



Operation instructions

Electric heater controller HE module



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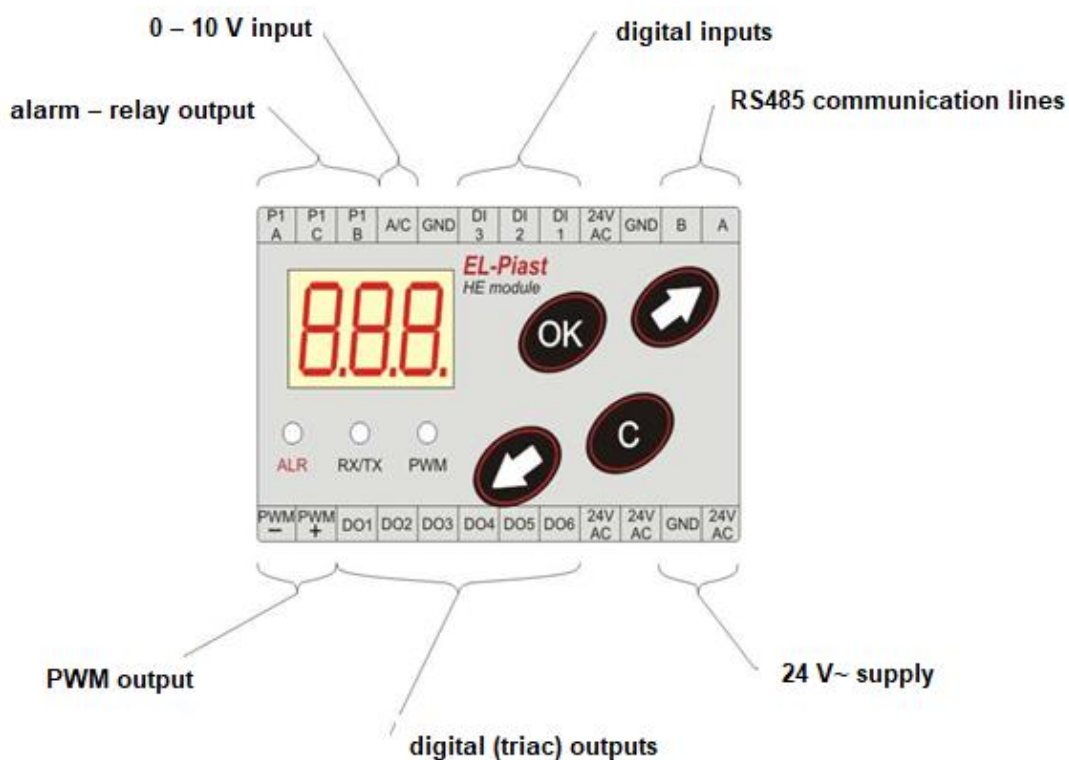
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2 TECHNICAL DATA

- Supply voltage: 24 V~ (+/- 10%)
- A/C voltage input: 0 – 10 V
- DI 1 – DI 3 digital inputs: 0 – 24 V~
- Relay – alarm output: normally closed contact 10 A, 250 V~
- Digital (triac) outputs: maximum permissible current – 200 mA
- PWM output: 0 – 7 V
- A, B communication lines in the RS485 standard

3 DESCRIPTION OF CONTROL ELEMENTS



4 LIST OF AVAILABLE PARAMETERS

Parameter	Function	Range	Factory setpoint	Type
10h	Upper signal limit in the analogue input	0.0 – 10.0 V	10.0	Write and read
11h	Lower signal limit in the analogue input	0.0 – 10.0 V	0.2	Write and read
12h	Signal value in the analogue (control) input	0.0 – 10.0 V	-	Read
13h	Number of switch-on heating stages	01..VI	2	Write and read
14h	PWM output period	1.0 – 10.0 s	10.0	Write and read
15h	PWM output limit	0 – 100%	-	Write and read
16h	Digital inputs		-	Read
17h	Digital outputs		-	Read
18h	Present PWM output level percentage	0.0 – 100%	-	Read
19h	Heater operating mode selection / heater power reduction rate of rise	0 – 100	0	Write and read
20h	Control method selection: normal / binary	nor / bin	nor	Write and read
21h	Controller address	0 – 255	10	Write and read

5 GENERAL PRINCIPLE OF CONTROL

Heater power is controlled by a PWM signal – width modulation by alternate switching on and off the PWM output. An element that controls the operation of the first heater stage, e.g. a contactor or a triac, should be connected to this input. Depending on the selected operating mode, switch-on time is directly proportional to the command signal supplied to the analogue input or to the DI3 digital input activation time. DI2 and DI6 digital outputs are switched on in sequence when the PWM signal reaches its maximum value. After switching on the next stage, the PWM signal decreases to a minimum.

5

Heater operating mode (19h=0)

The on-load voltage of the heaters is supplied only when all three two-stage inputs of the HE control module signal high state. It is sufficient for only one of the inputs to have low state in order for the control module to enter alarm state until all signals are present in two-stage inputs again. Alarms do not have to be cancelled.

Preheater operating mode (19h=1...100)

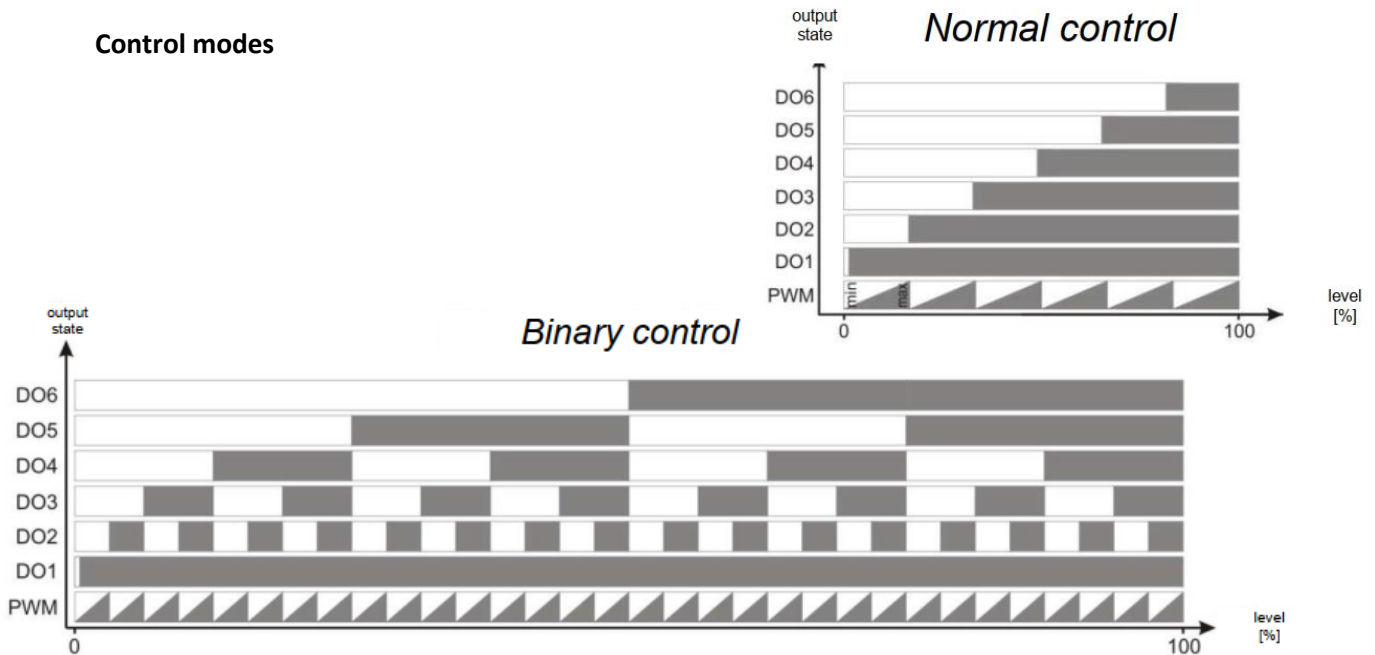
The on-load voltage of the heaters can be supplied only when DI1 and DI2 two-stage inputs of the HE control module signal high state. It is sufficient for only one of the inputs to have low state in order for the control module to lock heater operation. In the case of low state in the DI2 input the module enters alarm state. The DI3 input is the control input. If this input is active, the module increases heater power level. If it is inactive, heater power decreases. Heater power increase and decrease rate is set by the parameter 19h within a range of 1-100 per cent of full heater power per minute [%/min].



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Control modes



6 CONTROLLER PARAMETERS DESCRIPTION

10h Upper signal limit in the analogue input

Range: 0.0 – 10.0 V Write and read is possible. 10 is the default value.

This parameter specifies command signal value, at which the control module will provide full power level of the heater.

ATTENTION! The maximum value of heater power depends on the parameters 13h and 15h.

11h Lower signal limit in the analogue input

Range: 0.0 – 10.0 V Write and read is possible. 0.2 is the default value.

This parameter specifies command signal value, at which the control module switches on the first heating stage and will provide minimum power level of the heater. It is recommended to set this value higher than zero. Under the influence of other electrical equipment operation (noise) voltages may induce in the pilot wire. Setting the value of the parameter 11h too low may result in unintentional switching on of the electric heater.

12h Signal value in the analogue (control) input

Range: 0.0 – 10.0 V Read only.

This parameter contains information on the present signal value in the analogue (control) input. This parameter is of informative character and its primary function is to diagnose the system.

EXAMPLE If, contrary to the expectations, the heater is not in operation and no alarm message is displayed, it is required to read the value of the parameter 12h first. If this value is lower than the declared value in the parameter 11h, it means that the conditions required for heater switch-on have not occurred.

13h Number of switch-on heating stages

Range: 1 – 6. Write and read is possible. 2 is the default value.

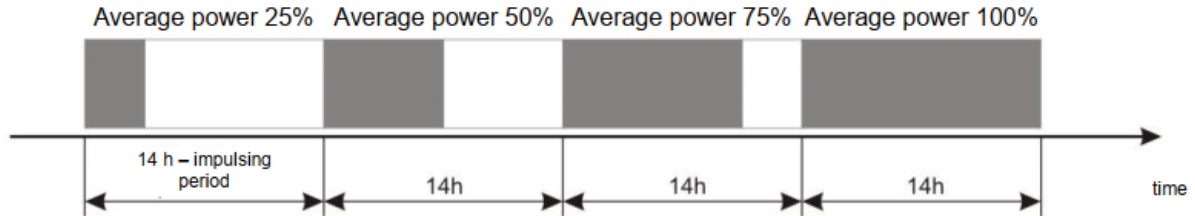
This parameter specifies the maximum number of heating stages available for operation.

ATTENTION! The maximum power value of the whole heater also depends on the parameter 15h.

14h PWM output period

Range: 1.0 – 10.0 s Write and read is possible. 10.0 is the default value.

This parameter defines the period of the full pulse-width modulation cycle. The full cycle consists of the first heating stage switch-on time (the grey rectangle) and the time during which the first heating stage is switched off.



Impulsing **time elongation** is recommended if the maximum power of the heater is lower than the power of the first stage, as well as when heater power consumption disrupts the operation of other electrical equipment, e.g. the lighting flickers.

Impulsing **time shortening** is recommended in order to improve adjustment quality, i.e. when the impulsing of the first heating stage causes periodic fluctuations in the temperature measurement of the supply air entering the room being heated.

15h PWM output limits

Range: 0 – 100 %. Write and read is possible. 100 % is the default value.

This parameter specifies the percentage of the maximum power at which the first heating stage may operate, utilising smooth power adjustment.

EXAMPLE 1. Power demand $P_n = 6.7 \text{ kW}$

$$15h = \frac{P_n * 100\%}{[13h] * P_{max}} = \frac{6,7kW * 100\%}{1 * 18kW} \approx 37\%$$

EXAMPLE 2. Power demand $P_n = 100 \text{ kW}$

$$15h = \frac{P_n * 100\%}{[13h] * P_{max}} = \frac{100kW * 100\%}{6 * 18kW} \approx 93\%$$

P_{max} – maximum power of a single stage of the 18kW heater

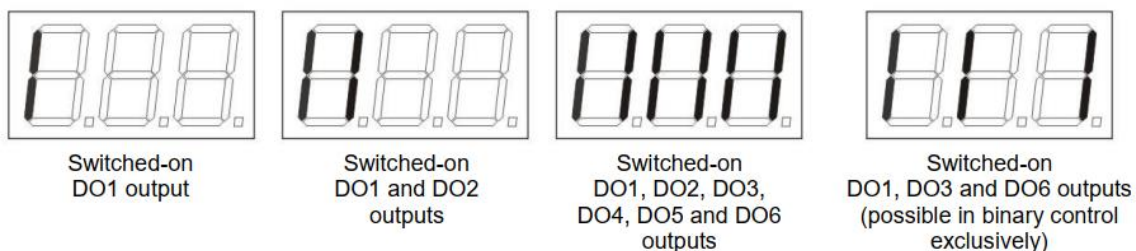
16h Digital (two-stage) inputs

Range: 000 – 111 (binary value). Read only.

This parameter contains information on the state of three available two-stage inputs: 0 means no input signal, 1 means that the 24V~ voltage signal is present.

17h Digital (two-stage) outputs

This parameter contains information on the state of six available digital outputs which are used to switch on subsequent contactors, through which subsequent stages of the heater are powered.



18h Present PWM output level percentage

Range: 0 – 100 %. Read only.

This parameter reports information on the per cent value of PWM output level. This information is to be interpreted as a per cent value of the maximum power of the first heating stage.

19h Heater operating mode selection

Range: 0 – 100. Write and read is possible.

This parameter imposes the heater operation algorithm.

0 – operation in the mode of a typical electric heater. Heater power is proportional to the signal in the analogue input and the function of digital inputs is to provide protection.

1-100 – operation in the preheater mode. Heater power smoothly accrues or decreases, depending on the state of the DI 3 digital input. The analogue input is inactive. The function of DI1 and DI2 digital inputs is to provide protection.

EXAMPLE: Heater power 36kW, parameter 19h=5. Depending on the state of the heater and the DI3 input, heater power will smoothly accrue or decrease at a rate of 1.8 kW per minute.

20h Control method selection

Range: nor / bin. Write and read is possible.

This parameter enables the user to choose between normal and binary control.

nor – normal control

bin – binary control

Normal control consists in switching on individual stages (outputs) in sequence: DO2 – DO6, in accordance with the present signal level. Each subsequent switching on is preceded by a linear accretion of pulse-width modulation (PWM), which ensures control smoothness.

In binary control individual outputs (DO2 – DO6) are treated as subsequent bits of a 6-bit word. DO2 is the least significant bit, while DO6 is the most significant bit. As the level increases, individual outputs are switched on in accordance with the binary code. Just as in the case of normal control, each subsequent switching on is preceded by a linear accretion of pulse-width modulation (PWM), which ensures control smoothness.

The DO1 output is switched on permanently after exceeding the threshold set in the parameter 11h.

A graphic representation of control methods is presented in Chapter 5.

21h Controller (module) address.

Range: 0 – 255. Write and read is possible.

This parameter is used to determine the MODBUS RTU address of the unit connected to the RS485 network.

7 ALARM OUTPUT

Upon the emergence of alarm state, all heating stages are switched off, the PWM signal amounts to zero and the contact of a three-pole alarm state is signaled on the display



alarm relay is switched over. The unit with the following symbol

Heater operating mode (19h=0)

It is generated by a decay of at least one of digital inputs, the present state of which is displayed under the parameter 16h. The alarm state decays automatically once all three signals are present in digital inputs.

Preheater operating mode (19h=1...100)

It is generated by signal decay in the DI2 input exclusively. The alarm state is automatically cancelled once the signal is present in the DI2 input again.

ATTENTION If the state of the DI2 input changes 3 times in one hour, then the system becomes locked and requires manual cancelling by switching off and back on the module or by changing the value of the parameter 19h to 0 and setting it to a value from the range 1...100 again.

8 CONNECTION DIAGRAM

