easyTermo

THERMAL AFTERBURNER CONTROLLER
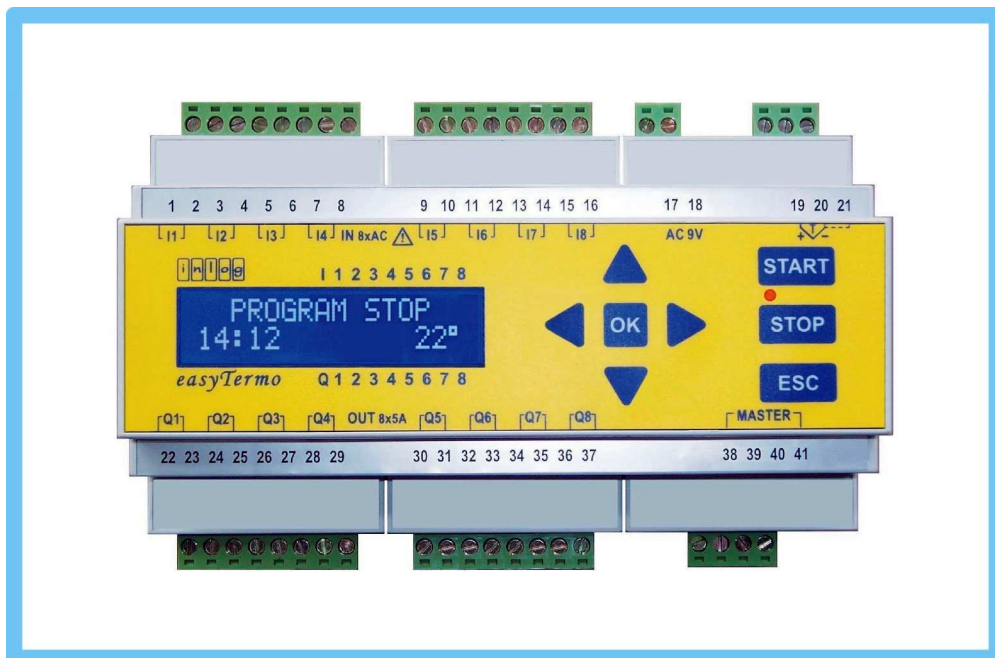
USER MANUAL

CONTENTS

GETTING STARTED

The *easyTermo* industrial controller is an electronic device. For safety reasons, please carefully read and follow the manual instructions.

WARNING: Personal injury may result from improper operation.

CAUTION: The *easyTermo* controller may be damaged by improper operation.

PRECAUTION FOR INSTALLATION
Compliance with the installation instructions and the user manual is absolutely necessary. Failure to comply could lead to improper operation, equipment damage or in extreme cases even death, serious bodily injury or considerable damage to property. When installing the controller insure that no wiring or foreign materials can fall into the openings. Damage to equipment, fire, or considerable damage to property could result. Always switch off power before you wire, connect, install, or remove any module. The wiring for the *easyTermo* controller is open and exposed, for this reason it is recommended that the controller be installed in an enclosure or cabinet to prevent accidental contact or exposure to the electrical circuits and components.
Never install the product in an environment beyond the limits specified in this user manual such as high temperature, humidity, dust, corrosive gas, vibration, etc.

PRECAUTION FOR WIRING
Improper wiring and installation could lead to death, serious bodily injury or considerable damage to property. The *easyTermo* controller should only be installed and wired by properly experienced and certified personnel.
Make sure the wiring of the *easyTermo* controller meets all applicable regulations and codes including local and national standards and codes.
Be sure to properly size cables for the required current rating.
Always separate AC wiring, DC wiring with high-frequency switching cycles, and low-voltage signal wiring.

PRECAUTION FOR OPERATION
To insure safety with the application of the *easyTermo* controller, complete functional and safety testing must be conducted. Run the *easyTermo* controller only after all testing and confirming safe and proper operation is complete. Any potential faults in the application should be included in the testing. Failure to do so could lead to improper operation, equipment damage or in extreme cases even death, serious bodily injury or considerable damage to property.
When the power is on, never contact the terminals, exposed conductors or electrical components. Failure to comply could lead to improper operation, equipment damage or in extreme cases even death, serious bodily injury or considerable damage to property. It is strongly recommended to add safety protection such as an emergency stop in case the *easyTermo* controller operation must be shut down immediately.

EXAMINATION BEFORE INSTALLATION
Every *easyTermo* controller has been carefully tested and examined before shipment. Please carry out the following examination procedures after unpacking your *easyTermo* controller:
- check to see if the model number of the *easyTermo* controller matches the model number that you ordered,
- check to see whether any damage occurred to the *easyTermo* controller during shipment. Do not connect the *easyTermo* controller to the power supply if there is any sign of damage.

CONTROLLER APPLICATION AND FEATURES

Microprocessor based controller of **easyTermo** family presented here, with dedicated firmware version for thermal afterburner allows monitoring of catalytic combustion process for up to 5 smoking or maturing chambers (with optional I/O expansion modules). Fitted with digital inputs (voltage type), relay outputs, temperature measurement input (K-type thermocouple) and a connector for optional I/O expansion modules, **easyTermo** controller can easily be adapted to other control tasks by simply replacing its firmware. Operator interface consists of a built-in front panel LCD display (2x16 characters), 8 keys keypad, buzzer and one bi-color LED signalling the current operating mode. Battery backed real-time clock allows time and day triggered actions or recording time stamps of selected control system events.

OPERATOR PANEL

The operator panel allows the afterburner user to modify the controller operating parameters, to start and stop the afterburner control program and to watch its current status. The panel view is shown in the following figure.
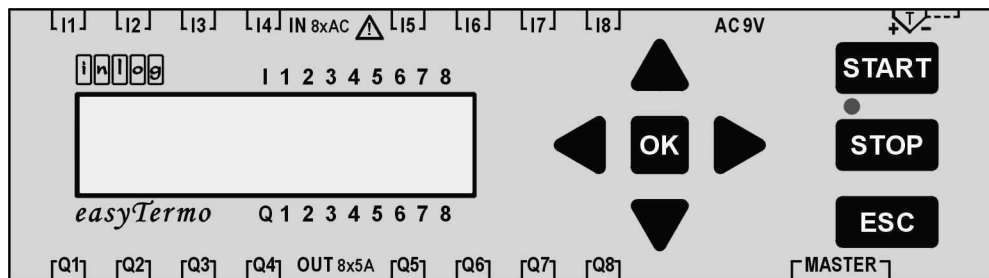
On the left side of the panel you will find an LCD display (2 lines of 16 characters each), showing information about the current state of the control system. The right part of the panel forms the keyboard with the following dedicated keys:

- **START** - press to start the afterburner control program,
- **STOP** - press to stop the afterburner control program ,
- **ESC** - press to enter the service mode or return to the previous function without approval of the changes made so far,
- **OK** - press to return to the previous function with approval of the changes,
- up / down arrows (↑ ↓) - press to increase / decrease the current parameter or select a function from the service menu,
- left / right arrows (← →) - press to select the field with parameter to be adjusted.

When in the service mode some keys act in a specific way, described in detail in the section devoted to this mode.

You will find a bi-color LED between START and STOP keys, which indicates the current status of the controller. If the afterburner control program is stopped, the LED lights in red, and if the program is running it lights in green.

Depending on the current condition of the controller, one of the two specific screens appears on its LCD display:

Program stopped

```
┌─────────────────────────┐
│  PROGRAM  STOP          │
│  12:00 *        150°     │
└─────────────────────────┘
```

The display constantly shows the temperature measured and the current time. After pressing the **OK** key current date is displayed instead of time. Press the **OK** key again to return to the time display mode. The **ESC** key activates the service mode.

The red LED is on.

Pressing the **START** key will activate the control program execution.

Program running

INPUTS   I 12345678
```
┌─────────────────────────┐
│    150°      ■□□■□■□□    │
│  12:00   *   □□□■□■□■□□  │
└─────────────────────────┘
```
OUTPUTS   Q 12345678

Aside from the temperature and time, the state of the controller inputs and outputs is also shown. The ■ and □ symbols on the display correspond to the I/O numbers placed on the panel. The ■ symbol represents the I/O activity, the □ symbol its inactivity.

The green LED is on.

Pressing the **STOP** key will halt the control program execution.

The ⌊*⌋ symbol displayed to the right of the current time informs you of a successful detection of I/O expansion modules and of establishing connection to them by the *easyTermo* controller. The I/O expansion modules let you connect up to three additional smoking or maturing chambers, which allows controlling the catalytic combustion process for up to 5 chambers. Lack of the ⌊*⌋ symbol indicates no I/O expansion modules connected or some malfunction in controller - I/O modules connection, while the ⌊!⌋ symbol indicates inconsistency between the number of I/O modules connected and the I/O modules number set during the controller configuration. In such a case you must first verify the correct controller configuration for operation with I/O expansion modules, using the *External modules* service function described hereinafter.

LCD display backlight switches off automatically after approximately 3 minutes of controller keyboard inactivity. This in turn reduces controller power consumption, which leads to lower level of controller interference emitted and raises its immunity to momentary power supply interruptions or brown-outs. Pressing any key in this state causes the immediate turning on of the display backlight. The first key-press is ignored in this case, so there is no fear of unintended change of the controller state. In the event of emergency in the controller's environment, e.g. the thermocouple damage, the display is automatically turned on until the cause of the failure is gone, to signal the erroneous state to the user. Additional acoustic signal and an error message on the LCD display may also acompany this state.

CONTROLLER CONFIGURATION

easyTermo controller configuration usually consists of a one-time setting up of the working parameters, using the service mode functions described below. The parameters set are stored in the controlller's nonvolatile memory, so they don't get lost after switching off the power. Due to the necessary knowledge of the controller operation details and the need to protect its proper functioning against unauthorized

user tampering, the service functions are divided into two groups, coded with different access passwords.
Entering the service mode is possible only when you press the **ESC** key while the afterburner control program is stopped. Using the ⬆ ⬇ i ➔ and **OK** keys you may enter one of the two password codes:

- **1983** for basic service functions set,
- **1994** for extended service functions set.

After entering the correct password, you will be presented with a list of service functions, which you can select using the ⬆ ⬇ keys and finally accept your selection by pressing the **OK** key**.**

BASIC SERVICE FUNCTIONS

Sensor correction (Temp. correction)
Allows the adjustment of the sensor temperature in the range of ± 50° C.

```
   -1°       Tk=100°
 ↑  ↓    OK or ESC
```

In the first line of the display the present value of the sensor correction flashes, while on the right side the currently measured temperature (including correction set) is shown. With the ⬆ ⬇ keys you can change the value of the correction. Press the **OK** key to approve the adjustments made or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.
It is recommended to adjust the sensor temperature after inserting the sensor into the water with ice (0°C) or into a vessel of possibly high thermal capacity and stable temperature measured by a reference instrument

Temperature thresholds
Allows you to set specific temperature thresholds and hysteresis used by the afterburner control program to turn on and off the flaps:

- T1 – jacket off temperature threshold   (default   60°C),
- T2 – flaps on temperature threshold   (default 400°C),
- T3 – burner off temperature threshold   (default 800°C),
- Th – flaps off hysteresis *(linked with T2)*   (default   -25°C).

```
 T1: 60°    T2:400°
 T3:800°    Th:-25°
```

To change the pulsing temperature field press the ⬆ and ⬇ keys, to select another field use the ⬅ and ➔ keys. An approval of the temperatures values set occurs when you press the **OK** key. Press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

The allowed range of values is set to 0-995°C for temperature thresholds and 0-50°C for the hysteresis, both in 5°C increments. While the operator enters the threshold temperatures, the controller interactively checks if the limits are not exceeded, not allowing to set the incorrect values.

Tk measurements filtering (Temp. filtering)

Allows you to set the measured temperature filtration depth, thus making possible adjusting it to the level of interference in your electrical network. This is achieved by setting the time in seconds used as a base for averaging temperature measurements, before beeing used by the afterburner control program. Longer filtration gives temperature measurements free from short-term disruptions, but may cause adverse delays in the response to the changes. Shorter filtration time affects the temperature measurements in the opposite direction.

```
tf= 5s    Tk= 25°
↑↓   OK or ESC
```

Current value of the temperature sensor filtration time flashes in the first line of the LCD display, while on the right side the currently measured temperature is shown, using present filtration time selected. With the ↑ ↓ keys you can change the value of filtration time in the range of 1 - 10 seconds, in 1s increments. Approval of the filtration time set occurs when you press the **OK** key, or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

Digital inputs filtering (Input filtering)

Allows you to set the controller digital inputs filtration depth, thus making possible adjusting it to the type of the input signals delivered or to the level of interference in your electrical network. This is achieved by setting the time (in seconds) during which the input '0' state must remain stable before the change from state '1 'to state '0' will be accepted by the afterburner control program. Longer filtration removes the short-term disruptions on the digital inputs, but may cause adverse delays in the response to the changes. Shorter filtration affects the interpretation of digital inputs in the opposite direction.

```
'0' VALID AFTER 5s
↑ ↓   OK or ESC
```

The current value of digital inputs '0'-state filtration time flashes in the first line of the LCD display. Using the ↑ ↓ keys you can change the value of filtration time in the range of 1 - 60 seconds, in 1s increments. Approval of the filtration time set occurs when you press the **OK** key, or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

Flaps delay

Sets the operation delay of flap number 2 with regard to flap number 1. Flap 2 changes its state to a state identical with flap 1 state after the time delay set by using this function. This applies to both switching on and off, for each pair of flaps, and to all the chambers, where the catalytic combustion process is supervised by **easyTermo** controller.

```
DELAY TIME:  5s
↑↓   OK or ESC
```

Current value of the flap 2 operation delay time flashes in the first line of the LCD display. Using the ↑ ↓ keys you can change the value of flap number 2 delay time in the range of 1 - 60 seconds, in 1s increments. Approval of the delay time set occurs when you press the **OK** key, or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

Jacket fan delay

Allows you to set the measured temperature additional filtration depth within the temperature range below the jacket off threshold, thus making possible adjusting it to the level of interference in your electrical network. This is achieved by setting the time (in seconds) during which the measured temperature must be lower than the jacket off temperature (T1 in the previously described service function used to set temperature thresholds) before the afterburner control algorithm considers this condition as met and takes the appropriate action.

```
┌─────────────────────────┐
│  Tk<60° during 5s       │
│ ↑↓     OK or ESC        │
└─────────────────────────┘
```

Current value of the jacket off temperature threshold is shown in the first line of the LCD display and the measured temperature filtration time near this threshold flashes on the right side of the display. Using the ↑ ↓ keys you can change the value of filtration time in the range of 1 - 60 seconds, in 1s increments. An approval of the time set occurs when you press the **OK** key, or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

Power-on autostart

Allows you to select one of two modes of the controller operation after power up:
- automatic startup mode of the afterburner control program,
- manual start mode of the afterburner control program using the **START** key.

```
┌─────────────────────────┐
│   AUTOMATIC START       │
│ ↑↓     OK or ESC        │
└─────────────────────────┘
```

The current controller operating mode after power up is shown in the first line of the LCD display. To change the mode use the ↑ and ↓ keys. An approval of the selected mode occurs when you press the **OK** key, or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

External modules

Allows you to adjust the controller configuration to the number of chambers serviced:
- no optional input / output expansion modules   *(1 to 2 chambers),*
- one or two input / output expansion modules   *(3 to 5 chambers).*

Selecting the controller configuration compatible with the current electrical system, protects against malfunctions due to reading of non-existent digital inputs or attempting to control not connected relays. Therefore, despite the security measures included in the afterburner control program, it is highly recommended to *always* set the number of I / O expansion modules conforming to the electrical installation of the control system.

```
┌─────────────────────────┐
│    MIDI MODUL           │
│ ↑↓     OK or ESC        │
└─────────────────────────┘
```

The currently selected modules configuration is shown in the first line of the LCD display. You you can change it with the ↑ and ↓ keys. An approval of the selected configuration mode occurs when you press the **OK** key or press the **ESC** key to return

to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

Connecting I / O expansion modules to the *easyTermo* controller is described in detail later in this manual.

Typical parameters (Factory defaults)

Use this function to set typical values of the controller's programmable parameters. This function may be useful for a rapid preparation of the controller to resume its function after losing some settings as a result of a strong interference, or after user error while setting the parameters.

```
TYPICAL PARAMETERS
OK-STORE  ESC-BACK
```

After pressing the **OK** key all the controller programmable parameters will be set to the typical values and an automatic restart will follow. Press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

Digital I/O test

Shows the status of digital inputs and allows the user to manually control the controller relays. This function is especially useful for faults location during controller installation or servicing.

```
ESC or   ■□□■□■□□
←→  OK   ■□■□□■□□
```

Controller inputs state is shown in the first line of the LCD display and controller outputs status in the second line. The ■ and □ display symbols correspond to the numbers of inputs and outputs placed on the frontpanel. The ■ symbol indicates the activity of a given input or output, while the □ symbol the lack of activity. The selection of the relay output to be tested is done using the ← and → keys, and a dot symbol is placed over the currently selected output. To change the selected output state press the ↑ and ↓ keys for the controller and the **START / STOP** keys for the expansion modules. With the **OK** key you can change the output state of the controller and expansion modules simultaneously (to the opposite state). To finish the test and return to the service menu press the **ESC** key. Pressing the **ESC** key again brings back the main screen.

All outputs will automatically be turned off after the test.

Setting the time (Clock time setup)

Use this function to set the astronomical time, currently shown on the LCD display.

```
    12:00:00
← → ↑↓ OK  ESC
```

Using the ↑ and ↓ keys you can change the state of currently flashing time field. The ← and → keys allow you to select the time field (hours - minutes - seconds), which is to be changed. An approval of the selected time occurs when you press the **OK** key or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

Setting the date (Clock date setup)
Use this function to set the date, currently shown on the LCD display.

```
      01-01-2006
← →  ↑↓  OK   ESC
```

Using the ↑ and ↓ keys you can change the state of currently flashing date field. The ← and → keys allow you to select the date field (year - month - day), which is to be changed. An approval of the selected date occurs when you press the **OK** key or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

Service phones
Displays the *easyTermo* controller technical support phone numbers.

```
REXPOL:322459034
INLOG :322507600
```

Pressing any key returns you to the service menu, and pressing the **ESC** key again brings back the main screen.

Language setup
Allows you to select the language version of the the LCD display messages.

```
   JĘZYK POLSKI
↑↓    OK or ESC
```

The currently selected language version is shown in the first line of the LCD display. Change the version from Polish to English (and vice versa) using the ↑ and ↓ keys. An approval of the selected language occurs when you press the **OK** key, or press the **ESC** key to return to the service menu without any changes. Pressing the **ESC** key again brings back the main screen.

EXTENDED SERVICE FUNCTIONS

Working mode simulation (Simulation mode)
This function sets the controller in a specific operating mode, where the state of digital inputs and temperature sensor readings are set using the keyboard, calculated output states are shown on the LCD display just like during a normal program execution, but the controller does not activate any of its outputs. This special mode allows to dry-test the control algorithm and to make sure it is working according to the requirements set.

```
  SIMULATE - OK
BACK TO MENU-ESC
```

To start the controller simulation mode press the **OK** key, or press the **ESC** key to return to the service menu without simulation. Pressing the **ESC** key again brings back the main screen.

The individual keys have the following meaning in the simulation mode:

- ← i →   - selection of the simulated input,
- **OK**   - simulation of input status change from inactive to active and vice versa,
- ↑ i ↓   - simulation of the measured temperature change, ±10° C respectively,
- **START** - a hint with the name of the input currently selected for the simulation,
- **ESC**   - a hint with the name of the output corresponding to the current input,
- **STOP**   - end of the simulation mode.

Firmware upgrade
This function is reserved exclusively for the controller manufacturer. It allows to change the controller internal software by means of a specialized programmer or an external memory module.

Factory number
Displays the factory number of the *easyTermo* controller, which may be needed for service purposes or for upgrading the controller firmware.

```
Factory number:
034 0710 4 NOREL
```

Pressing any key returns you to the service menu.

Diagnostics info
Displays the status of the *easyTermo* controller internal parameters, whose values may be useful in diagnosing the state of the controller by the manufacturer's technical support.

```
PF:0000 RST:0001
WD:0000 BOD:0002
```

After pressing the **OK** key all parameters are cleared. Press the arrow keys to show additional diagnostic information or press any other key to return to the service menu.

INSTALLATION OF THE CONTROLLER

easyTermo controller and the 230V / 9V transformer delivered along with it, are both intended to the standard DIN 35 mm rail mounting in the afterburner electrical enclosure.

Note the following requirements for the safety of the controller installation:
- the installation and controller connection should be done by qualified personnel only,
- all connections should be made with controller power turned off,
- before removing the controller from the DIN rail unplug all signal connectors,
- place all controller signal cables as far away from power cables as possible,
- do not supply the controller from the power rail used to supply devices that generate large disturbances, especially of pulse type,
- protect the controller relay outputs with external fuses (5A max).

easyTermo external connectors are shown in the following figure:
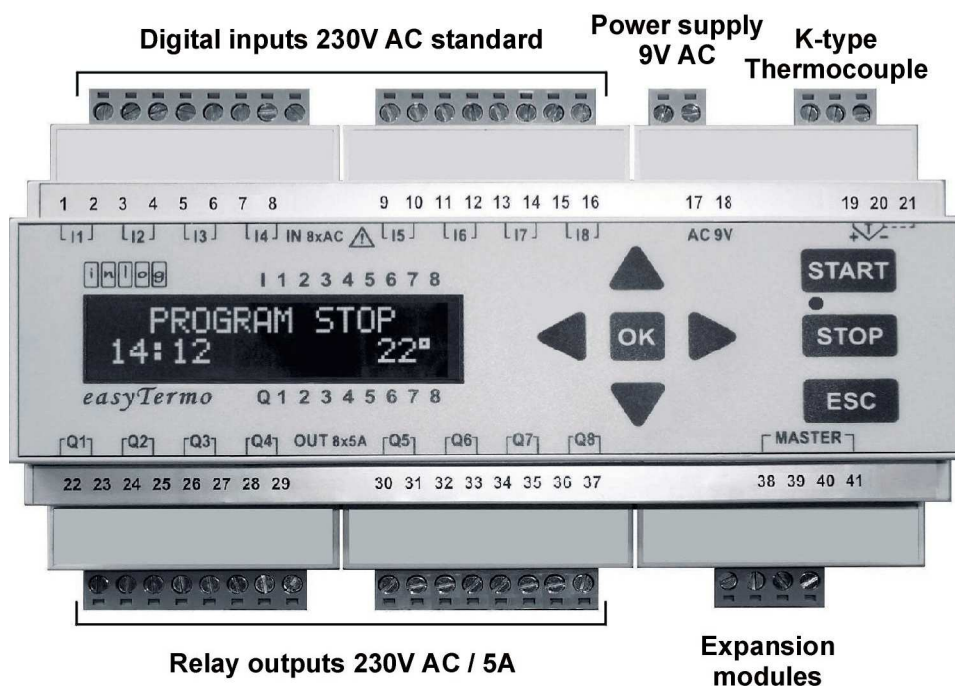
easyTermo connectors and signal types

Contact number	Signal type	Contact number	Signal type
1-2	digital input number 1	22-23	relay output number 1
3-4	digital input number 2	24-25	relay output number 2
5-6	digital input number 3	26-27	relay output number 3
7-8	digital input number 4	28-29	relay output number 4
9-10	digital input number 5	30-31	relay output number 5
11-12	digital input number 6	32-33	relay output number 6
13-14	digital input number 7	34-35	relay output number 7
15-16	digital input number 8	36-37	relay output number 8
17-18	9V AC supply	19-20	K Thermocouple (+ and -)
38-39-40-41	expansion module *(option)*	21-20	Thermocouple shunt *(option)*

easyTermo inputs and outputs connectors for afterburner control

Contact number	Control signal
1-2	preheating signal input from chamber number 1
3-4	afterburning signal input from chamber number 1
5-6	blocking signal input from chamber number 1
7-8	preheating signal input from chamber number 2
9-10	afterburning signal input from chamber number 2
11-12	blocking signal input from chamber number 2
13-14	preheating signal input from chamber number 3
15-16	afterburning signal input from chamber number 3
22-23	flap number 1 of chamber number 1 (exhaust flap) output
24-25	flap number 2 of chamber number 1 (smoke flap) output
26-27	flap number 1 of chamber number 2 (exhaust flap) output
28-29	flap number 2 of chamber number 2 (smoke flap) output
30-31	burner output
32-33	jacket fan output
34-35	smoke fan output
36-37	flap number 1 of chamber number 5 (exhaust flap) output
38-39-40-41	expansion modules communication link

If **_easyTermo_** controller is intended to supervise a catalytic combustion process for more than two smoking or maturing chambers, the I/O expansion modules must be connected to it. For three or four chambers, a standard **_midi I/O_** (4 digital inputs and 4 digital outputs) expansion module is needed, for five chambers you must also use the specialized version of the **_mini I/O_** (3 digital inputs and 1 digital output) expansion module. Assignment of signals for I/O expansion modules is shown in the tables below.

midi I/O expansion inputs and outputs connectors for afterburner control

Contact number	Control signal
1-2	blocking signal input from chamber number 3
3-4	preheating signal input from chamber number 4
5-6	afterburning signal input from chamber number 4
7-8	blocking signal input from chamber number 4
11-12	flap number 1 of chamber number 3 (exhaust flap) output
13-14	flap number 2 of chamber number 3 (smoke flap) output
15-16	flap number 1 of chamber number 4 (exhaust flap) output
17-18	flap number 2 of chamber number 4 (smoke flap) output
19-20-21-22	host controller communication link

mini I/O expansion inputs and outputs connectors for afterburner control

Contact number	Control signal
1-2	preheating signal input from chamber number 5
3-4	afterburning signal input from chamber number 5
5-6	blocking signal input from chamber number 5
7-8	flap number 2 of chamber number 5 (smoke flap) output
9-10-11-12	host controller communication link

Instead of *midi I/O* expansion module (4 digital inputs and 4 digital outputs) you can also use mini expansion modules combo: one *mini In* module (4 digital inputs) and one *mini Out* module (4 digital outputs). Assignment of signals for this configuration of modules is shown in the following tables.

mini In expansion inputs connectors for afterburner control

Contact number	Control signal
1-2	blocking signal input from chamber number 3
3-4	preheating signal input from chamber number 4
5-6	afterburning signal input from chamber number 4
7-8	blocking signal input from chamber number 4
9-10-11-12	host controller communication link

mini Out expansion outputs connectors for afterburner control

Contact number	Control signal
1-2	flap number 1 of chamber number 3 (exhaust flap) output
3-4	flap number 2 of chamber number 3 (smoke flap) output
5-6	flap number 1 of chamber number 4 (exhaust flap) output
7-8	flap number 2 of chamber number 4 (smoke flap) output
9-10-11-12	host controller communication link

mini Out expansion module (4 digital outputs) must be properly set to work in this configuration. To do this, remove carefully the plastic cover of the lower connector (**MASTER** connector), set the jumper number 2 (the jumper closer to the connector, next to the green LED) and finally place the connector cover back in its place.

Lack of the jumper no. 2 will cause malfunction of the *mini Out - mini In* modules set !

Using the previously described *External modules* service function, you must also choose the correct modules configuration and confirm the selection with the **OK** key.

```
MODUL MINI+MINI
↑↓   OK or ESC
```

After that, a set of *mini In* (4 digital inputs) and *mini Out* (4 digital outputs) expansion modules is correctly configured as the equivalent of a *midi I/O* module (4 digital inputs and 4 digital outputs).

In all of the expansion modules configurations described above, namely:

- one *midi I/O* module (up to 4 chambers),
- a pair of *mini In* and *mini Out* modules (up to 4 chambers),
- a pair of *midi I/O* and *mini I/O* modules (up to 5 chambers),

a separate power supply for the expansion modules is not required, because they are powered via the **MASTER** connector of an *easyTermo* controller.

CONNECTING THE DIGITAL INPUTS

easyTermo controller is equipped with 8 galvanically isolated 230V AC digital inputs. The following figure shows how to connect the signal source to the digital input.
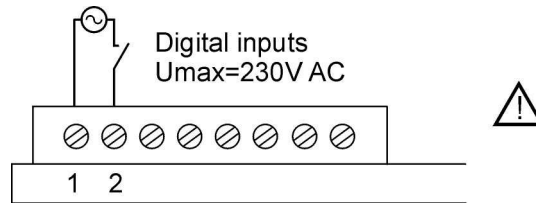
On request, the digital inputs can also be factory adjusted to other operating volatages. Active input state corresponds to the nominal voltage value at the input terminals.

CONNECTING THE RELAY OUTPUTS

easyTermo controller is equipped with 8 digital (relay) outputs, 250V AC / 5A each. The following figure shows how to connect the load to the relay output.
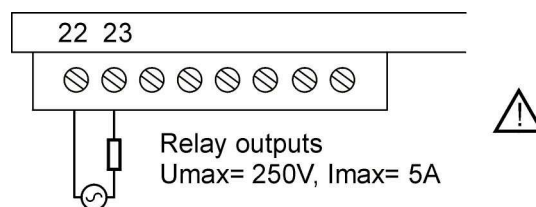
The outputs are independent and isolated from each other. Safeguarding against burning the relay contacts should be provided within the load circuit. Each relay output is also individually protected with a varistor of nominal voltage of 250V AC

CONNECTING THE TEMPERATURE SENSOR

easyTermo controller is equipped with one dedicated input for a K-type thermocouple temperature sensor. The controller accepts temperatures in the range of 0...1023°C, with measurement error typically no more than ± 3°C over the measurement range. Connect the thermocouple to the controller as shown in the following figure.
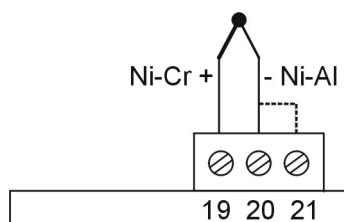
Terminal number 21 allows connecting the "-" thermocouple wire to the temperature measurement circuit analog ground, which in turn makes possible detection of a thermocouple open circuit. As - in some very specific cases - external connections to the *easyTermo* ground may cause controller malfunction, this connection is marked as optional, but highly recommended.

If any errors in the temperature measurement system are detected, then a non-typical temperature of 1100°C is simulated by the controller program, which in turn leads to emergency stop of the afterburner. To distinguish this erroneous state, the measured temperature flashes on the LCD display then.
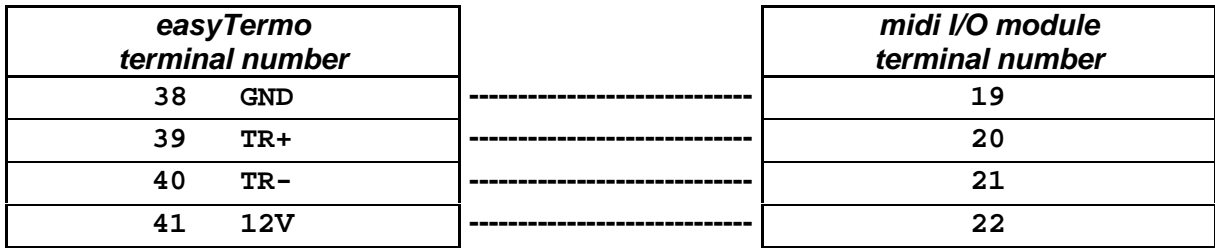
POWER SUPPLY

easyTermo controller power supply comes from a 230V / 9V transformer delivered along with the controller, which provides enough power supply for both the controller and the optional I/O expansion modules. Power supply voltage of 9V AC value must be connected to the controller terminals number 17 and 18.

CONNECTING THE EXPANSION MODULES

easyTermo inputs and outputs can optionally be extended using the expansion modules, to allow monitoring of more complex control systems, requiring an increased number of inputs and outputs. Detailed description of the expansion modules is contained in modules manuals. The following diagram shows a typical cable connecting *midi I/O* expansion module to the *easyTermo* controller.

Connecting *easyTermo* controller and *midi I/O* expansion module

easyTermo terminal number			midi I/O module terminal number
38	GND	---------------------------	19
39	TR+	---------------------------	20
40	TR-	---------------------------	21
41	12V	---------------------------	22

In the standard configuration an expansion module does not require a separate power supply, as it is supplied via the **MASTER** connector of the *easyTermo* controller (2 or more expansion modules may require an additional power supply). If the controller and expansion modules are placed in the same enclosure, next to each other, the cable connecting them can be made of practically any four-wire electrical cable. In case of a longer distance between the two devices or strong electrical interferences, the cable should be made of shielded twisted pair cable (SF/UTP), with the shield grounded at one of the cable ends. One cable pair should be used for signal lines (TRX+ and TRX-), two pairs for power supply and ground, and the fourth is reserved. Connect the next expansion modules in an identical manner. The ∗ symbol shown on the display to the right of the current time, indicates the detection of expansion modules and establishing correct communication link to them. Lack of this symbol indicates the configuration without expansion modules, and the ! symbol signals failure of the communication link between the controller and modules. In this case, using the previously described *External modules* service function, check the expansion modules configuration mode and - if it is correct - the cable connecting the controller and the modules.

Expansion modules signal their error free communication with the *easyTermo* controller with slow flashing of the **STATUS** lamp, while continuous illumination indicates lack of communication between the module and the controller.

TECHNICAL SPECIFICATIONS

- digital inputs   8 voltage type inputs, 230V AC each
- digital (relay) outputs   8 relay type outputs, 250V AC / 5A max each,
- temperature sensor input   1 K-type thermocouple,
- LCD display   2 lines x 16 characters, with backlight,
- keyboard   8 keys,
- power supply   9V AC, 250mA max,
- working temperature   0...<u>20</u>...45°C,
- working humidity   40...85%, non-condensing,
- case protecition   IP20.