NEX

Thermal protection device for electric units

4 analog input channels, 4 output relays

USER'S MANUAL

ALMA Elettronica S.r.l.

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The ALMA Elettronica S.r.l.company can modify the device and this manual without notice

Manual Code M0002

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Introduction

Congratulations for your choice to purchase *NEX*, the electronic device for temperature monitoring.
This manual gives you the information you need when you install and configure the *NEX* device.
For a useful usage of this manual, we suggest you to read it standing near to the *NEX* device to directly verify the instructions.

Device Overview

The *NEX* device comes into begin to satisfy the insulated resin transformers or dry type transformers user's requirements.
In details the *NEX* device characteristics are:

- **4 analog input channels** for resistive probes Pt100 to measure 4 temperatures: the temperatures in the three transformer columns and the one in the core (see figure 1).
- **backlighted LCD display 16 characters x 2 lines**, for the visualization of all the 4 measured temperatures. In this way we obtain the whole temperature situation in only one visualization.
- **Membrane keyboard** with 4 keys to program setup parameters.
- **Non volatile data storage**.
- **4 output relays** to perform 3 alarm levels equal for all the inputs, and a general alarm to signal operation anomalies in the device or in the probes. The 3 alarm levels are useful to drive fans, external signalings (as lights or sirens), and the unhook of the electric unit from the electrical line.

The system performs useful reading of the measured temperatures and a very easy definition of the control parameters.
The *NEX* device has been realized compliance with the electromagnetic compatibility requirement.

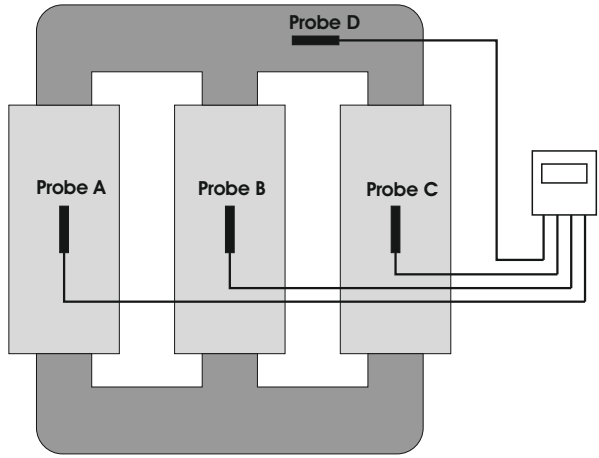


Figure 1

Technical specifications

Power supply

- Rated values 24 ÷ 380 Vdc and 24 ÷ 260 Vac with frequency 40÷60 Hz
- Maximum permissible values 20 ÷ 390 Vdc and 20 ÷ 265 Vac
- Without polarity respect for DC supply
- Power absorption <1 VA
- Protection against network disturbances

Inputs

- 4 inputs for DIN 43760 three-wire Pt100 resistive probes, each can be disabled by programming
- Input connection with removable 3,5 mm pitch terminals for wires of 0,1 ~ 1,5 mm^2 / 28 ~ 16 AWG wire cross section
- compensation for cables length up to 500 m with a cross-section of 1 mm^2
- Detection of faulty or disconnected probe
- Input channels protected against electromagnetic interference

Exits

- 4 relay outputs of 5A and 260Vac as follows:
  - one relay 1st switching level (for possible ventilation management)
  - one ralay 2nd intervention level (pre-alarm)
  - one relay 3rd switching level (for release of electrical machine)
  - one relay for signalling operating fault or faulty probe (general alarm)
- Connection of outputs with removable 5 mm pitch terminal blocks for 0,2 ~ 2,5 mm^2 / 24 ~ 12 AWG wire cross section

Enclosure

- Container dimension 96 mm x 96 mm according to DIN 43700 unification standard and maximum depth of 105 mm
- Panel mounting
- Panel drilling jig 92 mm x 92 mm
- Self-extinguishing PPO container
- Scratch-resistant polyester front with tactile keypad and indicator LEDs

Performances

- Temperature acquisition from -50°C to 200°C
- Temperature measurements accuracy ±0,5% full scale, ±1 digit. (1)
- Linearisation of probe signal according to DIN 43760

- Probe diagnosis
- Device working temperature from -25°C to +65°C
- Humidity less than 95% non-condensing
- Conforms to CE standards
- User data storage for 10 years without powering the device
- Self-diagnosis of device functionality
- Alarm signalling for incorrect operation or incorrect programming of user data

Displaying and data management

- backlighted LCD display 16 characters x 2 lines, for the visualization of all the 4 measured temperatures
- 3 leds indicating alarm levels
- 1 led indicating working anomalies or probe fault
- user data programming by membrane keypad
- automatic exit from programming procedure after 30 seconds of no operation
- 3 temperature levels programming for 3 input channels
- 3 temperature levels programming for the 4^{th} input channel
- hysteresis, alarm memory, delay and impulse data programming
- notification for wrong user data statements
- stated data recall and visualization by the membrane keypad
- maximum measured temperature storage for each input channel
- memory alarm reset by membrane keypad

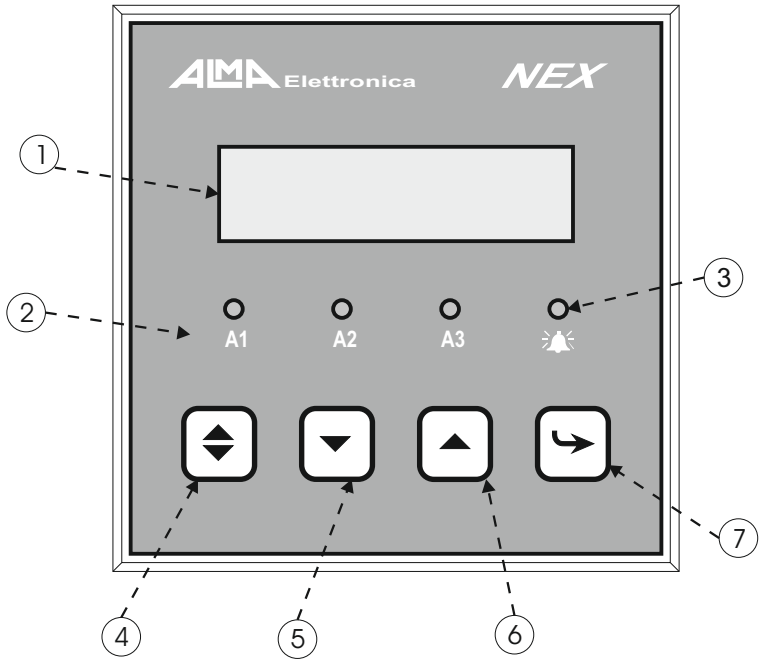
Cautions

- avoid power supply out of the device nominal range
- use shielded cables for the probes
- avoid the device working in room with conditions out of the nominal ones previously reported and in particular in presence of condensing humidity.

Installation Instructions

For a right operation, the *NEX* device has to be installed compliance to the requirements reported in the Technical Specifications paragraph.
The device provides fixing accessories and removable terminals for electrical connections.

Description of device and accessories



front view

Figure 2

A representative diagram of the device is shown in the figure.

Front panel

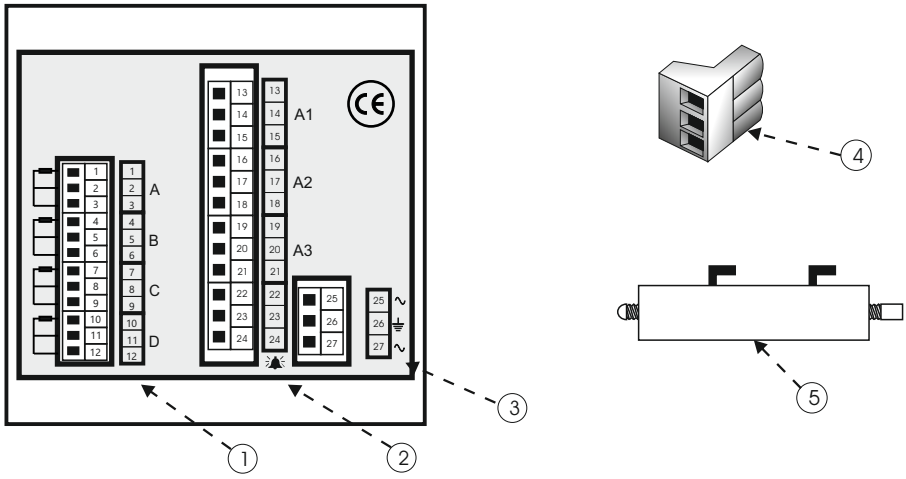
1. Backlit LCD display with 16 characters on 2 lines. Allows simultaneous display of measured temperatures. Alarm setting data can be displayed and changed using the keys.
2. LEDs A1, A2 and A3 for signalling activation of the relative alarm caused by one of the measured temperatures exceeding the set thresholds.
3. *General Alarm* LED for malfunction indication. This LED lights up in the following cases:
   – *Malfunction detected by the self-diagnosis programme*

– *Probe faulty or not connected*
– *System in control not active (data programming mode)*

4. Key ⬍ second function. Pressed in conjunction with the enter key (7), the programming mode is entered. In this mode it allows movement to the digits to be changed.
5. Decrease key ▼. Outside the programming mode, it is used to navigate the data display pages. In programming, this is used to decrease the value of the data being set.
6. Key ▲ increment. Outside the programming mode, it is used to navigate the data display pages. In programming, this is used to increase the value of the data being set
7. Confirmation key ↵. It serves to validate the data set.

Rear view and accessories

1. Connector for connecting probes
2. Connector for the relay outputs
3. Power supply connector
4. Removable terminals for wiring
5. Brackets for fixing the device to the panel front



Rear view and accessories

Figure 3

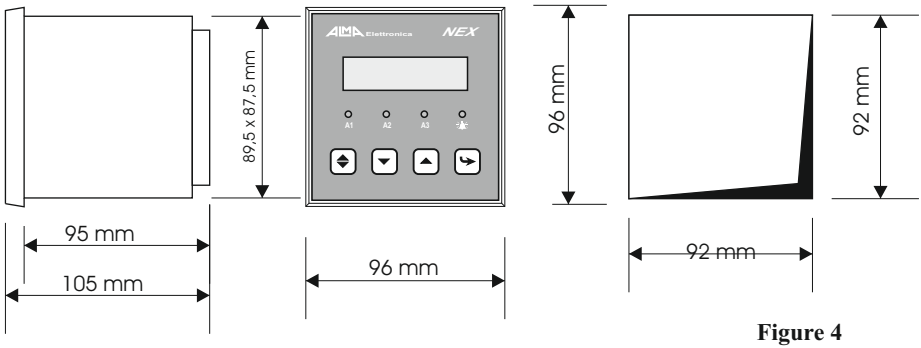


Figure 4

Mechanical installation

The NEX has a black self-extinguishing PPO housing for flush mounting. The dimensions are in accordance with the DIN 43700 unification standard: cross-section of 96 mm x 96 mm and maximum depth of 105 mm.
The dimensions of the panel drilling are 92 mm x 92 mm. Fixing is done using the brackets supplied with the device.

Electrical connections

All connections are made via sectionable terminal blocks supplied with the device for easy wiring.

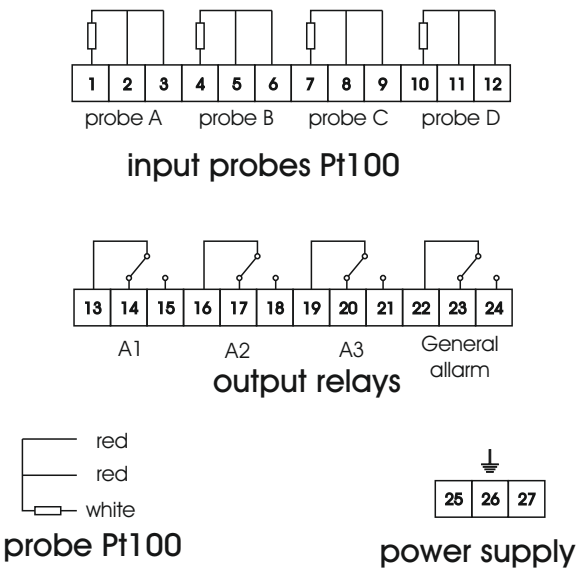


Figure 5

Power Supply

The power supply is connected by connecting the supply voltage to the terminals with numbers 25 and 27 without observing the polarity for DC voltage.
The permissible nominal voltages are from 24 Vdc to 380 Vdc, for direct voltage, or from 24 Vac to 260 Vac with a frequency of 40÷60 Hz, for alternating voltage.
The device does not have fuses inside, so suitable external protection must be provided.
The device's power supply is protected for momentary input

overvoltages.

Failure caused by incorrect power supply is not covered by warranty.

Connecting Relay Outputs

The figure opposite shows the position of the relays at rest (device switched off). Alarm relays are energised when programmed thresholds are exceeded. The Generic Alarm relay operates in intrinsic safety, so it is energised when the device is switched on if there are no error conditions, and is de-energised if the device is switched off or if there is a probe error. In this way, when the device is switched off, the control signal is not active. During installation it is possible to test the connection of the relays by entering relay test mode.

Relays testing

When switching on the device, if you hold down the button ▲▼, the relay test page can be displayed as shown in the image opposite. Pressing the leftmost button energizes relay1 and the corresponding LED lights up. Pressing the second button energizes relay 2 and turns on its LED, and so on. Pressing the button of an energised relay will de-energise it.

```
TEST RELAY  XXX
RL1 RL2 RL3 RL4
```

In the upper right-hand corner of the display is a decreasing counter. This counter is reset to the beginning of its value each time the relays are switched. When the counter reaches 0 the device is restarted in normal mode. This is to prevent the device being left in test mode for some reason and not in active control. The counter serves the installer for safety reasons so that he has an indication from the device before exiting the test mode.

Connecting the probes

The analogue inputs are compatible with three-wire Pt100 type resistive probes.
The following measures are recommended when connecting the sensors:

- Use a shielded cable to connect the probe with the device and with the screen attached to the third probe terminal (see figure). It is possible, but not necessary, to also connect the screen to the earth reference inside the electrical cabinet.
- The route of the probe connection cables must be separated from high-voltage cables or cables controlling inductive elements such as contactors.
- The three wires of each probe should have the same length and cross-section so that each has the same line resistance. The line resistance should be less than 10 W equivalent to approximately 500 metres of 1 mm2 cable. However, it is also possible to use 2-wire Pt100 probes by jumpering the terminals used to measure the line resistance, as shown in the example below. The longer the probe connection cable, the greater the error in temperature measurement.

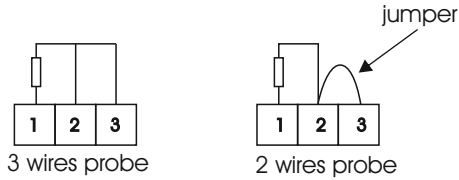


Figure 6

Instructions for use

Displaying and using the keyboard

On the NEX device, measured temperatures and setting data are displayed in pages navigable via the keyboard. This type of visualisation is not only very intuitive to use, but also allows several pieces of data from the same area to be displayed simultaneously.

Page navigation

Navigation between the display pages is done using the up and down keys indicated by the symbols ▲ and ▼.

The pages can be run cyclically, i.e. once you have reached the last page, you go straight to the first. See the diagram in the figure. Referring to the diagram, the key ▼ runs clockwise, while the key ▲ runs counterclockwise.

Page 1 is the main page, i.e. the one that is usually displayed. It displays the temperatures measured by the probes. The device displays this page when it is switched on and whenever it is left idle (no key is pressed) for longer than approximately 30 seconds.

Page 2 is used to program the operating mode with the light always on or with the light on for a limited time only on pressing a key.

Page 3 is used to select the display language.

Page 4 is for adjusting the display contrast.

Page 5 is used to load the data set with which the device is usually supplied.

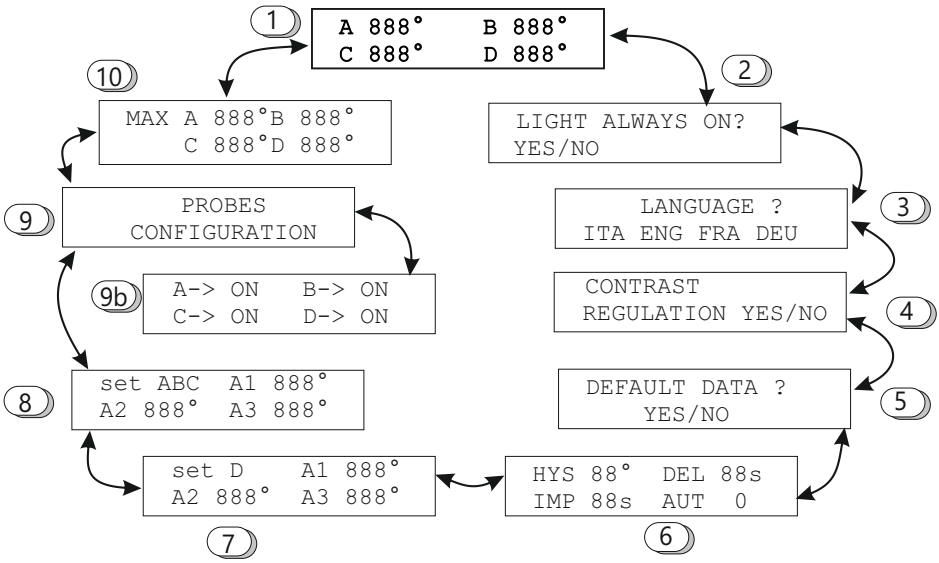


Figure 7

Page 6 displays hysteresis, delay, self-check and pulse trip data.
Page 7 displays the Setpoints of the three alarm levels set for probe D.
Page 8 displays the Setpoints of the three alarm levels set for probes A, B and C.
Page 9 gives access to **page 9b** which enables or disables each individual probe
Page 10 displays the maximum values of the temperatures measured by each probe.

Programming

A wizard, described below, has been developed for editing programmable data, which allows data to be set in small groups in an intuitive way.
The data are displayed grouped in pages as described in the previous paragraph. To change a group of these data, the following procedure must be followed:

- using the keys ▲ and ▼ (as indicated in the previous paragraph) you can position yourself on the display page that contains the data you wish to set (for example, page 3)
- pressing the keys ▲▼ and ↵ simultaneously, the programming mode is entered.

In programming mode, depending on the data group, either a guided page with specific questions is displayed or the same page is displayed but with a flashing cursor positioned over a digit of the first of the data to be changed. Entry into programming is recognisable as the *Generic Alarm* LED also flashes to indicate that the system is no longer in active control.

After entering programming, a flashing cursor appears on one of the displayed page numbers. Using the keys ▲ and ▼ it is possible to increase, decrease or otherwise modify. For numeric data, the edit cursor can be moved to the next digit by pressing ▲▼. The shift is cyclical, i.e. by continuing to press the ▲▼ button, you run through all the digits of the data and after the last one you move back to the initial one. This is useful for correcting incorrect settings. When the setting of the data is complete it must be confirmed by pressing the ↵key and the cursor will move to a digit of the next datum. If you do not want to change data, simply confirm it with the ↵ key.
Upon confirmation of the last data set in the displayed page, the device performs a conformity check of the data set and if the result is positive, these are stored and the device exits the programming mode returning to the usual display mode.
If the data check is unsuccessful, an error message will appear and the device will not exit the programming mode, displaying the same page of data for correction.
Exit from the programming mode can also occur due to inactivity (no key pressed) of at least 30 seconds. In this case any changes made to the data would be ignored and the device would reintegrate the data used before entering programming mode.

If the data to be set is not numeric, it must be set using the keys ▲ and ▼ and confirmed with the ↵ key.

A brief description for programming on each page follows:

- By entering the programming mode, pressing the keys ⇕ and ↪ at the same time, on **page 2** it is possible to choose between two different options for operating the backlight of the Display. If the light is always on, the backlight will be on regularly. In the second mode of operation, the backlighting will normally be off and will only be activated for a short time on the user pressing any key. In programming mode, you must answer with yes or no using the buttons ▲ and ▼.
- Entering the programming mode, by simultaneously pressing the keys ⇕ and ↪, on **page 3** it is possible to set the language to be displayed in the menus by using the key ⇕ and confirming the choice with ↪.
- Entering the programming mode, by pressing the keys ⇕ and ↪ at the same time, on **page 4** it is possible to adjust the contrast using the keys ▲ and ▼: the first one increases the contrast, the other one decreases it.
- By entering programming mode, pressing the keys ⇕ and ↪ at the same time, on **page 5**, the factory data can be restored. In programming mode, you must answer with yes or no using the buttons ▲ and ▼.
- Entering the programming mode, by pressing the keys ⇕ and ↪ at the same time, on **page 6** it is possible to program some data whose meaning is explained in the paragraph *description of programmable data*.
- Entering programming mode, by pressing the keys ⇕ and ↪ simultaneously, on **page 7**, you can modify the temperature thresholds associated with the alarms relating to probe D. This probe is usually associated with the transformer core, but on certain occasions is not installed. In these cases, to prevent the device from providing an alarm for the unconnected probe, it is necessary to disable the probe from programming on **page 9**. Threshold A1 is the first alarm level, threshold A2 is the second and threshold A3 is the last level (transformer release).
- Entering programming mode, by pressing the keys ⇕ and ↪ at the same time, on **page 8** it is possible to modify the temperature thresholds associated with the alarms relating to the three probes A, B and C. The procedure for modifying the data is the general one described above. As with probe D, threshold A1 represents the first alarm level, threshold A2 the second and threshold A3 the last level (transformer release).
- Entering programming mode, by pressing the keys ⇕ and ↪ at the same time, **page 9** accesses **page 9b** which allows the enabling or disabling of individual probes. You move to the probes with the ⇕ button and select ON or OFF using the ▲ and ▼ keys. Pressing the ↪ button confirms the selection and exits programming mode. The probes can be disabled so that no error is signalled if the probe is missing. On the main page, disabled probes will be indicated by 3 dashes instead of the temperature. If the probe was missing and not disabled, it would be indicated on the main page with ERR and the general alarm would be activated.
- Entering programming mode, by pressing the keys ⇕ and ↪ at the same time, on **page 10** you can modify the data of the maximum temperatures reached by each acquisition channel. These data are only resettable. When entering programming mode, the four maxima will be reset simultaneously. You will not see any zeros appearing, however, because as soon as the zeroing operation is complete, the

system compares the new maximum with the measured temperatures, which will undoubtedly be higher, and therefore the maximums will be instantly updated with the new values.

Simultaneously pressing the keys ⬍ and ↪, on the **main page** (**page 1**), silences the alarms if the automatic signalling system has been programmed (see paragraph *description of programmable data*).

When the data programming mode is active, the system is not in active control, so the relays are in the resting state and the "Control inactive/General Alarm" LED lights up.

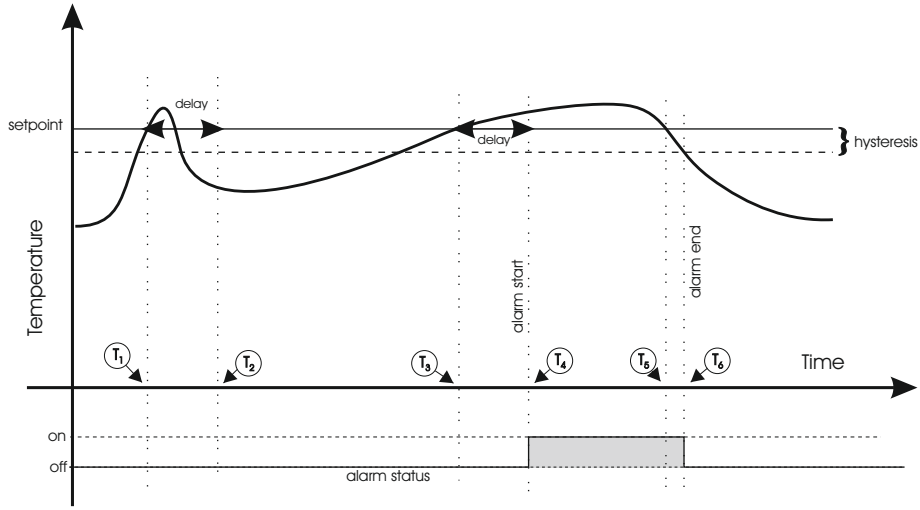
Description of programmable data

The programmable data are as follows:

- 3 *temperature thresholds* for ABC probes whose exceeding causes the activation of alarms A1, A2 and A3. On this data there is a constraint that the value of A1 is less than A2 and this is less than A3. If this constraint is not respected, the system gives an error message and does not allow exit from programming mode.
- 3 *temperature thresholds* for probe D, the exceeding of which causes the activation of alarms A1, A2 and A3. On this data there is a constraint that the value of A1 is less than A2 and this is less than A3. If this constraint is not respected, the system gives an error message and does not allow exit from programming mode.
- A single *hysteresis* figure for all programmable temperature thresholds. It is used to avoid close activation and shutdown of alarms due to temperature fluctuations around programmed thresholds. This figure is indicated as **HYS** on page 5.
- A *delay* data for the activation of each alarm from the moment a temperature threshold is exceeded: it represents the minimum time the temperature must remain above the setpoint for the output to be activated. This serves to filter out transient exceedances of programmed temperature thresholds. This figure is shown as **DEL** on page 5.
- *Self-tuning* of the release alarm to keep the release alarm active even when the temperature falls below the respective threshold. This option should be activated if you want a maintenance technician to check the causes of the alarm before switching the electrical machine back on, in which case the alarm must be cancelled manually by the operator using the keys on the front panel. This figure is shown as **AUT** on page 5.
- *Pulse duration*. This data works only on alarm A3 and is to be used in case you have a disconnecting switch with a release coil. The relay for alarm A3 (release) will be closed for a number of seconds equal to the duration of the given pulse duration. If impulse closing of this relay is not desired, this must be programmed to 0. This figure is shown as **IMP** on page 5.

The meaning of the above programmable data is shown in the figure.
In the figure, the horizontal axis represents time and the vertical axis represents

temperature.
The horizontal straight lines represent the programmable alarm temperature threshold (setpoint) and this minus the hysteresis temperature.
The alarm status is shown at the bottom of the graph, where an alarm is defined as the closure of the relevant relay.
At time T_1 the temperature representative curve exceeds the setpoint, but the alarm is not activated because the temperature returns below the setpoint before the end of the



programmed delay time corresponding to time T_2. This prevents the relevant threshold output from being activated for very fast transients.
At time T_3 the temperature representative curve exceeds the setpoint again and after the programmed delay, at time T_4, the output is activated.
At time T_5 representative curve the temperature falls below the setpoint, but the output is only deactivated at time T_6 when it falls below the setpoint minus the hysteresis value.

It follows the list of data with the corresponding minimum and maximum programmable value:

Name of Datum	Min. Programmable value	Max. Programmable Value	Standard Values	Notes
paginata 3				
SET ABC A1	0 °C	199 °C	100 °C	First alarm level for A, B e C probes
SET ABC A2	0 °C	199 °C	120 °C	This datum has to be greater than SET ABC A1
SET ABC A3	0 °C	199 °C	135 °C	This datum has to be greater than SET ABC A2
paginata 4				
SET D A1	0 °C	199 °C	110 °C	First alarm level for D probe
SET D A2	0 °C	199 °C	130 °C	This datum has to be greater than SET D A1
SET D A3	0 °C	199 °C	145 °C	This datum has to be greater than SET D A2
paginata 2				
MAX A	0 °C	0 °C	0 °C	Only zero setting
MAX B	0 °C	0 °C	0 °C	Only zero setting
MAX C	0 °C	0 °C	0 °C	Only zero setting
MAX D	0 °C	0 °C	0 °C	Only zero setting
paginata 5				
HYSTERESIS	0 °C	99 °C	5 °C	
DELAY	0 sec	99 sec	0 sec	
ALARM MEMORY (**AUT**)	0	1	0	If it is equal to 1 there is alarm memory, if it is equal to 0 there is not
IMPULSE	0 sec	99 sec	0 sec	If it is equal to 0 the unhooking relay stays closed for the alarm lenght. If it is not equal to 0 the unhooking relay stay closed only for a time, in seconds, equal to the set value (*impulse*)

Solution of problems

In this paragraph we give you some suggestions to solve anomalies you can meet using the *NEX* device.

Problem	Solution
The *NEX* device doesn't turn on	Verify the connection to the power supply. Verify there is line voltage. Verify that the power supply values are compliance with those specified in this manual. *If the problem persists please contact the device distributor.*
The device emits the *General Alarm* signal	Verify there is no error messages on the display. Verify the suitable connection of probes. Verify that the device is not in the programming modality. In this case wait 30 seconds before touching any key: the device will automatically exit this modality and turn back to the visualization one. *If the problem persists please contact the device distributor*
The device shows the message *Data Error* and doesn't exit the programming modality	This situation occurs when at the exit from the programming modality and the device carries out a conformity test of the set data. If you are setting the alarm thresholds for the probes, verify that A1<A2<A3. If you want to exit from the programming modality without changing data wait 30 seconds without touching any key: the device will automatically exit from this modality and turn back to the visualization one re-setting the previously used data.
The probe measures a temperature greater than the corresponding setpoint but the alarm doesn't activate	Verify if the delay datum has been set. If it has not the relay will close only after a time equal in seconds to the delay length if temperature doesn't undergo the set threshold before.
The A3 alarm is activated (the led is alight) but the relay is de-excited	Verify that the impulse datum has not been programmed.

Problem	Solution
The measured temperature is lower than the setpoint but the corresponding alarm is activated	Verify the value of the set datum of *hysteresis* and control if the measures temperature in lower than the threshold minus this value: the alarm stops only when the temperature undergoes the setpoint minus the hysteresis value (see figure 8). If this is not the cause of the problem, verify that the *alarm memory* has been set. In this case the alarms can be de-activated by hand the programming modality in the principal page (see page 1 of figure 7)
In the principal page of temperatures visualization on the D probe datum some dashes appear	If on the D probe datum some dashes appear instead of a number it means that the D probe is de-activated. To activate it see the procedure described in the *Programming* paragraph.
In the principal page of temperatures writing ERR appears on some probes' datum	If on the temperature datum measured by some probe the writing ERR appears it means that the probe is damaged or badly connected. In this situation also the *Generic Alarm* signaling lights up. Test the probe's connection and try to change the connection channel to verify if the problem it's really on the probe.

Guarantee conditions

The thermal protection *NEX* devices are covered by guarantee for a period of 24 months since the consignment date for anomalies due to production defects.

The guarantee consists in the free repair or substitution of the components that have been damaged in the devices' construction, arrived at our office carriage paid.

The product's guarantee declines in the following cases:

- device's damages deriving from negligence, use or installation not compliance with the instructions furnished in the user's manual
- wrong power supply
- damages due to changes in the line voltage to which the device is connected as in the case of discharges caused by thunderbolts or other external phenomena
- tampering with the device
- damages due to accidental causes or to negligence
- non-payment of the device

The guarantee period is determined on the basis of the serial number written on the device's label so that it has not to be cancelled nor modified.

Parts subjected to wear by use are not covered by guarantee.

Furthermore, removal and re-installation costs are not covered by guarantee, as transport costs and risks and any other direct or indirect cost due to repair of the device you consider damaged.

The constructor declines any responsibility for harms done to persons, animals or things directly or indirectly coming out from a proper or improper use of the device.

The device's repair or substitution is subjected to the unobjectionable constructor's opinion.

When the guarantee period falls the damaged device's repair will involve the debit entry for the damaged components substitution and for the labour.

For any dispute the competent Court is the one of Bologna (Italy).

Appendix A

If the device is directly supplied by the secondary circuit of a medium power transformer it is possible for the device to be crushed by a over-voltage of high intensity. This can occur when you insert the general switch of the installation without load. The phenomenon is particularly evident when the *NEX* is directly supplied by the copper bars of the secondary circuit of the transformer and fixed re-phasing capacitor batteries are present. Provide the device protection inserting an insulating 10 VA transformer (see figure 9).

Damage due to a wrong power supply of the device is not covered by guarantee.

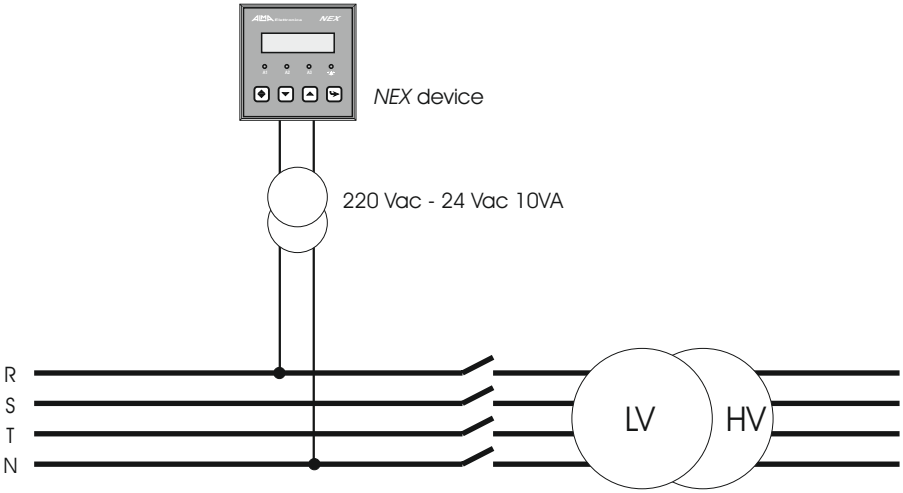


Figure 9

Notes

1. . In the frequency range of 200 MHz to 300 MHz in case of electromagnetic fields higher or equal to 10 V/m (About 100 W at 5 meters from the device) the temperature reading of the device may be raised by eight digits.

Notes

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