Industrial Microprocessor Controller

INDU-30

Intended for:

Drying chambers, Air conditioning chambers, Systems of temperature and humidity control

LIST OF CONTENTS

TECHNICAL DATA

- 2 analogue inputs PT-100 (PT-500, PT1000)
  channel 1: temperature – 'dry' thermometer
  channel 3: temperature – 'wet' thermometer
- Temperature measuring range: -30.. +400 °C (resolution 0.1 °C)
- 1 analogue input 0..20 (4..20) mA
  channel 2: analogue humidity sensor
- 5 relay outputs
- 1 x RS-485 communication with a PC computer
- 1 x RS-485 LOGGINET system digital sensor of humidity and temperature
- 2 control inputs (alarm signaling or keyboard lockout)
- Power supply 230 / (110) (24) ± 10% VAC
- Power consumption 3 W
- Protection level IP65 (from the front)
- Operation temperature –10 °C .. +55 °C
- Storage temperature –15 °C .. +60 °C
- Overall dimensions 134x134x65 mm
- Assembling hole 90x90 mm

AUTOSTART: according to RTC, with the possibility of an advanced programming (up to 10 days) of the controller switching on.

Governor type: 2 types of bistable governors and the PID governor.
Conditional end of the process programmable in SETUP.

Recording of the set and measured values, approximately 100,000 recordings*.

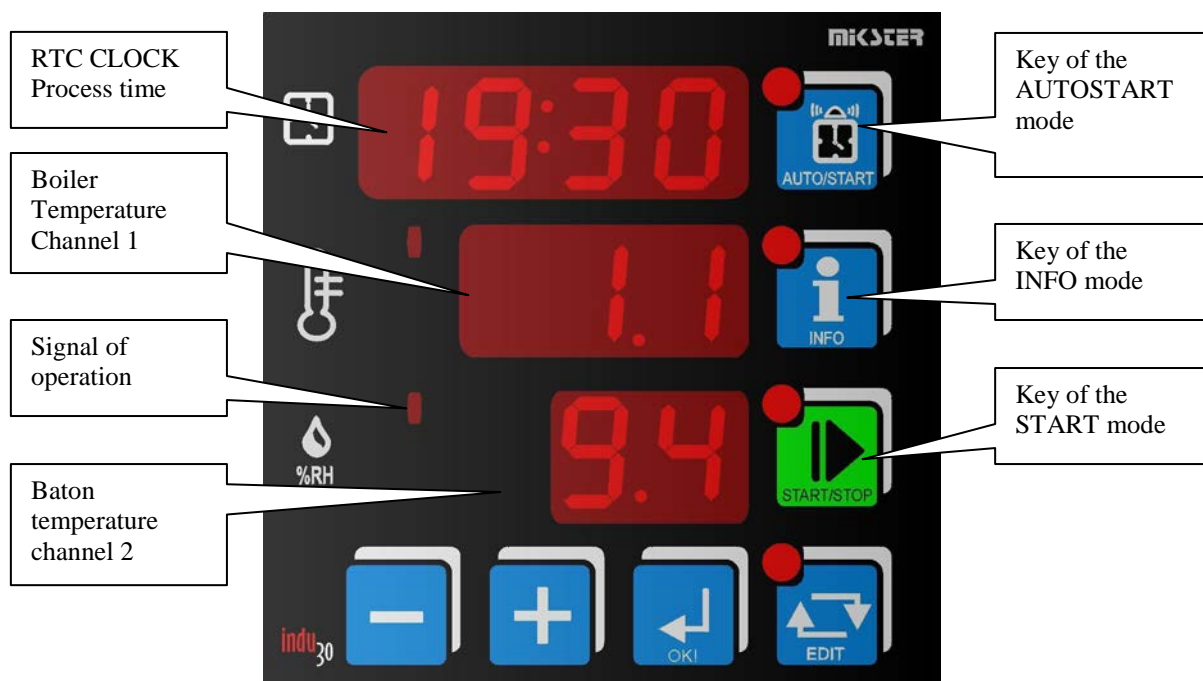<u>Assembling hole 90x90mm.</u>
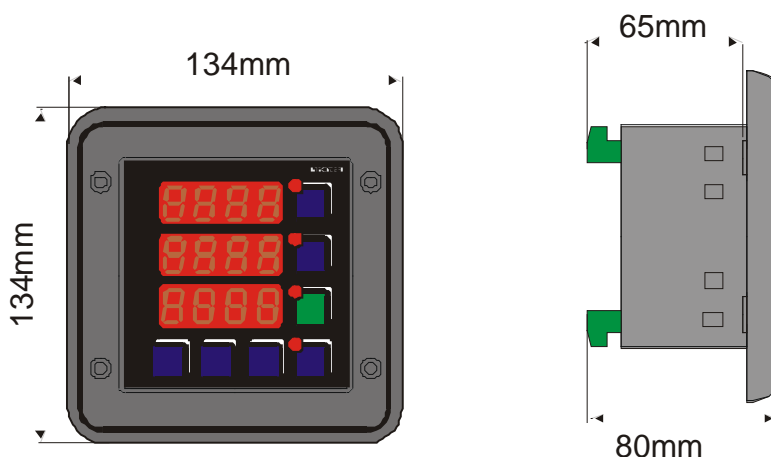
* recording module, R - version

ACTIVATION

When the LOGGINET system digital sensor and the mains are connected, the controller is automatically activated. After the welcoming words the device displays in turn: current hour and minute, measurement in channel 1 – temperature, measurement in channel 2 - humidity. Three horizontal lines on the display indicate the lack or failure of a measuring element. Diodes on the keys signal the mode of the device (e.g. editing or autostart mode). Horizontal lines at the left side of the displayed measured value signal the governor's mode: controlled output causes that the diode lights. Diodes on the keys indicate the controller's mode. Possible modes of operation are: AUTOSTART, START, INFO and EDIT.
In the STOP mode, when the START mode ended, the word „STOP" is displayed on the screen – instead of an hour and minute.

NOTE: in the case of power failure the controller remembers the mode of operation and returns to this mode at the power supply restart. (unless the time set in the 48 Setup cell expires).

OPERATING PANEL

Label	
RTC CLOCK Process time	Key of the AUTOSTART mode
Boiler Temperature Channel 1	Key of the INFO mode
Signal of operation	Key of the START mode
Baton temperature channel 2	

EDIT MODE – CHANGING OF THE SET VALUES

In order to enter the mode of editing the set parameters of the process the key should be pressed ⬚ . Entering into the edit mode is indicated by pulsation of the

diode on the key EDIT.

Keys ⬚ ⬚ are used for correction of parameters. Confirmation and proceeding to the next editing field is done by the OK key. Consecutive pressing of the key ⬚ means exit from the editing mode.

The set parameters are consecutively:
- START mode duration (number of hours and minutes)
- Set temperature (temperature controller)
- Set humidity (humidity controller)

INFO MODE

Single pressing of the INFO key causes the display of information in dependence of the controller's mode of operation:
For the AUTOSTART mode
 Depending on the parameter in the 47 Setup cell:
   At selecting HMD – hour, minute and twenty-four hours delay before the START mode   commences,
   At selecting HM – number of hours and minutes remaining to the START mode

Consecutive information, for all modes, are the same:
- Temperature measurement in channel 3 (Ad-3)
- Set temperature and humidity
- Actual date
- Actual time

Proceeding into the next (previous) information can be done by keys: ⬚ ⬚ .

AUTOSTART MODE

Pressing the AUTO/START key causes transition to the parameters editing of this mode.
There are two possibilities of setting the moment of the controller AUTOSTART:
1. Activation at the predetermined hour and minute – with the possibility of adding the twenty-four hour delay (F47 SETUP - HMD).
2. Activation after the predetermined number of hours and minutes (F47 SETUP - HM)
To exit the AUTOSTART mode the AUTO/START key should be pressed again.
There is also a possibility of a direct transition from the AUTOSTART into the START mode. Single pressing of the START key is needed.

START MODE

Beginning and ending of the START mode is done by pressing the key: .
For the typical settings of the controller, entering the START mode activates governors and the countdown of the process time starts.
The display shows the number of hours and minutes remaining to the end of the process.
Pressing the OK key switches off the sound signal.
Depending on the SETUP - various conditions of the process ending are possible, e.g.

- countdown of the process time
- obtaining of the adequate temperature and humidity value

The end of the process is indicated by the internal sound signal of the controller and by controlling of the relay output REL5 (unless it is declared in the cell 30 of Setup as the humidity governor).
Pressing the OK key switches off the sound signal.

FUNCTIONS OF RELAYS

REL 1: temperature governor
REL 2: humidity governor
REL 3: temperature governor
REL 4: controlled in the START mode
REL 5: humidity regulation or alarm event signaling.

 Selection of the regulation algorithm in the cells of Setup (27..30)

GOVERNOR OF THE „SET VALUE APPROACH"
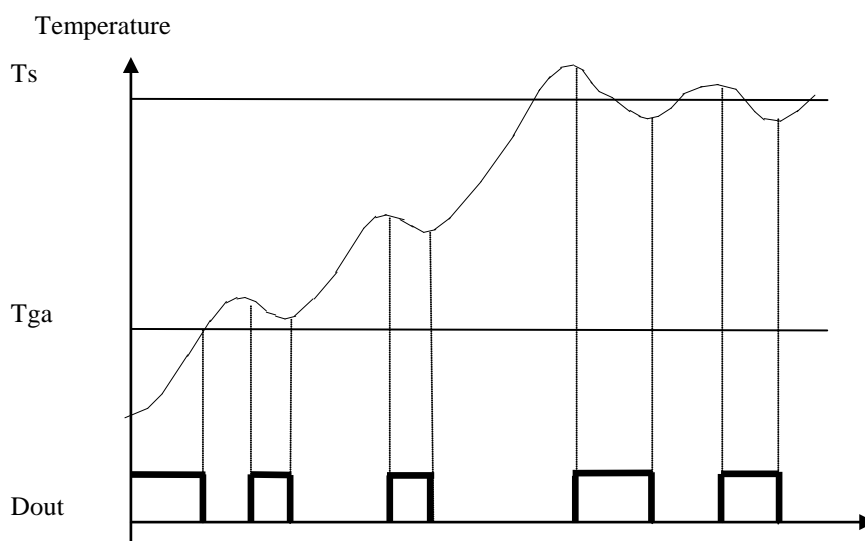
Parameters

T_s – set temperature value

T_{ga} – temperature of the governor activation; up to this temperature the output is controlled (heating). When this temperature is reached the governing algorithm starts.

D_{out} – state at the digital output (high state corresponds to the heaters being ON).

SELECTION OF SETTINGS OF THE PID GOVERNOR

To obtain an access to the settings of the PID governor coupled with the particular measuring channel the MINUS key should be pressed and held and then the INFO key. The upper display shows the information that the governor can be adjusted – then the OK key should be pressed. The edition of the selected parameter is being done on the middle display (pulsating value). Increasing of the parameter's value can be done by the PLUS key, while decreasing by the MINUS key. Proceeding to the next parameter and confirmation of changes is done by pressing OK. Exit from the edition mode - by pressing the EDIT key.

During the edition of parameters the relay REL1 shows 10% of filling. It might be helpful in characterizing the object and parameters selection.

Regulation is being done on the bases of:
Pr – amplification of the proportional element,
Ti – integration constant (doubling time),
Td – differential constant (advancing time),
TS – set temperature,

Writing 0 value for the integrating or differentiating element causes its switching off. Due to that feature, it is possible to obtain the arbitrary governing algorithm.

SERVICE FUNCTIONS ACCESSIBLE FOR THE USER

Cell number	Description
UF0	Setting of the real time clock. Next parameter is reached by the OK key.
UF1	Change of the access code for the user Range 0..9999 For 0 value – checking of the access code is switched off
UF2	Information concerning the current program version
UF3	Switching ON/OFF of the keyboard click OFF – switching off ON – switching on

 To enter the user's mode the MINUS key should be pressed and held, the PLUS key should be pressed and held. Those functions are accessible when the access code is given.

To switch off the checking of the access code its value should be set as zero.

As a rule the access to the user's settings is switched off.

ALARMS

 Controller INDU 30 signals 11 alarm events:

- Err 1   Failure or lack of the measuring element in the channel 1
- Err 2   Failure or lack of the measuring element in the channel 2
- Err 3   Failure or lack of the measuring element in the channel 3
- Err 4   Permissible MAX temperature exceeded
- Err 5   Permissible MAX humidity exceeded
- Err 6   -
- Err 7   Permissible MIN temperature exceeded
- Err 8   Permissible MIN humidity exceeded
- Err 9   -
- Err 10   Control input 1 not shorted
- Err 11   Control input 2 not shorted

The first step in an alarm activation is the setting of the time delay [seconds] in SETUP (cells 71..73) between an alarm event and the alarm activation. Then the activation of the selected alarms in SETUP (cells 60..70) should be done.

Alarm should be confirmed by the OK. key. If the cause of an alarm is not removed, the controller – after the time delay of the alarm activation - will again signal the alarm.

CONTROLLER SETUP

To enter SETUP the MINUS key should be pressed and held, then the EDIT key pressed. After providing the access code – the correction of the controller's parameters can be done.

No	DEFAULT VALUE	RANGE	DESCRIPTION
0	1	0..128	Address in the MODBUS network
1	0	0..4	Transmission rate 0 – 9600 1 – 19200 2 – 38400 3 – 57600 4 – 115200
2	1	0..12	Type of the measuring input for channel 1 0 – PT-500 1 – PT-100 2 – PT1000 3 – 0..20 mA* 4 – 4..20 mA* 5 – thermocouple s** 6 – thermocouple b** 7 – thermocouple r** 8 – thermocouple t** 9 – thermocouple j** 10 – thermocouple e** 11 – thermocouple k** 12 – thermocouple n** * current input version ** thermocouple service version
3	4	3..4	Type of the measuring input for channel 2
4	1	0..12	Type of the measuring input for channel 3
5	0	0…100%	Value corresponding to 0 mA for channel 1 for 0..20 mA
6	100	-99..999°C	Value corresponding to 20 mA for channel 1 for 0..20 mA
7	0	-99..999°C	Value corresponding to 0 mA for channel 2 for 0..20 mA
8	100	-99..999°C	Value corresponding to 20 mA for channel 2 for 0..20 mA
9	0	-99..999°C	Value corresponding to 0 mA for channel 3 for 0..20 mA
10	100	-99..999°C	Value corresponding to 20 mA for channel 3 fpr 0..20 mA
11	0	-99..999°C	Value corresponding to 4 mA for channel 1 for 4..20 mA
12	100	-99..999°C	Value corresponding to 20 mA for channel 1 for 4..20 mA
13	0	-99..999°C	Value corresponding to 4 mA for channel 2 for 4..20 mA
14	100	-99..999°C	Value corresponding to 20 mA for channel 2 for 4..20 mA
15	0	-99..999°C	Value corresponding to 4 mA for channel 3 for 4..20 mA
16	100	-99..999°C	Value corresponding to 20 mA for channel 3 for 4..20 mA
17	0,0	-20.0 .. 20.0°C	Temperature correction for channel 1
18	0,0	-20.0 .. 20.0°C	Temperature correction for channel 2

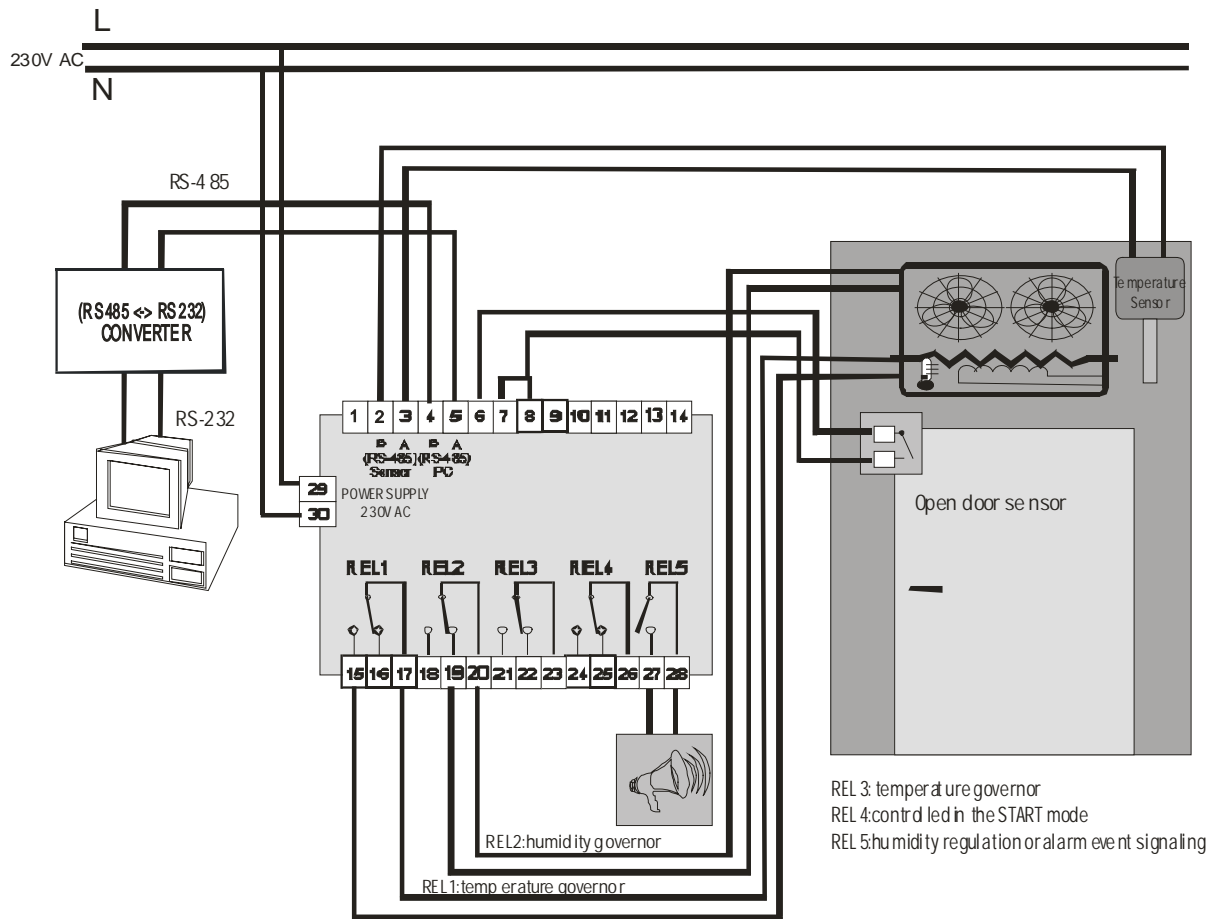| 19	0,0	-20.0 .. 20.0°C	Temperature correction for channel 3
20	On	On / Off	Temperature governor Off- always 0n- only when in the START mode
21	On	On / Off	Humidity governor Off- always 0n- only when in the START mode
22	-	-	-
23	-99	-99..400°C	The lowest Temperature value, which can be set by the user
24	150	-99..400°C	The highest Temperature value, which can be set by the user
25	-	-	-
26	-	-	-
27	0	0..3	Temperature governor coupled to relay REL 1 0 – simple hysteresis 1 – reversed hysteresis 2 – approaching hysteresis 3 - PID
28	1	0..1	Humidity governor coupled to relay REL 2 0 – simple hysteresis (increasing) 1 – reversed hysteresis (decreasing)
29	0	0..3	Temperature governor coupled to relay REL 3 0 – simple hysteresis 1 – reversed hysteresis 2 – approaching hysteresis 3 – PID
30	0	0..1	Humidity governor coupled to relay REL 5 0 – simple hysteresis (increasing) 1 – REL 5 signals ALARM
31	1,0	0.0 .. 5.0°C	Lower hysteresis for the governor coupled to REL 1
32	1,0	0.0 .. 5.0°C	Lower hysteresis for the governor coupled to REL 2
33	1,0	0.0 .. 5.0°C	Lower hysteresis for the governor coupled to REL 3
34	1,0	0.0 .. 5.0°C	Lower hysteresis for the governor coupled to REL 5
35	1,0	0.0 .. 5.0°C	Upper hysteresis for the governor coupled to REL 1
36	1,0	0.0 .. 5.0°C	Upper hysteresis for the governor coupled to REL 2
37	1,0	0.0 .. 5.0°C	Upper hysteresis for the governor coupled to REL 3
38	1,0°C	0.0 .. 5.0°C	Upper hysteresis for the governor coupled to REL 5
39	20°C	0..200°C	Temperature of activation (Tga) of the governor coupled to REL 1 for the „ set value approach" algorithm
40	20°C	0..200°C	Temperature of activation (Tga) of the governor coupled to REL 2 for the „ set value approach" algorithm
41	20°C	0..200°C	Temperature of activation (Tga) of the governor coupled to REL 3 for the „ set value approach" algorithm
42	1	0..100 s	Time delay of the governor [seconds] coupled to REL 1
43	1	0..100 s	Time delay of the governor [seconds] coupled to REL 2
44	1	0..100 s	Time delay of the governor [seconds] coupled to REL 3
45	0	0..12	Condition for the START mode end
46	1	0..1	Recording 0 – continuous recording 1 – recording only in the START mode

47	HMD	HMD / HM	AUTOSTART mode – parameters' format HMD – hour, minute and twenty-four hours delay before the START of the process HM – number of hours and minutes remaining to the START mode
48	5	0..10 hours	Maximal time (in hours) after which (when there was a power failure) the controller does not return to the START mode
49	1	1..360 min	Rate of the measurements recording
50	1	1..360 min	Rate of alarms recording
51	°C	°C / F	Temperature unit
52	1 [min]	0..99 [min]	Sound signal - duration. Note! When 0 value entered, the signal can be deleted by the OK key!
53	1	0..1	Alarm output mode of operation 0 – interrupted signal 1 – continuous signal
54	150°C	-99.. 999°C	Maximal permissible temperature (alarm)
55	99%	0…100%	Maximal permissible humidity (alarm)
56	-	-	-
57	-99°C	-99.. 999°C	Minimal permissible temperature (alarm)
58	99%	0…100%	Minimal permissible humidity (alarm)
59	-	-	-
60	Off	On / Off	Alarm activation – failure of the sensor in channel 1
61	Off	On / Off	Alarm activation – failure of the sensor in channel 2
62	Off	On / Off	Alarm activation – failure of the sensor in channel 3
63	Off	On / Off	Alarm activation - Max temperature exceeded
64	Off	On / Off	Alarm activation - Max humidity exceeded
65	-	-	-
66	Off	On / Off	Alarm activation - Min temperature exceeded
67	Off	On / Off	Alarm activation – Min humidity exceeded
68	-	-	-
69	0	0..4	Control input 1 0 - alarm switched off 1 – alarm, when inputs 6-8 shorted 2 – alarm, when inputs 6-8 not shorted 3 – keyboard lockout when inputs 6-8 shorted 4 - keyboard lockout when inputs 6-8 not shorted
70	0	0..4	Control input 2 0 - alarm switched off 1 – alarm, when inputs 7-8 shorted 2 – alarm, when inputs 7-8 not shorted 3 – keyboard lockout when inputs 7-8 shorted 4 - keyboard lockout when inputs 7-8 not shorted
71	60	0..999 s	Time delay in the alarm signaling, when sensors are faulty
72	60	0..999 s	Time delay in the alarm signaling, when permissible settings exceeded
73	60	0..999 s	Time delay in the alarm signaling, when alarm on control inputs
74	0	0..999	Change of the access code to SETUP 0 value – checking the code switched off
75	1	0..245	Address in MODBUS network of the SLAVE device (digital sensor of humidity and temperature)

76	1	0..3	Selection of the method of humidity measurement 0 – on the bases of current in channel 2 1 – external digital humidity sensor (RS485) 2 – psychrometric measurements 3 – digital measurement from the LGT (H) -02 CLIP sensor connected to the IN2 input
77	1	0..2	Selection of the method of temperature measurement 0 – analogue input of channel 1 1 – external digital temperature sensor (RS485) 2 – digital temperature sensor LGT (H) -02 CLIP sensor connected to the IN2 input
78	0	0..1	Selection of the psychrometric table 0 – table for the air velocity up to 0.5 m/s 1 – table for the air velocity up to 2.5 m/s
79	0	-99..100	The set temperature offset for the governor coupled to relay REL 3, used at two-step heating.

CONDITIONS FOR THE END OF THE CYCLE

No	Condition for the end of the cycle
0	End of the cycle, when the set time obtained
1	End of the cycle, when the set temperature exceeded
2	End of the cycle, when the set humidity exceeded
3	End of the cycle, when the set time obtained or when the set temperature exceeded
4	End of the cycle, when the set time obtained or when the set humidity exceeded
5	End of the cycle, when the set time obtained and the set temperature exceeded
6	End of the cycle, when the set time obtained and the set humidity exceeded
7	End of the cycle, when the temperature decreases below the set value
8	End of the cycle, when the humidity decreases below the set value
9	End of the cycle, when the set time obtained or when the temperature decreases below the set value
10	End of the cycle, when the set time obtained or when the humidity decreases below the set value
11	End of the cycle, when the set time obtained and when the temperature decreases below the set value
12	End of the cycle, when the set time obtained and the humidity decreases below the set value

EXAMPLE OF APPLICATION *

REL 3: temperature governor
REL 4: controled in the START mode
REL 5: humidity regulation or alarm event signaling

REL2: humidity governor

REL1: temperature governor

* The example of application should give the user a general idea only, and can not be considered the project of the control system - neither as total one nor as its part.

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