INSTRUCTION MANUAL

NT511
AD ANALOG & DIGITAL INSIDE

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INTRODUCTION

NT511 is a microprocessor electronic device devoted to the transformer thermal monitoring, complete with ventilation system control and protection.

The monitoring unit is designed to be directly mounted on the transformer box and it is equipped with a wide display to show and manage the temperatures, as well as the ventilation switching on and alarm thresholds. It has 4 inputs for 3-wire PT100 sensors and it can feed and directly monitor the working of 1-6 fans.

The monitoring unit has a current RS485 port with RTU Modbus protocol which allows the plant remote management.

SUPPLY • Rated values: 230VAC±10% 50/60Hz • Maximum absorption: 6VA (fans excluded), ~2KW fans included	**DIMENSIONS** • 210× 260× 90 mm • Panel CUT-OUT 182x232 mm (Figure 2 Page20)
INPUTS (Figure 3 Page 21) • 4 Inputs for 3-wire PT100 sensors • Removable rear terminals • Input channels protected against electromagnetic noises • Cable compensation for resistance bulbs up to 500 mt (1mm^2.)	**OUTPUTS (Figure 4 Page 22)** • 2 alarm relays (ALARM-TRIP) • 6 outputs for fan supply 230VAC 50/60Hz 1.5A x6 (protection fuse 2A) • 1 relay for sensor fault or working anomaly (FAULT) • Output relays with 5A-250Vca resistive contacts • RS485 Modbus RTU digital output • 4.20 mA analog output
TESTS AND PERFORMANCES • Assembling in accordance with CE rules • Protection against electrical noises CEI-EN-61000-4-4 • Dielectric strength 2500 Vca for 1 minute between relays and supply, relays and sensors, sensors and supply • Accuracy ± 1% full scale value, ± 1 digit @25°C • Working temperature from -20°C to +60° C • Humidity 90% no condensing • Housing: switchboard panel by painted steel • Digital linearization of sensor signal • Self-diagnosis circuit • Program and reading resolution:1 digit • Front frame in polycarbonate IP65 • Highest absorption 6VA • Data storage 10 years minimum • **Option:** protection treatment of the electronic part	**DISPLAY AND DATA MANAGEMENT** • Display to show temperature and programming parameters (°C TEMPERATURE) • Display to show the displayed channel (CHANNEL) • 3 leds to show the display mode (SCAN, HIGH, TMAX) • 4 leds to show the state of the alarms relevant to the displayed channel (FAULT, FAN, ALARM, TRIP) • 6 leds to show the motor fault (M1, M2, M3, M4, M5, M6) • Led to show the programming phase (PRG) • Led to show the fan forced activation (manual) (MAN) • Led to show the modbus communication (RS485) • Temperature monitoring from 0°C to 200°C • 2 alarm thresholds (alarm/trip) for each channel • 2 thresholds to check ON-OFF ventilation • Sensor diagnostic (Fcc-Foc) • Programming access through front key • Wrong programming display • Maximum temperatures reached by the channels, alarm storage and sensor fault. • Front key to reset the alarms

2) MOUNTING OF NT511 MONITORING UNIT

Make a hole in the panel sheet with dimensions 182 x 232 mm. according to the fixing template shown in the Figure 2 at Page 19.
Firmly tighten the device with the enclosed screws.

3) SUPPLY OF NT511 MONITORING UNIT

NT511 Monitoring unit has 230VCA ±10% 50-60Hz supply.
To terminal 37 must always be connected to the ground.
When the monitoring unit is directly fed from secondary winding of the transformer to be protected, it can be damaged by high-intensity overvoltages.
These problems occur if the main switch is connected without load.
Above mentioned problems are much more evident when the 220 Vac voltage is directly taken from the transformer secondary bars and there is a fixed capacitor battery to phase the transformer itself.

In case you have to replace an existing monitoring unit with a new one, in order to guarantee its safe and correct working, <u>you must</u> replace the sensor/relay/supply connection terminals with the new terminals supplied, provided that they are of a brand different from the ones previously mounted.

4) ELECTRICAL CONNECTIONS FOR ALARMS AND VENTILATION

Carry out the electrical connections on the removable rear terminals, after having removed them from the monitoring unit.
ALARM and TRIP relays switch only when the set temperature limits are reached .
FAULT relay (Fault) switches when the monitoring unit is fed, while gets de-energised when a fault occurs to Pt100 sensors, data memory fault (**Ech**) or when supply voltage is lacking.
M1-2-3-4-5-6 outputs can be used to feed the cooling fans (highest range 2A)

5) TEMPERATURE SENSOR CONNECTION

Each Pt100 temperature sensor has a white and two red wires (CEI 75.8 standards).
Figure 3 Page 20 shows the position inside the terminal box of the monitoring unit connection cables.
CH2 channel must always be referred to the transformer central column.
CH4 channel must be referred either to the transformer core or to Pt100 room sensor, if you want to thermostat the transformer room using the NT511 monitoring unit.

6) MEASURING SIGNAL TRANSFER.

All the measuring signal transfer cables for Pt100 must absolutely:

- be separated from the power ones
- be made with shielded cable and twisted conductors
- have at least 0,5 mm² section
- be twisted if there is no screen
- be firmly fixed inside the terminal boxes
- have tinned or silvered conductors

All the “NT” series monitoring units have the sensor signal linearization, with a max. error of 1% of full scale value.

7) CONNECTION WITH RS485 NETWORK

NT511 can be connected with a data acquiring device (PC, PLC, SCADA) for remote control. The used interface is RS485-type, which allows to connect 32 devices on the same line, and it is based on Modbus RTU protocol.

In order to guarantee a proper network working, please follow what laid down by EIA RS485 standard which suggests to use a 24AWG duplex cable.
The duplex cable which connects all the units in RS485 could require a 120 ohm termination on the last unit of the series.
Connect the duplex cable paying attention to the polarities and lay the network avoiding to make sharp bends or ring windings in order not to modify the line impedance.
In case of particular noises, it could be necessary to ground the shielding on GND terminal.

8) TEMPERATURE SENSOR DIAGNOSTIC

8) TEMPERATURE SENSOR DIAGNOSTIC

In case of breaking of a temperature sensor mounted on the machine to be protected, **FAULT** relay immediately switches with the relevant indication of the defective sensor on the corresponding channel.

- **Fcc** for short-circuited sensor.
- **Foc** for interrupted sensor.
- **Fcd** temperature fast increasing (see pag.10).

To eliminate the message and reset Fault switching, it is necessary to verify Pt100 connections and, in case, replace the defective sensor.

Note: **CAL** message appears when it is determined the damage of the measuring circuit. The temperature values shown could be incorrect. Please contact Tecsystem to return the unit for repairing.

9) PROGRAMMED DATA DIAGNOSTIC

In case of breaking of the internal storage or corruption of programmed data, just after switching on, the **Ech** wording is displayed with the relevant reporting of the Fault contact.
For safety reasons, in this case the default parameters Alarm Ch1-2-3= 90°C, Trip Ch1-2-3= 119°C, Ch4= Yes, Alarm Ch4= 120°C, Trip Ch4= 140°C, Ch-Fan= 1-2-3, Fan-on= 70°, Fan-off= 60°, HFN= 000 are automatically loaded.
To remove **Ech** wording, press RESET and run programming to insert the desired values.
Finally turn off and turn on again the unit to verify the correct memory working; in case it is damaged and the **Ech** wording is still displayed, please return the monitoring unit to Tecsystem for repair).

10) TEMPERATURE DIAGNOSTIC

If one of the temperature sensor detects a temperature higher than 1°C compared to set value as alarm limit, after approximately 5 seconds **ALARM** relay switches together with the turning on of *ALARM* LED of the reference channel (CH*n*).
When the release temperature limit is passed, **TRIP** relay switches together with the turning on of LED *TRIP* of the reference channel (CH*n*).
As soon as the taken temperature returns to equal or lower values than the set limit for **ALARM** and **TRIP** relay switching, they de-energise with consequent turning off of relevant LED's.

11) COOLING FAN CONTROL (Figure 4 Page 21)
NT511 Monitoring unit, if opportunely programmed, can control ON-OFF of fans accompanying the transformer, according to set temperatures.
Fans on machine can be driven in two different ways:

- Using the temperatures taken by the sensors on the three columns
  CHF 1.2.3
  (ex. ON at 80°C - OFF at 70°C)

  Through an extra sensor (**CH4/YES**) for the room temperature inside the transformer box.
  CHF 4
  (ex. ON at 40°C - OFF at 30°C)

12) FAN TEST
It is possible, through programming (**HFn**), impose that the fans are activated for 5 minutes each "*xxx*" hours, regardless of column or room temperature values (ex.: with HFn=001 fans are activated for 5 minutes each hour).
This function has the aim to periodically verify the working of the fans and their control apparatus during long idle periods.
Loading **000** value this function is inhibited.

13) DISPLAY MODE
Pressing MODE key, the display mode is loaded:

- *SCAN*: monitoring unit displays in scansion (each 2 seconds) all the activated channels
- *AUTO*: monitoring unit automatically displays the hottest channel
- *T.MAX*: monitoring unit displays the highest temperature reached by the sensors and possible alarm or fault situations occurred after the last reset.
  Select channels with ▲▼, reset values with RESET.

14) WORKING PROGRAM CONTROL
To check the programmed temperature values, shortly press PRG key. **viS** indication is displayed for 2 seconds, confirming entering in the program vision mode.
By repeatedly pressing PRG key, all the previously loaded values are rolled in sequence.
After 1 minute of keyboard no-operation, display-programming procedure will be automatically left.
To end display, press ENT key.

15) LAMP TEST
Lamp test is carried out when the monitoring unit is turned on and when the data display and programming phases are over.
During lamp test all the displays are on for 2 seconds.

16) ALARM RELAY SILENCING
If you want to silence the ALARM signal press RESET key: relay de-energises and LED ALARM, which was fixed, will start to blink.
Silence system is automatically disconnected when the temperature goes under the ALARM threshold.

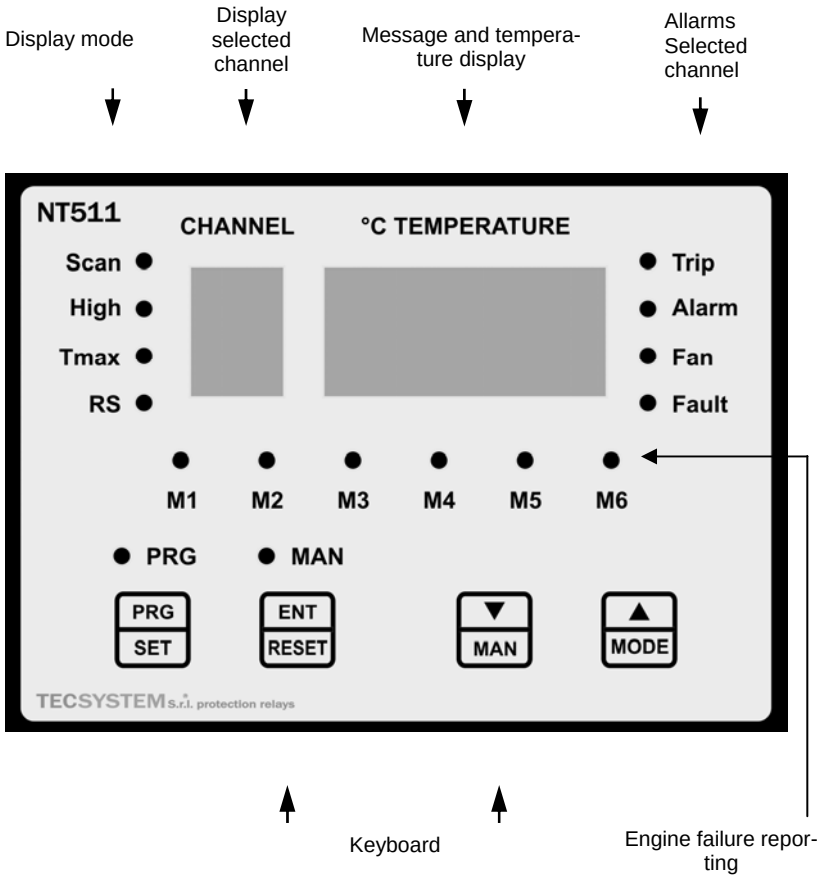
17) IMPORTANT NOTICE

Before carrying out the insulation test on the switchboard where the monitoring unit is mounted, you have to disconnect it from the mains in order to avoid serious damages.

If one of the LED's should not work, you are kindly requested to return the monitoring unit to TECSYSTEM.

18) FRONT PANEL

FIGURE 1



19) PROGRAMMING
NOTE: LED PRG-ON OFF: PROGRAM DISPLAY.
LED PRG-ON ON: PROGRAM MODIFICATION

N°	PRESS	EFFECT	NOTES
1	PRG/SET	Keep pressed PRG key until PRG-ON led turns on. After PRG indication, it appears ALARM threshold for CH 1-2-3	
2		load desired threshold	
3	PRG/SET	it appears TRIP thresold for CH 1-2-3	
4		load desired threshold	
5	PRG/SET	I4 on CH display appears	Enabling CH 4
6		Load YES or NO	With YES CH 4 is connected With NO CH 4 is disconnected
7	PRG/SET	ALARM threshold for CH 4 appears	If CH 4=NO go to point 11
8		load desired threshold	
9	PRG/SET	TRIP threshold for CH 4 appears	
10		load desired threshold	
11	PRG/SET	CHF is displayed	Reference channel for fan switching on
12		Select: No, 123 or (if ch4 yes)	123 or 4: Reference channels for fan switching on No: FAN function excluded go to point 21
13	PRG/SET	Fan Led blinks and the number of fans to be driven is displayed	From 1 to 6 fans
14		Load number of fans (from 1 to 6)	
15	PRG/SET	Display shows ON	FAN turning on
16	PRG/SET	ON thresolf for FAN appears	
17		load desired threshold	
18	PRG/SET	Display shows OFF	FAN turning off
19	PRG/SET	OFF threshold for FAN appears	
20		load desired threshold	
21	PRG/SET	Display shows HFN	Fan cyclic test for 5 minutes each “n” hours
22	PRG/SET	Load desired number of hours	000= disabile function
23		Load desired number of hours	
24	PRG/SET	Display shows FCD <> “datum”	Fault for fast temperature increase (°C/sec)
25		Load desired value (see Page 10)	From “no” (excluded function) to 30 °C/sec
26	PRG/SET	Display shows ADR <> “datum”	Modbus address
27		Load desired address	From 1 to 255
28	PRG/SET	Display shows BDR <> “datum”	Modbus transmission speed
29		Load desired speed	From 4.8 Kb/s to 38.4 Kb/s
30	PRG/SET	Display shows PAR <> “datum”	Select parity bit
31		Load desired parity bit	None (No), Even (EVE), Odd (ODD)
32	PRG/SET	Display shows 420 <> “datum”	Programming 4.20 mA output
33		Select desired 4.20 mA output	1-2-3-4; fixed channel SCA: scanning HOT: hottest channel

34	PRG/SET	Display shows END	Programming end
35	ENT	Loaded data storage and programmino exit	Err: wrong programming for values indicated by LED's (NOTE 2)
36	PRG/SET	Return to step 1	

NOTES:
1) ***If pressing ENT, "Err" appears, it means that one of the following mistakes has been made: ALARM ≥ TRIP or FAN-OFF ≥ FAN-ON. Press PRG to return to step 1 and correct the data.***
2) After 1 minute of keyboard no-operation, programming is left without data storage.

20) EXTENSION CABLE FOR Pt100 TECHNICAL SPECIFICATIONS

Cable 20xAWG 20/19 Cu/Sn
Section 0,55 mm²
Insulation against fire PVC105
Standards CEI 20.35 IEC 332.1
Max. working temperature : 105°C
Structure : 4 terns composed of three twisted and coloured wires
Shield in Cu/Sn
Sheath in PVC against fire
External diameter 9,0 mm
Standard packaging in coils of 100 m

FAULT DIAGNOSTIC	**CAUSES AND *RIMEDIES***
Monitoring unit doesn't turn on, even if the terminals are fed.	Connector not well placed inside its seat. Connection cables are not well tightened in the terminal. Burnt out feeder. Burnt out fuse protection(500mA 250V Fast) *Take out and give supply again.*
CH4 is in FAULT FOC (just the 3 Pt100 sensors are connected)	Monitoring unit wrongly programmed with CH4/no. *Repeat the programming.*
One of three/four channels is in FAULT for FOC/ FCC	Check Pt100 sensor connections. Possible defective sensor. *Replace the damaged sensor.*
When turning on the display shows "ECH"	A strong disturbance damaged the stored data. Please refer to paragraph 8. If this problem should persist, please contact *TECSYSTEM S.r.l. Technical Department.*
All the Pt100 sensors are in FCC.	Wrong sensor connections. Terminal board mounted upside down. *Check the connections and the terminal board.*
Temperature indicated by one or more channels is wrong.	Contact *TECSYSTEM S.r.l. Technical Department*
Sudden trip of the main switch. Temperature is on standard levels. Just one channel has caused the trip.	Verify through T.MAX fuction possible defective sensors. *Replace the sensor. Check the measuring signal support terminal boards .*

21) NOTES ABOUT FCD FUNCTION

NT device series has an innovative control function combined with the Pt100 sensor dynamic state.
If a temperature sensor should accidentally break down, the defect turns out with a fast increase of its resistance and therefore of the temperature registered by the monitoring unit. It is obvious that this increase is not consequential to the increase of power of the machine to be protected, whether it is a motor or a dry or encapsulated transformer.
Therefore it is advisable to discriminate the state of the sensor and report a Fault notification rather than an Alarm or, worse, a Trip signal.
In case of temperature control for electrical motors, the fast increase of the temperature could be the consequence of the working with jammed rotor and not of defective sensor; in this case the Fault relay, once energised, makes evident this anomalous condition for the motor working.

By activating the FCD function it is possible to have on 26-27-28 contacts a Fault signal when the temperature registered by a Pt100 increases with a speed higher than **"n" °C/sec** (loadable from 1 to 30).

Depending on the loaded value, you can have a different sensitivity, which can be useful for various applications:

-**from 1 to 10**: high sensitivity, for instance useful to immediately report a jammed rotor in a motor.
-from **10 to 20**: medium sensitivity, useful to have indications for possible noises which affect the sensor reading, connection problems or defective sensors.
-from **20 to 30**: low sensitivity, useful for applications where an higher sensitivity could give rise to faults for undesired FCD.
- loading **"no"**, FCD function is disabled.

When a channel is in Fault condition for FCD, relevant Alarm and trip signallings are inhibited in order to just report the anomaly for too fast increase of the temperature.
Press Reset to cancel the FCD signalling of all the channels and restore the fault relay.

22) INTRODUCTION TO MODBUS INSIDE MODULE

MODBUS INSIDE expansion module is built in the monitoring unit and it allows the data transfer on a RS485 network with MODBUS RTU protocol.

23) WORKING NOTES

For a correct working of the module it is necessary to load RS485 network set-up parameters: address, baud rate, parity bit.
Please refer to the programming steps from 23 to 28 as shown on the table at page 8.
The serial communication of the temperature control monitoring unit is active just when NT511 is in temperature control working mode in one of the intended modes (Scan, Auto, and T.Max).
When other functions such as programming, programming display and relay test are activated, the ModBus communication is temporarily deactivated.

24) DATA TRANSMISSION ON MODBUS NETWORK

The MODBUS INSIDE internal module allows to connect NT511 monitoring unit with a RS485 network with Modbus RTU protocol in order to read the data shown in the table section 35 and to write the ones shown in section 32. The module is always in slave mode.
NT511 monitoring unit is connected with the network just when it is temperature reading mode, and not when it is in programming, programming display or relay test.

25) RS485 ELECTRICAL CONNECTIONS

As far as the signal cable to be used in order to ensure a proper network working is concerned, we recommend to follow what laid down by EIA RS485 standard which suggests to use a 24AWG duplex cable.
The duplex cable which connects all the units in RS485 could require the activation of a 120 ohm termination on the last unit of the series.
Connect the duplex cable paying attention to polarities and lay the network avoiding to make sharp bends or ring windings in order not to modify the line impedance.
If necessary, also the GND terminal for grounding is available

26) DATA FRAME

The frame in asynchronous transmission is composed of: 1 start bit, 8 data bits, 1 parity bit (even or odd, if the parity has been set) and 1 stop bit.
Admitted baud rates are: 2400, 4800, 9600, 19200 and 38400 b/s.
Where no otherwise specified, the word length (DATA) is of 16 bits.

27) DATA PACKET

A complete sequence of request/answer is composed as follows:

Master request.

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

Slave request.

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

28) FUNCTION CODE

ModBus module supports the following function codes:

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

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

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

29) 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.

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

30) 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.

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

The writable registers are the ones containing the following data: Alarm, Trip, Fan-on, Fan-off.
Therefore the possible starting addresses are: **00-21** for alarm and trip thresholds, **00-29** for Fan-On and Fan-off thresholds and **00-37** for optional variables which could be present on special monitoring unit models.
Number of Point LO parameter can be loaded from 1 to 8 (max).

If a writing request is sent to an address different from the above mentioned ones, ModBus will answer with a 02 error code (wrong data address).

If a writing request is sent to more than 8 registers (Number of point LO), ModBus won't be able to grant the request and it won't give any answer. Therefore the query will go in "timeout".

31) NOTES FOR REMOTE PROGRAMMING

In case you want to program a NT511 you have to bear in mind that Alarm settings of channels 1-2-3 (register 00-17, 00-18, 00-19) must have the same values, since the monitoring unit handles them as channels with shared thresholds.
The same note must be kept into consideration for Trip thresholds (registers 00-25, 00-26, 00-27).

Fan on thresholds (registers 00-29, 00-30, 00-31, 00-32) have all to be loaded with the same value.

Fan off thresholds (registers 00-33, 00-34, 00-35, 00-36) have all to be loaded with the same value.

Also in the remote programming via ModBus phase you must take into consideration 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.

Alarm and Trip thresholds must be programmed together in the remote writing operations. Therefore the group of 8 addresses from 21 to 28 will be considered as a sole writing block. The same thing is for fan-on and fan-off thresholds: group of 8 addresses from 29 to 36

In case you try to load these thresholds in a wrong way, NT511 monitoring unit won't proceed with the programming and data storage; therefore in the coming readings you will read the data relevant to the previous programming.

After having sent a writing request, the monitoring unit will take approximately 1'' to store the data in eeprom; during the storage phase, ModBus interface won't be able to process further requests.
If the programming request successfully concludes, the monitoring unit automatically resets and loads the new loaded values.

32) ERROR CODES (exception code)

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

1: - Non-supported function code
2: - Wrong data address
3: - Wrong data (for instance length)

33) POLLING FREQUENCY

The max. time to give an answer to a calling never exceeds 1 second; therefore we suggest not to use polling frequencies with lower duration.

34) MODBUS MAPPING TABLE

Address HI (10)	**Address LO (10)**	**Data HI**	**Data LO**	**Primary tables**	**Notes**
00	01	00	Temperature Ch1	Holding register	Range 0-200° Offset $20_{(10)}$ 20=0°C 21=1°C 22=2°C
00	02	00	Temperature Ch2	Holding register	
00	03	00	Temperature Ch3	Holding register	
00	04	00	Temperature Ch4	Holding register	
00	05	00	Stato Ch1	Holding register	(See note 1)
00	06	00	Stato Ch2	Holding register	
00	07	00	Stato Ch3	Holding register	
00	08	00	Stato Ch4	Holding register	

Address HI (10)	Address LO (10)	Data HI	Data LO	Primary tables	Notes
00	09	00	Setting Ch1	Holding register	(See note 2)
00	10	00	Setting Ch2	Holding register	
00	11	00	Setting Ch3	Holding register	
00	12	00	Setting Ch4	Holding register	
00	13	00	T. max Ch1	Holding register	Range 0-200° Offset $20_{(10)}$ 20=0°C 21=1°C 22=2°C
00	14	00	T. max Ch2	Holding register	
00	15	00	T. max Ch3	Holding register	
00	16	00	T. max Ch4	Holding register	
00	17	00	Story Ch1	Holding register	(See note 3)
00	18	00	Story Ch2	Holding register	
00	19	00	Story Ch3	Holding register	
00	20	00	Story Ch4	Holding register	
00	21	00	Alarm Set -point Ch1	Holding register	Addresses from 21 to 28 constitute a sole writing block
00	22	00	Alarm Set -point Ch2	Holding register	
00	23	00	Alarm Set -point Ch3	Holding register	
00	24	00	Alarm Set -point Ch4	Holding register	

Address HI (10)	Address LO (10)	Data HI	Data LO	Primary tables	Notes
00	25	00	Trip Set-point Ch1	Holding register	
00	26	00	Trip Set-point Ch2	Holding register	
00	27	00	Trip Set-point Ch3	Holding register	
00	28	00	Trip Set-point Ch4	Holding register	
00	29	00	Fan-On Set -point Ch1	Holding register	Addresses from 29 to 36 constitute a sole writing block
00	30	00	Fan-On Set -point Ch2	Holding register	
00	31	00	Fan-On Set -point Ch3	Holding register	
00	32	00	Fan-On Set -point Ch4	Holding register	
00	33	00	Fan-Off Set -point Ch1	Holding register	
00	34	00	Fan-Off Set -point Ch2	Holding register	
00	35	00	Fan-Off Set -point Ch3	Holding register	
00	36	00	Fan-Off Set -point Ch4	Holding register	
00	37	00	General Flag	Holding register	(See note 4)
00	38	00	“Free”	Holding register	Free register
00	39	00	HFN	Holding register	Hours for fan test cycle
00	40	00	SET_FCD	Holding register	FCD setting

Address HI (10)	Address LO (10)	Data HI	Data LO	Primary tables	Notes
00	41	00	"Free"	Holding register	Free register
00	42	00	NUM_CH	Holding register	Number of enabled channels –1 EX.: if N°=2 enabled channels are 3
00	43	00	NUM_FAN	Holding register	Number of enabled fans
00	44	00	FAULT_FAN	Holding register	Faulty fans

NOTE 1: STATE REGISTER

The state register contains the information relevant to the state of the alarms for the related channel.

B7	B6	B5	B4	B3	B2	B1	B0
TRIP	ALARM	FREE	FAN	FOC	FCC	FCD	FREE

Each bit represents a flag which is active when its value is 1.

B7	B6	B5	B4	B3	B2	B1	B0
FREE	FREE	FREE	FREE	FREE	FREE	FAN-EN	CH-EN

NOTE 2: SETTING REGISTER

The state register contains the information relevant to the setting for the related channel.
Each bit represents a flag which is active when its value is 1.
B0: shows that the channel is enabled.
B1: shows that the fan for relevant channel is enabled

NOTE 3: REGISTER FOR HISTORIC ALARMS

The state register contains the information relevant to the storage of the alarm interventions for the related channel.

B7	B6	B5	B4	B3	B2	B1	B0
TRIP	ALARM	FREE	FAN	FOC	FCC	FREE	FREE

Each bit represents a flag which is active when its value is 1.

NOTE 4: GENERAL FLAG REGISTER

B7	B6	B5	B4	B3	B2	B1	B0
FAN-MAN	RESET OK	ERRORECAL	WRITE EEPROM	ECH	CYCLE FAN	RESET ALL.	SIGN -

The general function register contains the information relevant to the enabling of general functions.
B0: shows the displayed temperature is lower than 0°C.
B1: shows that an alarm has been reset.
B2: shows that the fan cyclic switching on (duration:5 minutes) is under way
B3: shows the presence of an error in the eeprom writing.
B4: shows that the programming data back-up in eeprom is under way
B5: shows the presence of an error in the monitoring unit calibration
B6: shows that the calibration error has been reset
B7: shows that the fans have been manually set off

NOTE 5: FAULTY FAN FLAG

B7	B6	B5	B4	B3	B2	B1	B0
FREE	FREE	FAN6	FAN5	FAN4	FAN3	FAN2	FAN1

Each bit represents a flag which is active when its value is 1.
When the flag is active, it means that the fan, even if fed, is not working because any current is detected (presence of no-load voltage). One assume that fan is faulty or wrongly connected.

35) CRC CALCULATION

This protocol includes 2 CRC-16 bytes in each transmission. The characteristic polynomial (11000000000000101B) is used for the calculation and the result is “hung” at the end of the package. The polynomial is used in the reverse order with the most significant bit suppressed because useless for calculation.

36) PARAMETER DESCRIPTION

A - 16-bit register
AL - At low side
AH - At high side
i,j, - KWH METERS
(+) - EXCLUSIVE OR
Di - Frame data «i»th of the packet
N - number of byte of the packet excluded 2 belonging to CRC
G - Polynomial : 1010-0000-0000-0001
shr - right shift

37) ALGORITHM

1) 0xFFFF -> A
2) 0 -> i
3) 0 -> j
4) Di (+) AL -> AL
5) j +1 -> j
6) shr A
7) if carry then G (+) A -> A
8) if NOT j=8 then goto 5
9) i +1 -> i
10) if NOT i = N then goto 3
11) A -> in CRC (result is in the order L,H)

38) 4.20 mA OUTPUT

With 4.20 mA output it is possible to connect an acquisition or read-out device.
The allowed load impedance for each output goes **from 0 to 500 ohm**.
Loop is optoinsulated-type to grant the highest noise immunity. .
4-20 mA signal is referred to 0-240°C range with an accuracy of 1% compare to full scale value.

It is possible to require a special calibration with reference to a 0-200°C range.

420 INSIDE inner module allows to take from output a 4-20 mA current signal referred to the programmed channel in the steps 29-30 of the table at page 8.

1-2-3-4: 4.20 mA output is referred to the fixed channel that has been loaded.
SCA: 4.20 mA output automatically scans the active channels every 2 seconds (default setting)
HOT: 4.20mA output is automatically referred to the hottest channel among the active ones.

For 0-240 range, the current-temperature relation is as follows:

I_{out}= (T/15)+4 (T=temperature in °C)

Example:

If T=100°C I_{out}= 100/15+4= 10,67 mA (±0.2 mA)

For range 0 +150 relation is: I_{out}= (T/9.375)+4 (T=temperature in °C)

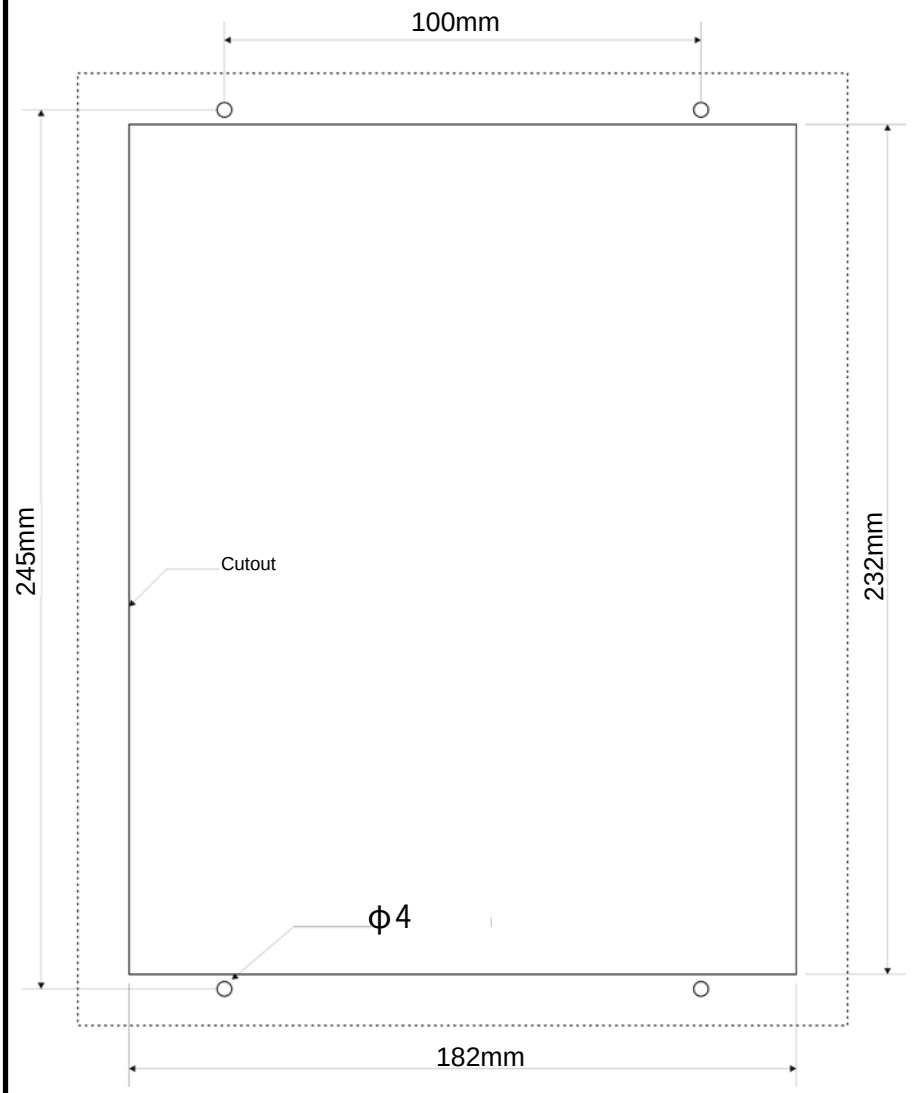
For range 0 +200 relation is: I_{out}= (T/12,5)+4 (T=temperature in °C)

For range –40 +200 relation is: I_{out}= (T/15)+6.7 (T=temperature in °C)

Note: temperature range on request, standard set 0°C + 200 °C.

38) DRAWING FOR MOUNTING

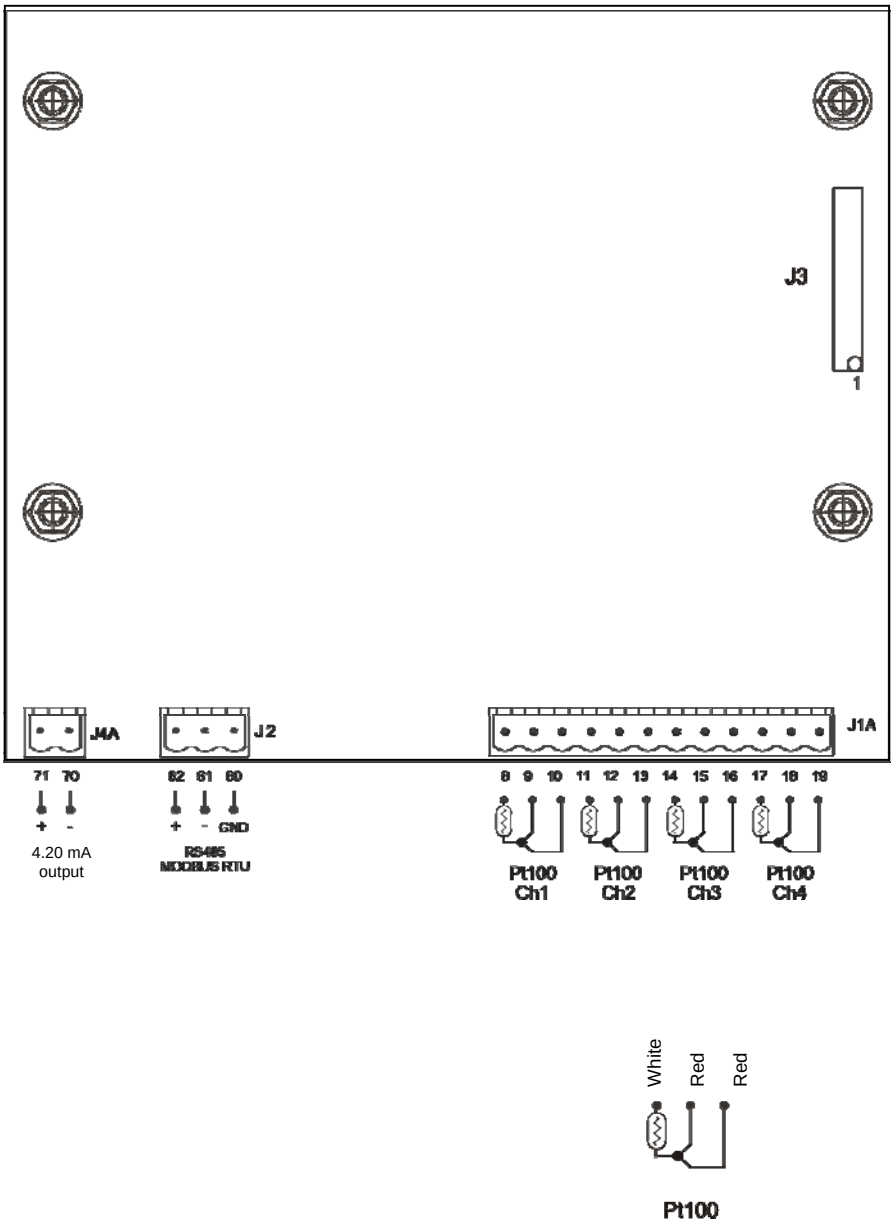
FIGURE 2



Box unit rear dimensions: 180mm×230mm

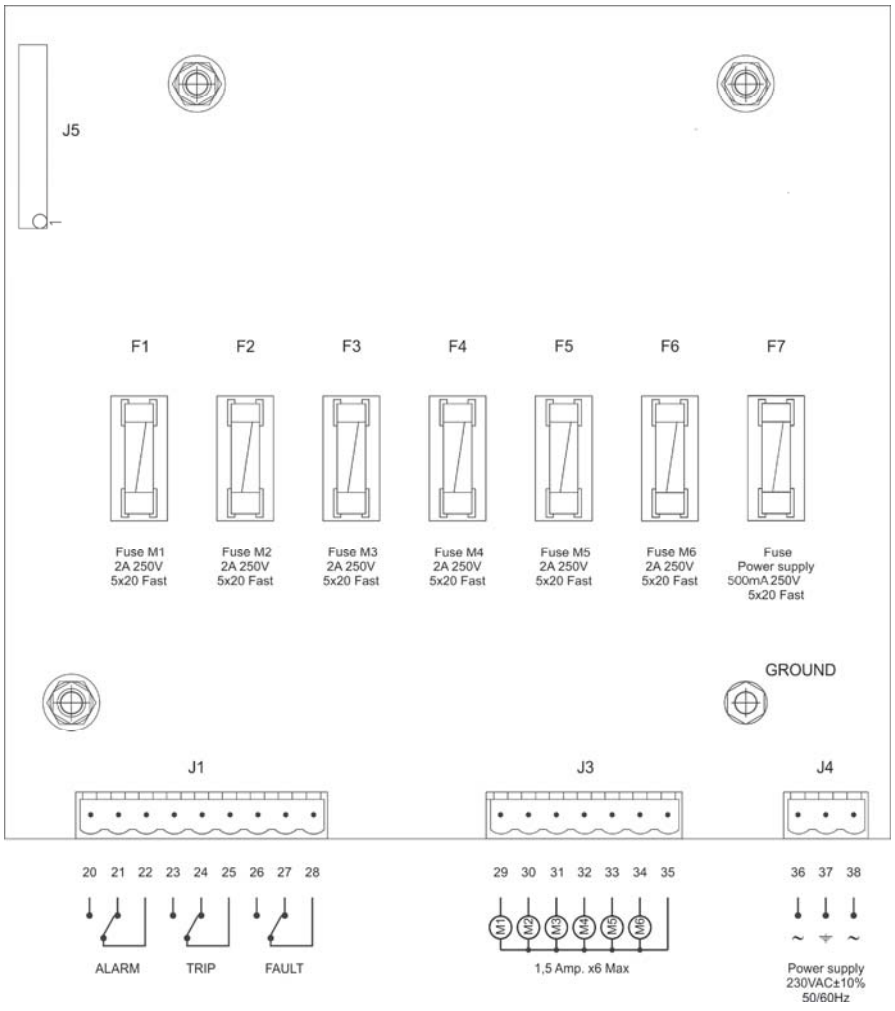
39) PT100 AND MODBUS ELECTRICAL CONNECTIONS

FIGURE 3



40) RELAY, FAN, SUPPLY ELECTRICAL CONNECTIONS

FIGURE 4



41) RULES FOR WARRANTY

The product warranty is two years from delivery.

The warranty is considered valid only when the product will be damaged by causes attributable to TECSYSTEM SHANGHAI, such as manufacturing or components defects.
The warranty is invalid if the Product proves tampered / modified, incorrectly connected, because voltages outside the limits, non-compliance with the technical data for use and assembly, as described in this instruction manual.

RAEE: This symbol shown on the unit means that the waste must be subject to "separate collection". Therefore the end-user shall send this unit to the waste separate collection centers or to return it to the dealer against the purchase of a new equivalent device.