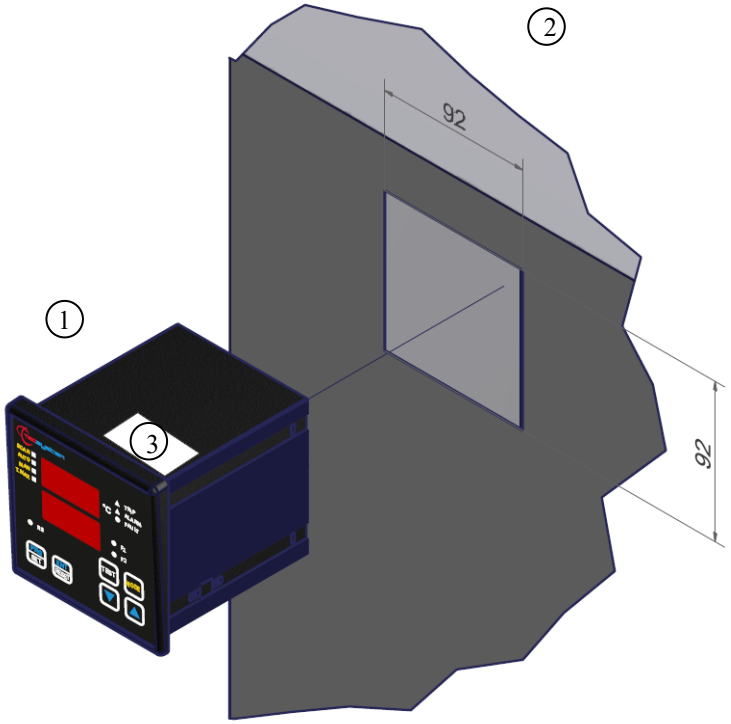
ATTENTION: accessing at the relay test mode will temporarily disable the failsafe function, the relays with function enabled switch (ALARM-TRIP-FAULT).

ALARM RELAY SILENCING

To silence the ALARM signal, press the RESET key: the relay will de-energise and the ALARM LED, which is on steady, will start to flash. Silencing is automatically disabled when the temperature goes below the ALARM threshold.

ASSEMBLY

Drill a hole in the panel sheet with dimensions of 92 x 92 mm.



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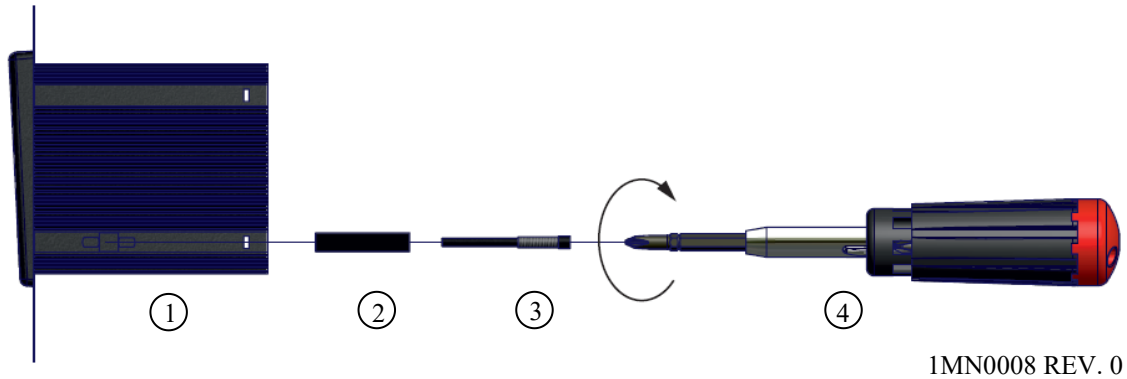
1)	Control unit	2)	Panel hole dimensions (+0.8 mm tolerance)
3)	Identification label		

Secure the appliance firmly by means of the supplied fixing blocks.



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1)	Control unit	3)	Locking screws
2)	Fixing blocks	4)	Cross-head screwdriver #1X100mm

ELECTRICAL CONNECTIONS

NOTE: all the useful information on the TRBH system's electrical connections is available in the TRBH SYSTEM manual.

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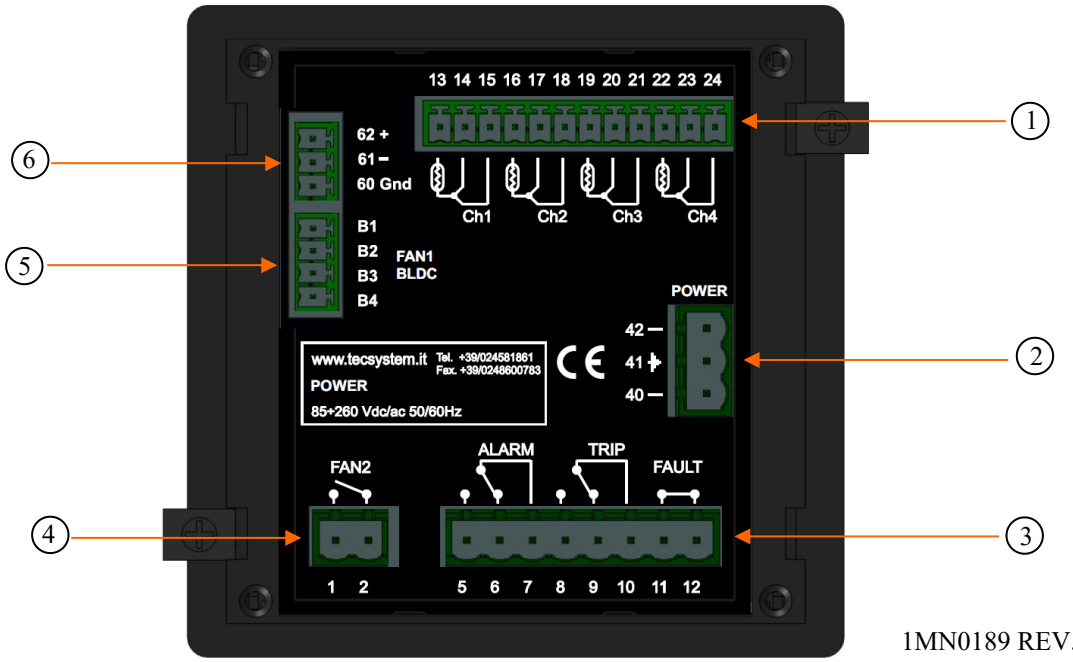

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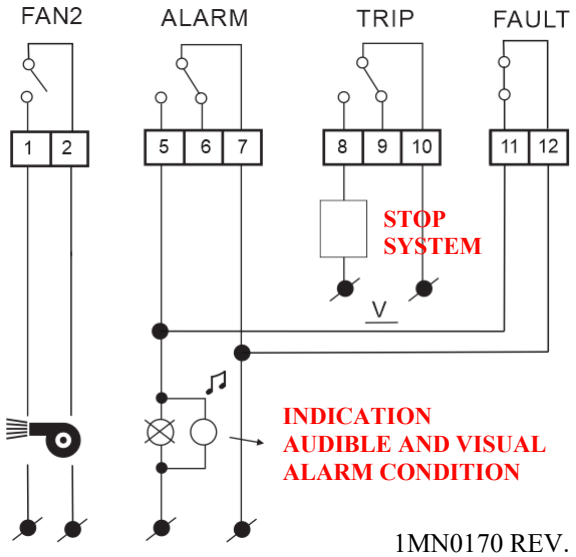
1)	Pt100 sensors (white-red-red)	4)	Relay (FAN2)
2)	Power supply 85-260Vac-cc 50/60Hz.	5)	FAN1 BLDC output (parallel connection of control box B1 or control box extractor)
3)	Relays (ALARM-TRIP-FAULT)	6)	RS485 output Modbus RTU

Note: image relay contacts in non-alarm condition, except for the FAULT relay which switches: contacts 11-12 open (NO) contacts 11-12 closed (NC) fault condition identification. Read paragraph Alarms pag.12 and see image of fault contact opening.

RELAYS CONNECTION EXAMPLE



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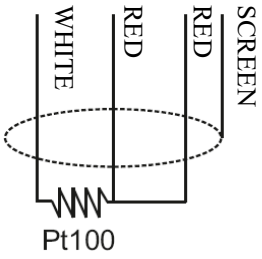
Pt100 CONNECTION EXAMPLE



Note: before connecting the probes to the control unit, carefully read the paragraph measurement signal transfer on page 15.

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

POWER SUPPLY

The NT935BH control unit 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.

When the control unit is powered directly by the secondary of the transformer to be protected, it can be burnt out by high intensity overvoltages.
These problems occur if the main switch is closed and the transformer does not have the load (no load test).
The above is much more evident when the 220 Vac voltage is taken directly from the transformer secondary bars and there is a fixed capacitor battery to phase the transformer itself.

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/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 unit is located in one of the methods described below does not monitor heat, also the relay will all be banned: The fault contact switches and the fault LED flashes.

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

The ALARM and TRIP relays only switch when the set temperature thresholds are exceeded.

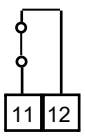
The FAULT (fault) contact, programmed in active failsafe mode (default YES), opens (11-12) when the appliance is powered, only if during the access phase the control unit does not detect anomalies, and keeps the switching until when one of the following events occurs:

- Data memory fault (Ech message).
- Pt100 sensor fault (FCC short-circuited sensor, FOC interrupted sensor or Fcd quick temperature increase)
- CAL damage to the measurement circuit.
- Insufficient supply voltage.
- During the power on reset after programming (PRG), displaying the data (VIS) and relay Test.
- Fan fault signalling (RS1-RSE-RS2-B1-B2-B1.2 EST)

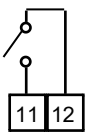
The FAULT failsafe mode can be disabled FAULT failsafe "NO" see programming step 34-35 page 14.

NOTE: in order to avoid unwanted system outages, do not connect the FAULT relay to the transformer tripping circuit.

FAULT CONTACT OPERATION (failsafe active)



FAULT 11-12 NC: ALARM FAULT OR POWER OFF



FAULT 11-12 NO: POWER ON OR NO FAULT

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	erasable message
2) CAL	measurement circuit fault	erasable message
3) FCD	quick temp. increase fault	resettable condition
4) PT ERR	FCC or FOC sensor fault	non-resettable condition
5) BH ERR	fan failure	non-resettable condition

PROGRAMMING

NT935BH D

STEPS	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	The ALARM threshold for (CH 1-2-3) is displayed. Set the desired threshold, the Alarm LED flashes	▼ ▲	Default 90°C
4	PRG SET	The TRIP threshold for (CH 1-2-3) appears and the Trip LED flashes.		
5		Set the desired threshold	▼ ▲	Default 119°C
6	PRG SET	The display shows FAN1 TRBH (CH 1-2-3) the led Fan1 flashes.		Default YES
7		Select YES/NO	▼ ▲	
8	PRG SET	The display shows (CH4) Enabling CH4		
9		Select YES or NO	▼ ▲	with YES the CH4 is enabled with NO the CH4 is disabled
10	PRG SET	The ALARM threshold for (CH4) is displayed, the Alarm led flashes.		If CH4=NO jump to step 16, Default NO
11		Set the desired threshold	▼ ▲	Default 120°C
12	PRG SET	The TRIP threshold for (CH4) is displayed, The Trip led flashes		
13		Set the desired threshold	▼ ▲	Default 140°C
14	PRG SET	The display shows FAN2 for (CH4)		Default Yes
15		Select YES/NO	▼ ▲	
16	PRG SET	B-M is displayed The FAN1 led flashes		Default B2-M3
17		Select the desired TRBH configuration, TRBH notes on page 17	▼ ▲	TRBH: B1-M3 B0-M0 B2-M1 B1-M1 B2-M2 B1-M2 B2-M3
18	PRG SET	The display shows ON (CH 1-2-3) the FAN1 led flashes		Default 60°C
19		Set the desired threshold FAN1 ON	▼ ▲	
20	PRG SET	EST n_0 is displayed The FAN2 led flashes		Default n_0
21		Select the desired TRBH EXTRACTOR configuration **TRBH notes on page 17**	▼ ▲	TRBH EXTRACTOR: n_0 n_1 n_2 n_3

22	PRG SET	The display shows ON (CH4) the FAN 2 LED flashes		Default 45°C
23		Set the desired threshold FAN2 ON		If FAN 2 NO is selected skip to step 24
24	PRG SET	HFN (NO) is displayed The FAN1-FAN2 LEDs flash		Fan cyclic test for 5 min. every “n” hours
25		Set the desired number of hours		Default NO = function disabled
26	PRG SET	FCD (NO) is displayed		Fault for quick temperature of the temperature (°C/sec)
27		Set the desired value (FCD info on page 27)		Default NO (function excluded)
28	PRG SET	VOT (NO) is displayed (Voting info on page 16)		
29		Select YES or NO		Default NO (function excluded)
30	PRG SET	FLS (ALARM) is displayed Blinking ALARM LED (FAIL SAFE info on page 26)		
31		Select YES or NO		Default NO
32	PRG SET	FLS (TRIP) is displayed Blinking TRIP LED		
33		Select YES or NO		Default NO
34	PRG SET	FLS (FAULT) is displayed Blinking FAULT LED		
35		Select YES or NO		Default YES
36	PRG SET	ADR <> "datum" is displayed		Modbus address Default 001
37		Set the address		From 1 to 255
38	PRG SET	BDR <> "datum" is displayed		Modbus transmission speed Default 19.2 Kb/s
39		Set the desired speed		From 2.4 Kb/s to 38.4 Kb/s
40	PRG SET	PAR <> "datum" is displayed		Parity bit selection EVE Default
41		Set the desired parity bit		None (N-1 or N-2), Even (EVE), Odd (ODD) See Data frame on page 18.
42	PRG SET	END is displayed		End of programming
43	ENT RESET	Press ENT to save the set data and exit programming		incorrect programming of the LED values indicated (note 6)
44	PRG SET	Return to step 1		See programming notes on page 15

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 the enabling of the functions described in this manual must be checked (by a specialized engineer) according to the application and features of the system the control unit is installed on.

PROGRAMMING NOTES

1) The MODE key allows reversing the programming steps according to the sequence 28-26-8-1
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) If pressing ENT, "Err" appears, it means that one of the following mistakes has been made:
ERR ALL. = ALARM ≥ TRIP

The device automatically prepares itself for the programming step of the error committed

NOTE: EVERY TIME THE CONTROL UNIT PROGRAMMING, WITH CONFIRMATION OF DATA SAVING, THE VALUES STORED IN T-MAX ARE RESET AT THE TIME OF STORING.

TEMPERATURE SENSORS

Each Pt100 thermometric sensor has a white conductor and two red ones (CEI 75.8 standards).
The CH2 channel must always refer to the central column of the transformer.
The CH4 channel must refer either to the transformer core, or to the Pt100 room sensor whenever it is necessary to thermostat the transformer room using the NT935 control unit.

MEASUREMENT SIGNAL TRANSFER

All the Pt100 measurement signal transfer cables must strictly comply with the following rules:

1. Every Pt100 must be connected with a three-wire cable with a minimum section of 0.35mm² and a maximum of 1 mm².
2. The extension cable must be screened with tinned copper braid with an 80% cover
3. Conductors must be twisted, maximum recommended step 60mm
4. The cable screening must only be earthed with a termination, preferably on the control unit side.
5. The sensors' signal transfer cable must not be near electrical cables, either low or medium-high voltage.
6. The Pt100 cable and the signal transfer cable must be laid in a straight line, without any winding.
7. Any caps used to butt conductors must be crimped properly to avoid false contacts.

NOTE: to install the sensors and signal transferring cable correctly, read the SCS/SENSORS installation rules manual.

What may happen when installation rules are not complied with.

1)The electrical field propagating from the power line of another circuit couples capacitively with the conductors (in particular with unscreened cables). The effect of this coupling creates a signal that overlaps the signal transmitted by the nearby conductors, causing incorrect readings.

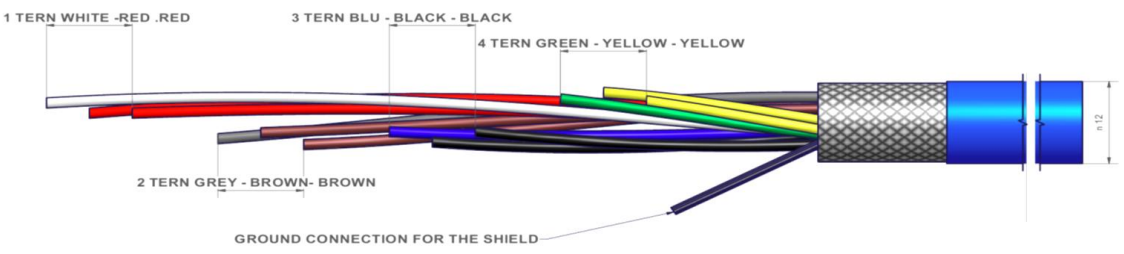
2) The variations in magnetic flux in the power lines may induce an electromotive force on the signal transferring cables (in particular non-twisted cables), that, being a closed circuit, generates a current. This interference current, multiplied by the circuit resistance, gives a voltage value that overlaps the signal to be transmitted, distorting the sensor measurement.

3) False contacts can alter the signal with the consequent variation in the temperature detected.

In specific cases, when the rules for connecting the Pt100 sensors are not complied with, the following anomalies can occur between the SCS box and the temperature control unit:

a) incorrect temperature readings, alarms or anomalous tripping
b) mechanical/electrical fault of the Pt100 sensors
c) damage to the Pt100 inputs of the control unit.

TECSYSTEM S.r.l. has designed its own special cable to transfer the measurement signals, CEI-compliant, with all the protection requirements provided for mod. CT-ES



NOTE: *the use of cables not complying with the above could cause possible reading anomalies. It is always important to take into account that any interference on the signal lines might cause anomalies on the Pt100 inputs (CH1-CH2-CH3-CH4.) or on the sensors themselves.*

All "NT" series control units have linearity of the sensor signal, with a maximum error of 1% of full scale value.

TEMPERATURE SENSOR DIAGNOSTICS

In case of failure or exceeded full scale value of one of the thermometric sensors installed on the machine to be protected, the FAULT relay opens immediately with the relative warning of faulty sensor on the corresponding channel.

Fcc indicates sensor in short circuit or exceeding the minimum full scale value of the control unit -8°C (for version 0° ÷ 240°C) and -48°C (for version -40°C ÷ 200°C)

Foc indicates sensor interrupted or exceeding the maximum full scale value of the control unit 243°C (for version 0°÷240°C) and 203°C (for version -40°C÷200°C)

To eliminate the message and to restore the Fault opening, check the connections of the Pt100 and to replace the faulty sensor if necessary. 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.

Note: exceeding the minimum/maximum full scale can also be caused by possible disturbances on the sensor lines, in this case the following are recommended:

Check correct installation of the sensors and especially of the extension cable (as indicated in the paragraph MEASUREMENT SIGNALS TRANSFER).
Activation of the functions: VOTING (shown below) or FCD (on page 27) must always be operated taking into account the working conditions of the system.

CAL message display: the indication appears when the measurement circuit is damaged. The temperature values displayed might be incorrect. Return the control unit to TECSYSTEM for repairs.

VOTING FUNCTION

The voting function derives from the redundancy concept that consists in duplicating the components of a system to increase their **reliability**.

How does VOTING work?
Using the redundancy principle, we use the sensors installed on the three phases U-V-W to monitor the transformer's operation, and at the same time to ascertain the sensors are working correctly, discriminating against any false alarms (generated by installation errors).

By activating the **VOTING "YES"** function, the control unit compares the temperature values recorded on the monitored CH1-CH2-CH3 channels and enables the switching of the(**TRIP)** disconnect contact only if the **TRIP** threshold has been exceeded on at least two channels over the same period T.

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

Note: if Voting "Yes" is programmed, the switching of the **ALARM** contact will signal exceeding of the alarm threshold on each individual channel.

To enable the Voting function, read the programming section on pages 13-14.

Attention: To control the transformer correctly from a temperature point of view, enabling the VOTING function is allowed where the load distributed between the phases of the transformer is adequately balanced. In addition, any conditions of FAULT: FCC-FOC-FCD on two or more channels, with active voting, can determine the TRIP contact inhibition.

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 13-14).
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).

TEMPERATURE DIAGNOSTICS

When one of the thermometers detects a temperature higher than 1°C with respect to the pre-set value as the alarm limit, after approximately 5 seconds the **ALARM** relay switches and the channel *ALARM* LED (CH*n*)switches on.
When the trip temperature limit is exceeded, after approximately 5 seconds the **TRIP** relay switches and the channel *TRIP* LED (CH*n*) switches on.
As soon as the recorded temperature returns to values equal to or lower than the limit set for the **ALARM** and **TRIP** relays switching, these relays de-energise and the corresponding LEDs switch off.
The values of **ALARM** and **TRIP** are kept in the internal memories: they can be recalled by entering the Vis modes (displaying programmed parameters) and modifiable in the PRG mode (programming).

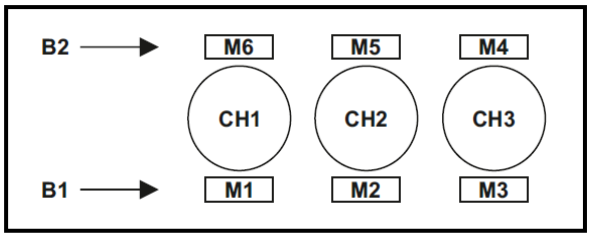
COOLING FAN CONTROL

The NT935BH control unit, connected to the TRBH bars (B1-B2) will manage the activation and regulation of the speed (rpm) of the connected fans. The activation and shutdown of the ventilation system, programmable on the thermometric devices, they will be anticipated by 10° C with respect to the FAN1 ON threshold (programmed on CH1-CH2-CH3): ON speed S1 and OFF speed S0, maximum speed S10 will reach at the threshold value of FAN1 ON.

CHF 1.2.3: e.g. FAN1 ON 60°C = S1 ON TRBH 61°C OFF TRBH 60°C (S1 = speed 1).

The speed regulation (rpm) on the fans is divided into 10 steps in relation to the temperature detected on the CHF channel and to the FAN 1 ON value, following the following combinations CH1 (M1-M6) - CH2 (M2-M5) - CH3 (M3-M4), selection of number of B2-M3 bars/fans.

CHF 1.2.3: e.g. FAN1 ON 70°C = **S1 ON TRBH** 61°C, **S2** 62°C, **S3** 63°C, **S4** 64°C, **S5** 65°C, **S6** 66°C, **S7** 67°C, **S8** 68°C, **S9** 69°C, **S10** 70°C (S10 = maximum speed).



Example: **FAN1 ON 60°C - B2-M3 SELECTION**

Channel	Temperature	Speed	Motors
CH1	61°C	S1	M1-M6
CH2	63°C	S3	M2-M5
CH3	60°C	OFF(S0)	M3-M4

The speed regulation on the single CH 1-2-3 will allow to regulate the air flow inside the transformer columns, also introducing the following advantages:

1) Reduction of transformer thermal shock
2) Reduction in fan power consumption
3) Implementation of the fan fault signalling

The TRBH system programming includes the following selections:

A) TRBH system enabling, steps 6-7 page 13, YES/NO selection: **YES** (activates CH1-2-3) - **NO** (not active).
B) Selection of number of bars and fans, steps 16-17 page 14, selection:

B0-M0 = fans configuration disabled.
B1-M1 = 1 bar (B1) 1 fan connected (M1), reference HOT channel (the hottest channel of CH1-CH2-CH3)
B1-M2 = 1 bar (B1) 2 fans connected (M1-M2), ref. HOT channel (the hottest channel of CH1-CH2-CH3)
B1-M3 = 1 bar (B1) 3 fans connected (M1-M2-M3), ref. Channel single CH1 (M1) CH2 (M2) CH3 (M3)

B2-M1 = 2 bars (B1-B2) 2 fans connected (M1-M6), ref. HOT channel (the hottest channel of CH1-CH2-CH3)
B2-M2 = 2 bars (B1-B2) 4 connected fans (M1-M2-M5-M6), ref. Channel HOT (the hottest channel of CH1-CH2-CH3)
B2-M3 = 2 bars (B1-B2) 6 fans connected (M1-M2-M3-M4-M5-M6) ref. Channel single CH1 (M1-M6) CH2 (M2-M5) CH3 (M3-M6)

C) setting the FAN threshold 1 ON (speed S1), steps 18-19 page 13, programmable according to the standard range 1°C at 230°C (range 0°C to 240°C) or 1°C 190°C (range -40°C to 200°C).

NOTE: fan speed regulation (rpm), with selections different from B1-3 and B2-3, is managed with reference HOT channel (the hottest channel of CH1-CH2-CH3). In the event of failure of one of the CH1-2-3 probes (FOC, FCC, FCD) the system automatically sets itself to speed S5 (M1-M2-M3-M4-M5-M6).
The speeds (rpm) of the S1-S2-S3- Sx… fans. S10 and the TRBH system electrical connections are available on the **TRBH SYSTEM** manual.

The **FAN 2** via the supplementary probe (CH4/YES), dedicated to the room / core temperature, can be used to manage the possible ON / OFF activation of an extractor or alarm installed in the cabin. By combining the device with the TRBH extractor system, it will be possible to manage the ventilation of the cabin/box by adjusting the flow rate of the extractors to 10 speeds. the TRBH extractor system can be configured with a maximum of three extractors.

FAN 2 YES/NO programming, steps 14-15 page 13, YES (CH4 active) - NO (not active).

The programming of the TRBH extractor system provides for the following selections with the number of connected extractors, steps 20-21 page 14:
n 0 = no fan connected.
n 1 = 1 fan connected (M1), reference channel CH4
n 2 = 2 fans connected (M1-M2), reference channel CH4
n 3 = 3 fans connected (M1-M2-M3), reference channel CH4

FAN 2 threshold ON, steps 22-23 pages 13-14, (e.g. ON at 45°C – fixed switch-off (OFF) at 35°C).
Depending on the set threshold, the Fan OFF delta will always be 10°C with respect to the programmed threshold ON.

Threshold setting FAN 2 ON can be programmed according to the standard range 1°C to 230°C (range 0°C to 240°C) or 1°C 190°C (range -40°C to 200°C).

NOTE: fan speed adjustment (rpm), with selections other than M1-M2-M3, is managed with channel CH4. In case of failure of one of the CH4 probes (FOC, FCC, FCD) the system automatically sets itself to speed S5 (M1-M2-M3)
The speeds (rpm) of the fans S1-S2-S3-Sx…. S10 and the electrical connections of the TRBH system are available in the TRBH EXTRACTOR manual.

NOTE: when FAN2 is enabled on CH4, by disabling the extractor function TRBH (n_0) it will be possible to manage the possible connection of an extractor or alarm installed in the cabin using the FAN2 relay. FAN 2 threshold ON, steps 22-23 pages 13-14, (eg. ON at 45°C – fixed switch-off (OFF) at 35°C). Depending on the set threshold, the Fan OFF delta will always be 10°C with respect to the programmed threshold ON .

TRBH FANS DIAGNOSTICS

The NT935BH control unit, connected to the BH bars (B1-B2), is able to identify any faults on the ventilation bars. In the event of a fault, the display shows **BH Err** followed by the relevant indication:

FLT RS1 or RSE: communication failure with the B1 control box or extractor control box (RSE)
FLT RS2: communication failure with the B2 control box
FLT B1 or EST: failure of at least one motor on the B1 bar or of an extractor (EST)
FLT B2: failure of at least one motor on the bar B2
FLT B1-B2: failure of at least one motor on the B1 bar and B2 bar

The fault signal **BH Err** involves the switching of the FAULT contact of the control unit.

The NT935BH-D model, through the Modbus Mapping, also is used to monitor the speed (rpm) set by the control unit and the following failure cases for the single motor:

- motor over temperature (motor temperature over 70°C)
- general motor failure (motor blocked or under stress - impeller disconnected from the motor shaft - motor broken - errors or interruptions of electrical connections)

FAN TEST

It is possible, by programming (**HFn**), to make sure that the fans are operated for 5 minutes every *xxx*" hours, regardless of the temperature values of the columns or the environment (e.g.: with HFn = 001 the fans are activated for 5 minutes every hour).
This function is designed to periodically check the operation of the fans and of their control equipment.
Setting **NO**, this function is inhibited.

To enable the HFN function, read the programming section on pages 13-14.

IMPORTANT INFORMATION

Before carrying out the isolation test of the electrical panel the control unit is installed on, disconnect it together with the sensors from the power supply to prevent it from being seriously damaged.

OUTPUT RS485 MODBUS

INTRODUCTION TO THE MODBUS INSIDE MODULE

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

OPERATING NOTES

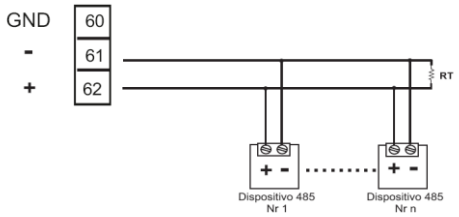
For correct functioning of the module it is necessary to set the RS485 network set-up parameters: address, baud rate, parity bit.See programming steps 36 to 41 on page 11.
The serial communication of the temperature control monitoring unit is only active when the NT935BH-D is in temperature control mode in one of the intended modes (Scan, Auto, Man and T.Max).
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 MODBUS INSIDE internal module makes it possible to connect the NT935BH-D control unit to an RS485 network with Modbus RTU protocol in order to be able to read the data indicated in the Modbus table, page 21, and to be able to write the data indicated in the paragraph notes for remote programming. The module is always in slave mode.
The NT935 RS485 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 120 ohm 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 NO parity (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 request:
SLAVE ADDRESS - 1 byte
FUNCTION CODE - 1 byte
DATA - variable, depends on the function code
CRC - 2 byte

Slave request
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 80, see table page.

Channels 1÷3 cannot be disabled; in case of incorrect setting they are always forced as enabled channels.

In the case in which the channel 4 is not enabled and/or the information is not provided we have the following answers:

1. **Measured temperatures = 0000 (0°C)**
2. **Temperature AL./TRIP = Value written in E2PROM**
3. **Channel status = 0000**
4. **Channel setting = %00000000; %xxxxxxx0 (x=n.d.)**

Also in the remote programming phase via ModBus it must be considered that the Alarm thresholds must be lower than the Trip thresholds and that the Fan-on thresholds must be higher than the Fan-off thresholds.

If these thresholds are set incorrectly, the control unit NT935BH-D will not proceed with the programming and storage of data and therefore in subsequent readings the data from the previous schedule will be read

After having sent a request for writing the control unit will take a time of about 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.

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 (Tmax = 0°C) 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: - Wrong data (for instance length)

The memory area containing the HFN datum must undergo no forcing.

In the case in which all the fans are turned off (FAN1, FAN2 and INT) the test of the relay will not take place.

UNACCEPTABLE DATA

There are some programmings that are not acceptable as they are not foreseen by the NT935BH-D instrument; such data will be discarded without producing any error message (EXCEPTION CODE).

CH 1-2-3: → channels that cannot be disabled
CH 1-2-3: → FAN_2 cannot be enabled
CH 4: → FAN_1 cannot be enabled
CH 4: → FAN_2 cannot be enabled if CH 4 = no

ILLEGAL DATA

Instead, some combinations are programming errors because they are incorrect 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
CH_1 Trip ≤ Alarm	Code error 01
CH_4 Trip ≤ Alarm	Code error 04
Value HFN > max see table: SYSTEM - Setting and Status	Code error 020
Value FCD > max see table: SYSTEM - Setting and Status	Code error 021
Value Voting > max see table: SYSTEM - Setting and Status	Code error 023

Note. If the value of Voting is higher than the max value expected for the model in question, it will be set equal to "0", that is NO_VOTING.

CONTROL UNIT GENERAL NOTES

The models of the control unit can be equipped with different options; to avoid disruption of production, their existence is defined by the Fw indicated, upon ignition, with dedicated messages on display LEDs.

This information can be accessed by reading the Modbus register 6 (OPTIONS) with the following meaning:

LOW Byte

Bit_0 = RS485 Modbus

HIGH Byte

Bit_0/1 = 00 - Range 0°C ÷ 240°C
Bit_0/1 = 10 - Range -40°C ÷ 200°C

Note: if the values programmed by ModBus are out of range, an "Exception" error data response will be generated.

POLLING FREQUENCY

It is advisable to adopt polling frequencies greater than or equal to 1 second.
Questions frequently can 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	R: read 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	Qty channels (2*ASCII)		R
6	Options (see note)	Options (see note)	R
7	00	Wrong 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	HFN (Fan test)	0=No test	1÷200h	RW
11	00	FCD	temperature increment	0=No FCD 1÷30°/sec	RW
12	00	Voting	0=No 1 = Enable		RW
13	00	CPU Setting	See Notes		RW
14	00	CPU Error	See Notes		R
15	00	Relays Status	See Notes		R
16	00	FREE	FREE		R

17	00	Address	Modbus address	1÷255	R
18	00	Bdr	Modbus baud rate	0=2400 1=4800 2=9600 3=19200 4=38400	R
19	00	Parity	Modbus parity bit	0=N-1 None+1Stop 1=Even 2=Odd 3=N-2 None+2Stop	R
20	00	Bars/Fans Structure	See notes on page 25/26		R

TEMPERATURE FANs:

Address LO (10)	Data HI	Data LO	Notes 1	Notes 2	R: read W: write RW: read/write
21	2'compl. sign	Fan_1 ON TRBH	1°C ÷ 240°C 1°C ÷ 200°C (*)	MAX SPEED	RW
22	2'compl. sign	FREE	See Notes		R
23	2'compl. sign	Fan_2 ON	1° to÷ 240° 1°C ÷ 200°C (*)	MAX SPEED	RW
24	2'compl. sign	FREE	See Notes		R

(*) for version –40°C ÷ + 200°C

TEMPERATURES channels 1÷4:

Address LO (10)	Data HI	Data LO	Notes 1	Notes 2	R: read W: write RW: read/write
25	2'compl. sign	2'compl. Ch1 temper.	-10°C ÷ 240°C –48°C÷200°C (*)		R
26	2'compl. sign	2'compl. Ch1 max temperat.	0°C ÷ 240°C 0°C÷200°C (*)		R
27	2'compl. sign	2'compl. Ch1 temper. alarm set point	1°C ÷ 240°C 1°C÷200°C (*)	(AL)	RW
28	2'compl. sign	2'compl. Ch1 temper. trip set point	1°C ÷ 240°C 1°C÷200°C (*)	(TRP)	RW
29	2'compl. sign	2'compl. Ch2 temper.	-10°C ÷ 240°C –48°C÷200°C (*)		R
30	2'compl. sign	2'compl. Ch2 max temperat.	0°C 240°C 0°C÷200°C (*)		R
31	2'compl. sign	2'compl. Ch2 temper. alarm set point	1°C ÷ 240°C 1°C÷200°C (*)	As (AL)	R
32	2'compl. sign	2'compl. Ch2 temper. trip set point	1°C ÷ 240°C 1°C÷200°C (*)	As (TRP)	R
33	2'compl. sign	2'compl. Ch3 temper.	-10°C ÷ 240°C –48°C÷200°C (*)		R
34	2'compl. sign	2'compl. Ch3 max temperat.	0°C ÷ 240°C 0°C÷200°C (*)		R

35	2'compl. sign	2'compl. Ch3 temper. alarm set point	1°C ÷ 240°C 1°C÷200°C (*)	As (AL)	R
36	2'compl. sign	2'compl. Ch3 temper. trip set point	1°C ÷ 240°C 1°C÷200°C (*)	As (TRP)	R
37	2'compl. sign	2'compl. Ch4 temper.	-10°C ÷ 240°C –48°C÷200°C (*)		R
38	2'compl. sign	2'compl. Ch4 max temperat.	0°C ÷ 240°C 0°C÷200°C (*)		R
39	2'compl. sign	2'compl. Ch4 temper. alarm set point	1°C ÷ 240°C 1°C÷200°C (*)	(AL)	RW
40	2'compl. sign	2'compl. Ch4 temper. trip set point	1°C ÷ 240°C 1°C÷200°C (*)	(TRP)	RW
41	00	00			R
42	00	00			R
43	00	00			R
44	00	00			R
45	00	TRBH _1 speed	M1-M6 motors		R
46	00	TRBH _1 motors status Bars 1/2	See the TRBH notes on page 25/26.		R
47	00	00			R
48	00	00			R
49	00	TRBH _2 speed	M2-M5 motors		R
50	00	TRBH_2 motors status Bars 1/2	See the TRBH notes on page 25/26.		R
51	00	00			R
52	00	00			R
53	00	TRBH _3 speed	M3-M4 motors		R
54	00	TRBH_3 motors status Bars 1/2	See the TRBH notes on page 25/26.		R
55	00	00			R
56	00	00			R

(*) for version –40°C ÷ +200°C

CHANNELS 1÷4: Setting

Address LO (10)	Data HI	Data LO	Notes 1	Notes 2	R: read W:write RW: read/write
57	00	Ch1 Setting	See Notes CHx		RW
58	00	Ch2 Setting	See Notes CHx		R
59	00	Ch3 Setting	See Notes CHx		R
60	00	Ch4 Setting	See Notes CHx		RW
61	00	00	--		R
62	00	00	--		R
63	00	00	--		R
64	00	00	--		R

CHANNELS 1÷4: Status

Address LO (10)	Data HI	Data LO	Notes 1	Notes 2	R: read W:write RW: read/write
65	Ch1 story	Ch1 status	See Notes CHx		R
66	Ch2 story	Ch2 status	See Notes CHx		R
67	Ch3 story	Ch3 status	See Notes CHx		R
68	Ch4 story	Ch4 status	See Notes CHx		R
69	00	00	--		R
70	00	00	--		R
71	00	00	--		R
72	00	00	--		R

Various registers extractors

Address LO (10)	Data HI	Data LO	Note 1	Note 2	R: read W:write RW: read/write
73	00	Number of Extractor TRBH	Valori=00-03		R
74	00	Extractor's speed TRBH_M1			R
75	00	Motor status TRBH_M1	See Note TRBH page 26		R
76	00	Extractor's speed TRBH_M2		as TRBH_M1	R
77	00	Motor status TRBH_M2	See Note TRBH page 26		R
78	00	Extractor's speed TRBH_M3		as TRBH_M1	R
79	00	Motor status TRBH_M3	See Note TRBH page 26		R
80	00	00			R

REGISTERS NOTES

INFO various causes (READ)

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	-	-	-	-	*(*) RESET (R) has taken place*

COMMANDS (WRITE)

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	-	-	*Reset Reg. CPU_ERR OR*	*(*) Reset historical data*	*(*) Reset BIT: RESET has taken place*

CHn SETTING

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	--	FAN2 AND EXT .TRBH	FAN1 TRBH	CAN_enabled

CHn STATUS

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	TRIP	ALARM	FAN_2 TRBH	FAN_1 TRBH	FCD	FOC	FCC

CHn STORY

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	TRIP	ALARM	--	--	--	FOC	FCC

RELAY STATUS (coil energising status)

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	Relay FAULT 1=ON	TRIP Relay 1=ON	ALARM Relay 1=ON	FAN_2 Relay 1=ON	FAN_1 Relay 1=ON

CPU ERROR

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	FAULT TRBH EST	FAULT TRBH	PT ERROR	CAL	FCD Fault	ECH

CPU SETTING

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

BARS/FANS STRUCTURE

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	**--**	Num. Bars 1;2		--	--	Num. Motors for bar 1; 2; 3	

Bar programming TRBH Bit 5-4:0 0 = NO BARS
0 1=BAR1
1 0=BAR1-2

Programming of motors TRBH Bit 0-1: 0 0 = NO motors
0 1 = M1
1 0 = M1-M2
1 1 = M1-M2-M3

TRBH BAR'S MOTORS STATUS

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	Motor status Bar_2		Motor status Bar_1	

TRBH motor status: 00=OK
10=overtemperature
01=general motor fault
11= communication failure with the control box/bar

EXTRACTOR BH NUMBER

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	--	--	Num. Motors for est 1; 2; 3	

Programming of motors TRBH Bit 0-1: 0 0 = NO motors
0 1 = M1
1 0 = M1-M2
1 1 = M1-M2-M3

TRBH EXTRACTOR MOTORS STATUS

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
--	--	--	--	--	--	Motor status est	

TRBH motor status: 00=OK
10=overtemperature
01=general motor fault
11= communication failure with the control box/bar

FAIL SAFE FUNCTION

The NT935 control unit has the selection n.o (normally open contact)/n.c (normally closed contact) for the ALARM, TRIP and FAULT relays, programming steps from 30 to 35 page 14. Selecting the YES/NO setting introduces the Fail Safe and No Fail Safe functions.

ALARM AND TRIP
By setting NO (NO Fail safe) the normally open contacts are in positions 5-7 Alarm and 8-10 Trip, they switch only when the pre-set temperature limits are reached.

By setting YES (Fail safe), the normally closed contacts are in positions 5-7 Alarm and 8-10 Trip, they switch only when the pre-set temperature limits are reached or as a result of no voltage.

FAULT
By setting YES (Fail safe), contact 11-12 is positioned as normally open, switches (closed) when a fault condition is identified; see paragraph on alarms and ventilation on page 12.

Setting NO (NO Fail safe) the contact 11-12 is positioned as normally closed, switches (open) when a fault condition is identified; see paragraph on alarms and ventilation on page 12.

If the fail safe function is disabled on the fault contact, the control unit will no longer be able to signal the fault due to power failure. In this case it is advisable to enable the Fail safe on the ALARM contact for the afore-mentioned indication.

NOTE: NOTE: when the control unit is in one of the modes indicated below, it does not perform any thermal monitoring, moreover the relays will all be disabled the FAULT led will flash.
• Vis. display programming.
• PRG programming.
• Test of the relays.
The FAIL SAFE function is temporarily disabled and the FAULT relay switches.

ATTENTION: accessing at the relay test mode will temporarily disable the failsafe function, the relays with function enabled switch (ALARM-TRIP-FAULT).

TECHNICAL SPECIFICATIONS OF THE EXTENSION CABLE FOR Pt100

1. Cable 20 x AWG 20/19 Cu/Sn
2. Section 0.55 mm²
3. Flame-protection insulation PVC105
4. Standards CEI 20.35 IEC 332.1
5. Maximum operating temperature: 90°C
6. Configuration: 4 triples of three twisted and coloured conductors
7. Screen on Cu/Sn
8. Fireproof PVC sheath
9. Outer diameter 12 mm
10. Standard configuration in 100 m coils

FCD FUNCTION

The NT series equipment boasts an innovative control function combined with the dynamic status of the Pt100 sensor.

Activating FCD, the control unit analyses the increase in temperature ΔT (*) recorded in a second (**°C/sec**).

Enabling the function, the user can select the value (ΔT) from a minimum of 1°C/sec up to a maximum of 30°C/sec. If the measured value is higher than the value set by the user, the control unit inhibits any activation of the ALARM and TRIP alarms and activates the switching of the FAULT relay (11-12), signalling on the display **"fault for Fcd".**

e.g. setting the function to 5°C, the fault switching for FCD will only be activated if the control unit detects an increase ΔT higher than 5°C in one second on the monitored system.

Setting "no" the FCD function is disabled.

When a channel is in Fault for FCD, the relative alarm and trip signals are inhibited on the single channel; therefore only the anomaly of excessively rapid increase of the temperature is signalled.

Press Reset to cancel the FCD signals of all the channels and reset the relay fault.

Possible applications of FCD

Identification of a possible induced interference on the Pt100 sensor line

If the installation instructions are not complied with (see page 15), any interference on the Pt100 sensor line can cause false readings or anomalous alarms.

Setting the FCD function in a temperature range of between 1°C and 10°C (5°C recommended), the effects caused by false readings can be suppressed and the alarm relay activation can be prevented, as shown above.

Corrective actions: check the installation of the sensor extension cable is in line with the instructions given in the paragraph on the measurement signal transfer on page 15.

Identification of a sensor fault or faulty connection

In case of a faulty connection or sensor fault, a quick positive or negative variation in temperature might occur, leading to the system tripping or the alarms of the monitored system to be triggered.

In this specific case we recommend the FCD function to be set in a temperature range of between 10°C and 20°C.

Corrective actions: check the terminals the sensor is connected to are tightened and replace the faulty sensor, if required.

Identification of the electrical motor rotor block

In case of temperature control of the electrical motors, the quick temperature increase might be due to a blocked rotor.

In this specific case, it is advisable to set the FCD function in a temperature range of between 20°C and 30°C**.** This setting is recommended in order to avoid activation of the FCD function during the motor starting phase, i.e. in the presence of the increase **ΔT/sec.** has a very rapid variation.

(*) The ΔT value shows the temperature range for each second.

NOTE: it is advisable not to enable the FCD function with VOTING active.

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.
CH4 is in FAULT for FOC (only the 3 Pt100 sensors are connected)	Programming error of the CH4/YES control unit. *Check and repeat the programming on page 13-14 select CH4 /NO.*
One of the three/four channels is in FAULT for FOC/FCC	Check the Pt100 probe connections, check the indications given in the paragraphs: *transfer of measurement signals and temperature probe diagnostics on page 15-16.*
When turned on, the indication "ECH" appears	A strong disturbance has damaged the memory data. See the paragraph for programmed data diagnostics on page 15.
All the Pt100 sensors are in FCC.	Incorrect sensor connection, the terminal block has been inserted upside down. *Check the connections and the terminal board.*
The temperature shown by one or more channels is wrong.	Contact the *TECSYSTEM* Technical Department.
Sudden trip of the main switch. The temperature is on standard levels. Just one channel has caused the trip.	Check the temperatures recorded in T-MAX, check the indications given in the paragraphs: *transfer of measurement signals and temperature probe diagnostics pag.15. Activate the FCD function.*
FCD warning	See the FCD function on page 27.
The control unit signals BH ERR RS1 or RSE	Check the connection between the control unit and the Control box BAR B1 or to the extractor control box RSE, TRBH SYSTEM manual.
The control unit signals BH ERR RS2	Check the connection between the Control box BAR B1 and the Control box B2, TRBH SYSTEM manual.
The control unit signals BH ERR B1 or EST	Check the operating status and the connection of the motors installed on the B1 bar or connected to the EST extractor control box, TRBH SYSTEM manual.
The control unit signals BH ERR B2	Check the operating status and connection of the motors installed on the B2 bar, TRBH SYSTEM manual.
The control unit signals BH ERR B1-2	Check the operating status and connection of the motors installed on the B1-2 bars, TRBH SYSTEM manual.
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 devices and to encourage the recycling and re-use of materials and components of these appliances, thus reducing the disposal of waste and compounds harmful from electrical and electronic equipment.

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: support@tecsystem.it

COMMERCIAL INFORMATION: info@tecsystem.it

CHANGES TO VERSION C03 NT935 BH-D

When the device is turned on, the message **NT935 BH C03** appears.
This indicates that the product purchased is a custom C03 version.

Differences introduced in the custom C03 model

Compared to the standard versions, control units with C03 configuration do not allow remote programming via Modbus protocol (function code 16).

Default Modbus settings:

- Address: **13**
- Baud rate: **9600**
- Parity: **NONE**
- Stop bit: **2**