INSTRUCTION MANUAL

NT511

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R. 1.4 14/07/14

INTRODUCTION

NT511 is an microprocessor electronic device dedicated 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.

1) NT511 TECHNICAL SPECIFICATIONS

SUPPLY • Rated values: 230VAC±10% 50/60Hz • Maximum absorption: 6VA (fans exclusive), ~2KW fans inclusive	**OPTIONS** • RS485 Modbus RTU digital output • 4.20 mA Analog output
INPUTS (Figure 3 Page 12) • 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 13)** • 2 alarm relays (ALARM-TRIP) • 6 outputs for ventilator supply 230VAC 50/60Hz 1.5A x6 (back-up fuse 2A) • 1 relay for sensor fault or working anomaly (FAULT) • Output relays with 5A-250Vca resistive contacts
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% vfs, ± 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) • 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 automatic display • Maximum temperatures reached by the channels, alarm storage and sensor fault. • Front key to reset the alarms
DIMENSIONS • 210x260x85 mm • Panel CUT-OUT 182x232 mm (Figure 2 Page11)	

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 11.
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 41 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, you must 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 12 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) 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.

8) 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).

9) 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.

10) COOLING FAN CONTROL (Figure 4 Page 13)
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)

11) 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.

12) DISPLAY MODE

Pressing MODE key, the display mode is loaded:

- *SCAN*: monitoring unit displays in scansion (each 2 seconds) all the activated channels
- *HIGH*: 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.
  Reset values with RESET.

13) 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.

14) 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.

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

15) ALARM RELAY SILENCING

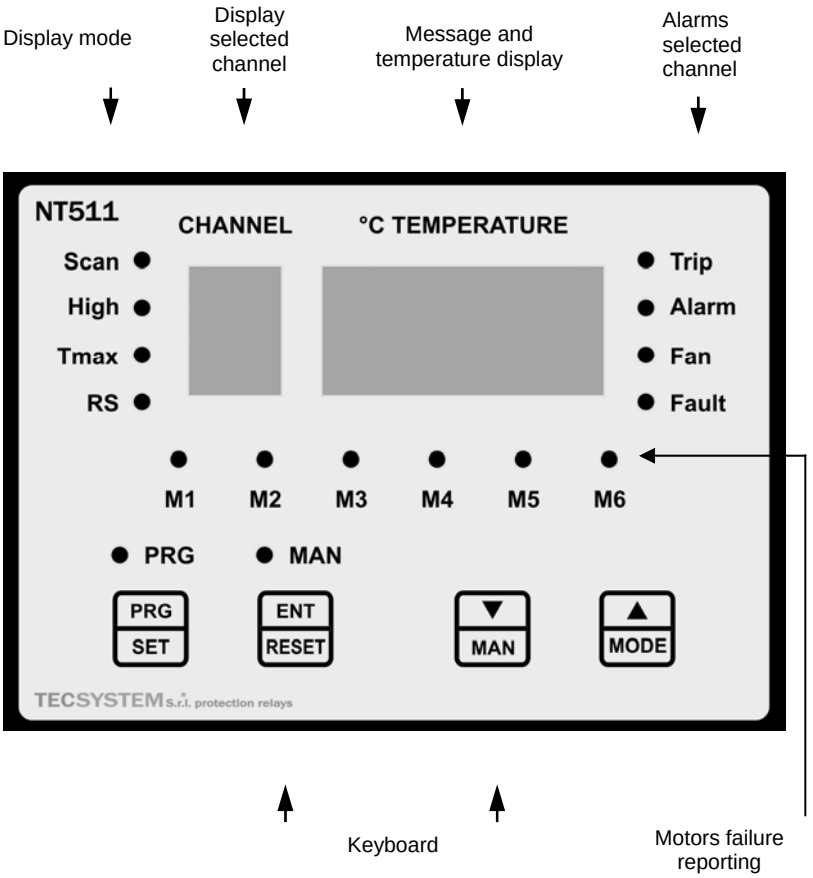
If you want to silence the ALARM signal press RESET key: relay de-energises and LED ALARM, which was fixed, will start to blink.
Silence system is automatically disconnected when the temperature goes under the ALARM threshold.

16) 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.

17) FRONT PANEL

FIGURE 1



18) 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	TRIP threshold for CH 1-2-3 is displayed	
4	▲ ▼	load desired threshold	
5	PRG/SET	It appears 4 on display CH	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 is displayed	If CH 4=NO go to point 11
8	▲ ▼	load desired threshold	
9	PRG/SET	It appaears TRIP threshold for CH 4	
10	▲ ▼	load desired threshold	
11	PRG/SET	Display shows CHF	Reference channel to activate the fans
12	▲ ▼	Select No, 123 or 4 (if CH4 yes)	123 or 4 : Reference channels to activate the fans No: FAN excluded function,go to point 20
13	PRG/SET	Led Fan is blinking and it appears the number of fans that you want to control	From 1 to 6 fans
14	▲ ▼	Load FANS number (from 1 to 6)	
15	PRG/SET	Display shows ON	FAN turning on
16	PRG/SET	It appears ON threshold for FAN	
17	▲ ▼	load desired threshold	
18	PRG/SET	Display shows OFF	FAN turning off
19	PRG/SET	It appears OFF threshold for FAN	
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= disabled function
23	▲ ▼	Load desired number of hours	
24	PRG/SET	Display shows FCD <> “threshold”	Fault for fast temperature increase (°C/sec)
25	▲ ▼	Load desired value (please see Page 10)	From “no” (function excluded) Up to 30 °C/sec
26	PRG/SET	Display shows END	Programming end
27	ENT	Loaded data storage and programming exit	Err: wrong programming for values indicated by leds (note 2)
28	PRG/SET	Return to step 1	

1) ***If pressing ENT it appears "Err", 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.***

19) 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 : 90°C
Structure : 4 terns composed of three twisted and coloured wires
Shield in Cu/Sn
Shealth 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 back-up fuse (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 .*

20) 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).

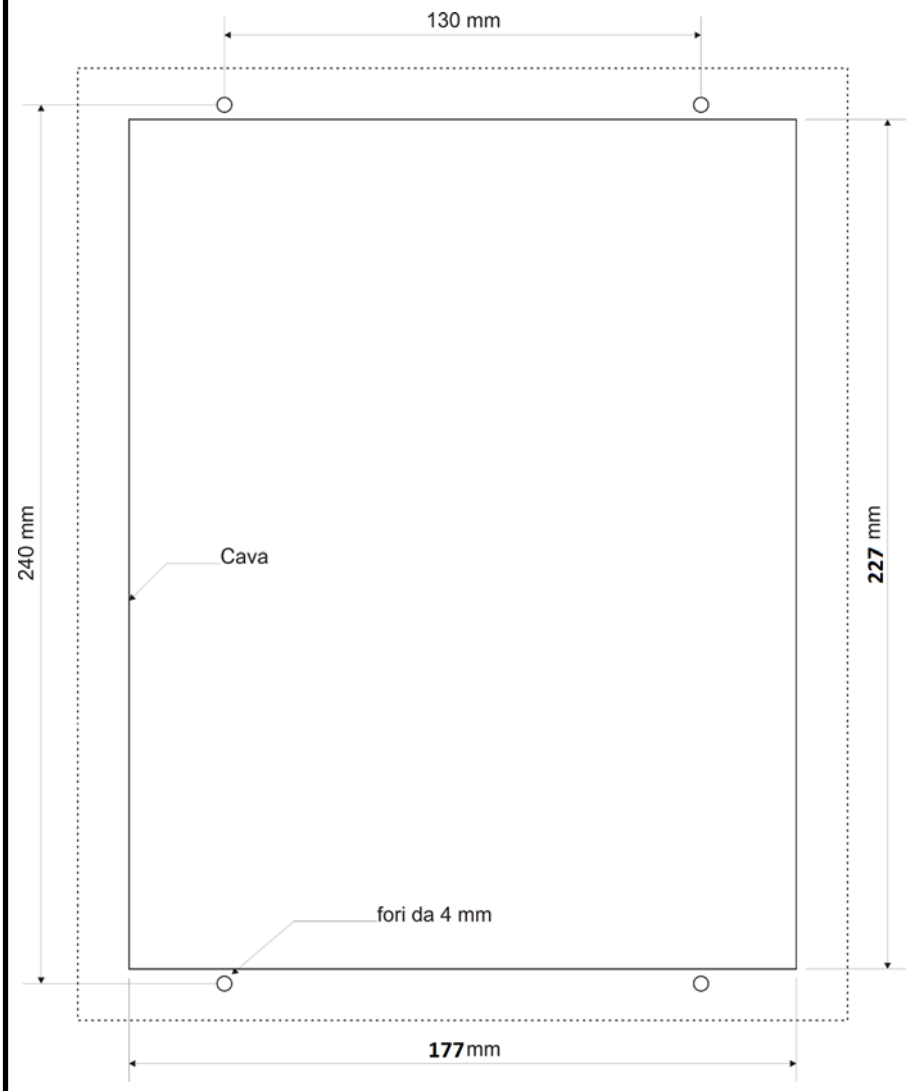
Depending on the loaded value, you can have a different sensitivity, which can be useful for various applications:

-**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 signalling 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.

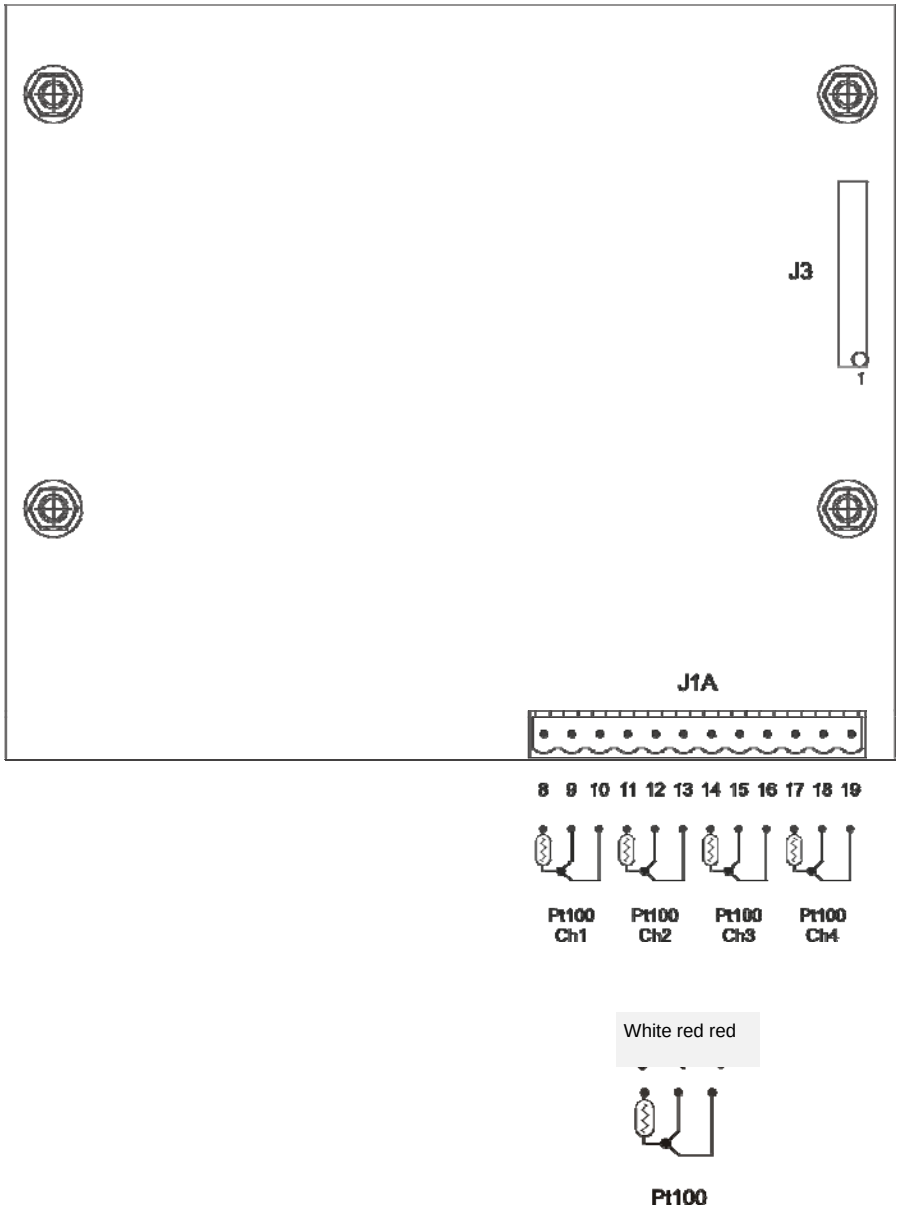
21) DRAWING FOR MOUNTING

FIGURE 2



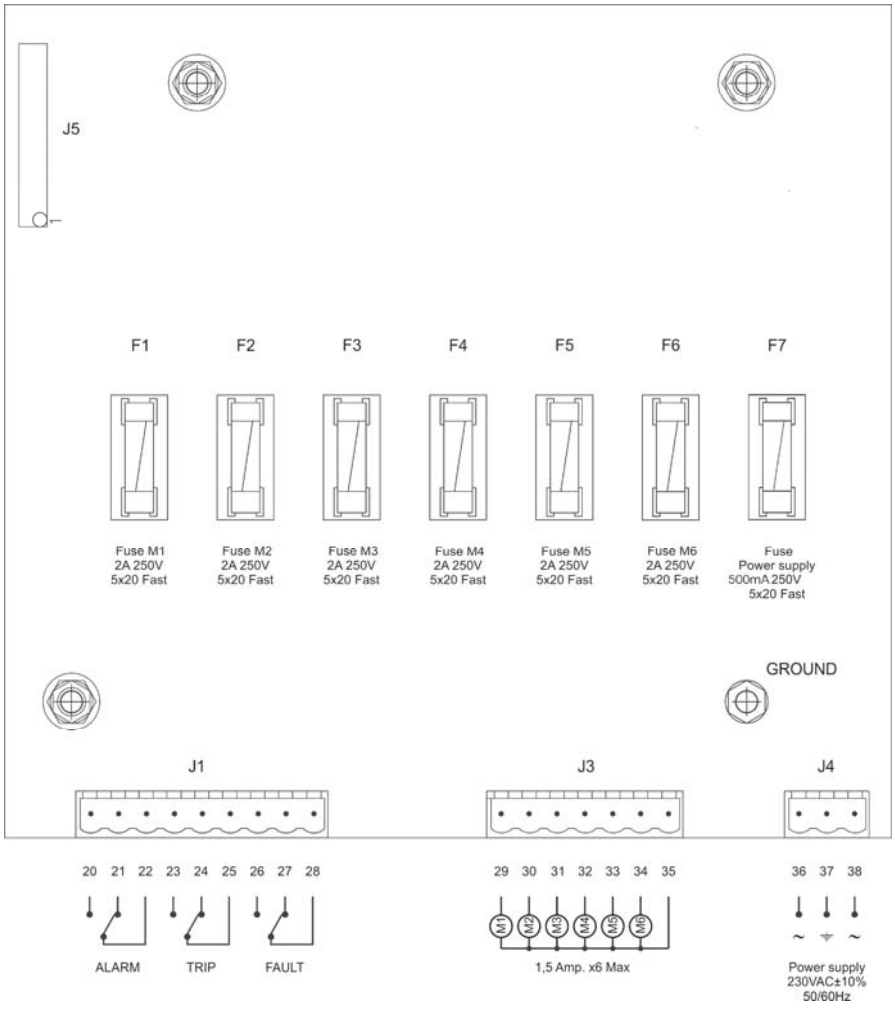
22) PT100 ELECTRICAL CONNECTIONS

FIGURE 3



23) RELE', FANS, POWER SUPPLY ELECTRICAL CONNECTIONS

FIGURE 4



24) RULES FOR WARRANTY

The Product purchased is covered by manufacturer's warranty or the seller's terms and conditions set forth in the "General Conditions of Sale Tecsystem srl", available at www.tecsystem.it and / or purchase agreement.
The warranty is considered valid only when the product will be damaged by causes attributable to TECSYSTEM srl, 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.
Any action about warranty is always at our factory in Corsico-MI, Italy as stated by the
" General Conditions of Sale Tecsystem srl ".

RAEE: This SYMBOL, shown on the unit, indicates that the waste must be subject to "separate collection". The end-user must send the unit to the "waste collection centers", or return the unit to the dealer against the purchase of a new equivalent device.

NOTES: