NR9003/STA61M

CODE	DESCRIPTION
NR9003	Digital Controller for radiant panels
STA61M	Ambient temperature and humidity sensor

APPLICATION AND USE

NR9003 is a digital controller that allows to manage the control both in heating and cooling of the mixing group of a radiant panel system with a maximum of 9 independent zones through temperature and relative humidity sensors positioned in each single zone acting on actuators electrothermals positioned on the distribution manifold (if more than 3 zones have to be managed, a second controller must be added as expansion connected to the master controller via Modbus communication bus). In addition, the controller is able to enable a possible dehumidifier on the basis of the relative humidity measured in the rooms for humidity control and as a safety against possible condensation during the summer. STA61M temperature and relative humidity sensors are connected to the controller via a Modbus communication bus and allow the setting of an hourly temperature setpoint (daily and weekly) and a relative humidity setpoint for each individual zone.

NR9003 is equipped with a second RS485 communication port (Slave) to communicate with a supervision or other Master devices, through the Modbus protocol.

NR9003 is built on an M6 module for mounting on a DIN rail.

TECHNICAL CHARCTERISTICS

NR9003 power supply: 85-265Vac (isolated)
Protection degree: IP 20
Operating temperature: 2T45°C
Storage temperature: -25T65°C

NR9003 "MASTER" Input

Digital input (DI1) Plant On/Off [1]

Digital input (DI2) Seasonal change [2]

Digital input (DI3) Thermostat for the detection of the maximum flow temperature [3]

Digital input (DI4) End-stroke status of electro-thermal heads / Dew detector [4]

Analogic input (S1) Flow temperature sensor (NTC)

Analogic input (S2) Passive external temperature sensor (NTC)

Analogic input (S3) "Bath Towel" temperature sensor (NTC)

Analogic input (S4) External temperature sensor active (0-10V)

The digital inputs are different meaning based on their configuration.

[1] Through the configurator it is possible to select whether the switching on or off can be verified by local input (DI1), by supervision, or both. In this case, input DI1 will be interpreted on the signal voltage.

[2] The configurator can be used to select whether the seasonal switching can be made from room (input DI2), from supervision or from exceeding external temperature thresholds (settable values).

[3] Through the configurator you can select whether or not there is a thermostat for detecting the maximum flow temperature.

[4] The configurator can be used to select whether the DI4 input is used to identify the end-of-stroke status of the electrothermal heads or as a dew detector.

Through the configurator it is possible to invert the meaning of the status of the digital inputs (normally open (N.O.) or normally closed (N.C) contacts.
The default states (factory configuration) are shown in the following table:

DIGITAL INPUT	DEFAULT	DESCRIPTION
ON / OFF PLANT	Normally open	OPEN – comfort CLOSE – off (antifreeze protection)
SEASONAL CHANGE	Normally open	OPEN – Winter CLOSE – Summer
THERMOSTAT FOR THE PRESSURE OF THE MAXIMUM FLOW TEMPERATURE	Normally open	OPEN – No detection CLOSE – Maximum temperature detection
END-STROKE STATUS OF ELECTRO-THERMAL HEADS / DEW DETECTOR	Normally open	OPEN – No detection CLOSE – End-stroke / Condensed detection

Input NR9003 "SLAVE"

They are not used.

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NR9003 "MASTER Output

4 Triacs outputs (Contact Range 24-250V 4A)
- Output Triac 1 Control open hot/cold Valve
- Output Triac 2 Control close hot/cold Valve
- Output Triac 3 Zone 3 thermostatic head control
- Output Triac 4 "Heated towel rail" thermostatic head

6 Relay Outputs (Contact Range 24-250V 8A)
- Output Relay 1 Zone 1 thermostatic head control
- Output Relay 2 Zone 2 thermostatic head control
- Output Relay 3 Circulation pump control (flow)
- Output Relay 4 Dehumidifier control
- Output Relay 5 Integration control
- Output Relay 6 Heat pump control

2 Analogic output 0-10 V (Max Curent: 20 mA)
- Output AO1 Proportional Control hot/cold Valve
- Output AO2 Not used

2 Output Open Collector (Maximum range of 18mA. They can be used to drive 12Vdc relays with a maximum power of 220 mW and winding resistance ≥ 640 Ohm (relay module reference Controlli code DGSRMV)
- Output Open Collector 1 Heat Pump S/W Control
- Output Open Collector 2 Not used

1 RS484 Slave communication port
- Supervision connection with Modbus protocol

1 RS484 Master communication port
- Connection to NR9003 device configured as Slave and STA61M sensors

NR9003 "SLAVE" Output

Only Relay outputs are used.

6 Relay Outputs (contact range 24-250V 8A)
- Output Relay 1 Zone 4 thermostatic head control
- Output Relay 2 Zone 5 thermostatic head control
- Output Relay 3 Zone 6 thermostatic head control
- Output Relay 4 Zone 7 thermostatic head control
- Output Relay 5 Zone 8 thermostatic head control
- Output Relay 6 Zone 9 thermostatic head control

1 RS484 Slave communication port
- Connection to NR9003 with Modbus protocol

Directives and Regulations

CEI EN 60730-1 standard for EMC directive.
Standard CEI EN 60730-1 and CEI EN 60730-2-9 for LVD directive.

INSTALLATION

NR9003 controller

NR9003 is suitable for DIN rail mounting with quick coupling. The electrical connections must be made in compliance with current controls and using conductors with a maximum cross-section of 2.5mm^2 for terminals J1 and J2 and 1.5mm^2 of section for connectors J3 and J4.
Use cable lugs on the power cables to avoid accidental contact between cables with different voltages, in case of incorrect installation.
The main power supply is completely isolated, but it is advisable to install a protection device in compliance with current legislation with a 125mA operating threshold and a minimum of 3mm contact opening. The device is not supplied with the product.

STA61M sensor

Refer to the DBL469e documentation attached to the product.

MAINTENANCE

The equipment is maintenance-free.

TERMINAL BLOCKS

The controller is equipped with removable 5.08mm pitch terminals (J1 and J2) for low voltage (230V) and 3.5mm pitch (J3 and J4) signals for very low voltage signals.

NR9003 "MASTER"

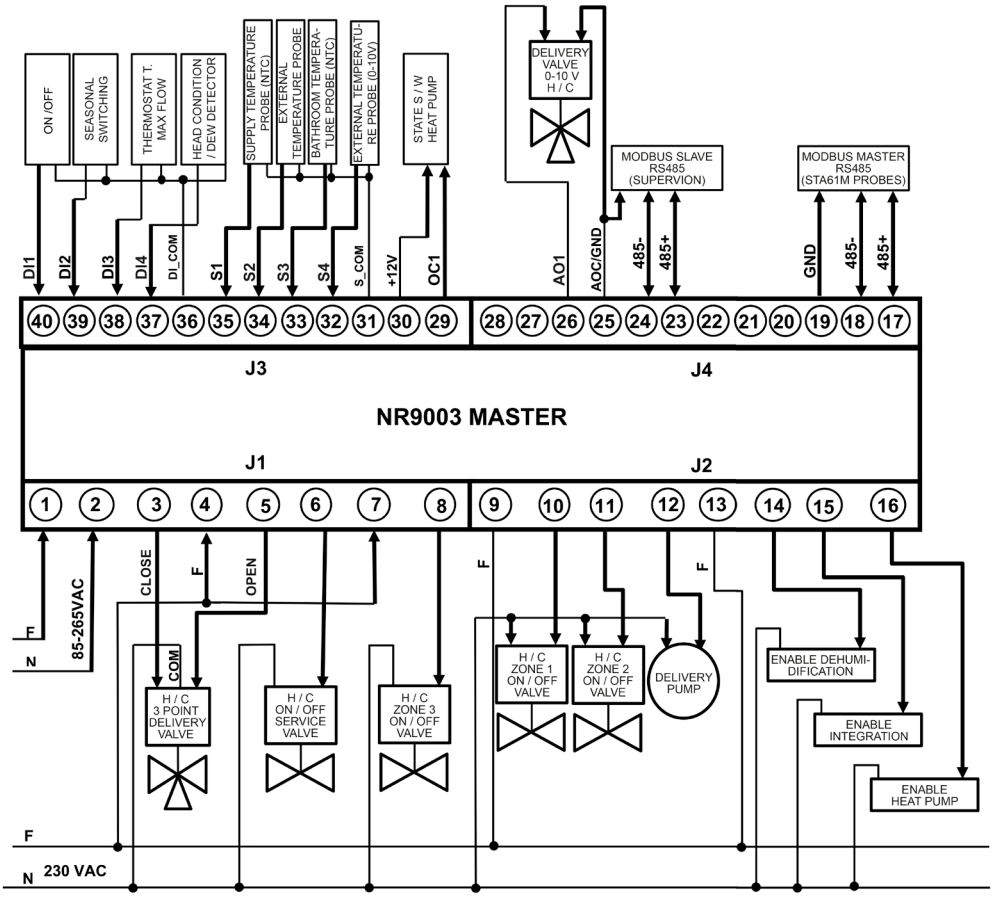
CONN	# pin	Signal	Direction	Type of signal	Description
J1	1	F	Input	85-265Vac line phase	Power supply
	2	N		85-265Vac line neutral	
	3	TR 2	Output	Triac 24…230Vac 4A	Close Hot / Cold Valve
	4	Com 1/2	Output	COM Triac 1-2	Valve COM
	5	TR 1	Output	Triac 24…230Vac 4A	Open Hot / Cold Valve
	6	TR 4	Output	Triac 24…230Vac 4A	"Bathroom" Electrothermal Head
	7	Com 3 /4	Output	COM Triac 3-4	COM Head / Pump
	8	TR 3	Output	Triac 24…230Vac 4A	Zone 3 Electrothermal Head
J2	9	Com R123	Output	COM Relay 123	COM Relay 1, 2, 3
	10	R1	Output	Relay 24…230Vac 8A	Zone 1 Electrothermal Head
	11	R2	Output	Relay 24…230Vac 8A	Zone 2 Electrothermal Head
	12	R3	Output	Relay 24…230Vac 8A	Circulation pump
	13	Com R456	Output	COM Relay 456	COM Relay 4, 5, 6
	14	R4	Output	Relay 24…230Vac 8A	Dehumidifier
	15	R5	Output	Relay 24…230Vac 8A	Integration
	16	R6	Output	Relay 24…230Vac 8A	Heat pump
J3	40	DI1	Input	Digital 1 / 24Vac	Plant ON / OFF
	39	DI2	Input	Digital 2 / 24Vac	E / I switching
	38	DI3	Input	Digital 3 / 24Vac	Thermostat T. Max Flow
	37	DI4	Input	Digital 4 / 24Vac	Head Condition / Dew Detector
	36	Com DI	Input	COM	Digital input COM
	35	S1	Input	Analogic Input 1	Supply Temperature Sensor (NTC)
	34	S2	Input	Analogic Input 2	External Temperature Sensor (NTC)
	33	S3	Input	Analogic Input 3	Bathroom Temperature Sensor (NTC)
	32	S4	Input	Analogic Input 4	External Temperature Sensor (0-10V)
	31	Com S	Input	Analogic Input COM	COM Sensor
	30	Com OC	Output	COM Open Collector	COM Open Collector + 12V
	29	OC1	Output	Open Collector 1	External relay 1 - State E / I Heat Pump
J4	28	OC2	Output	Not used	
	27	AO2	Output	Not used	
	26	AO1	Output	Analogic output 1	Proportional C / F Valve (0-10V)
	25	Com AO	Bidir.	Analog. Output COM	COM / Shield 485
	24	485-	Bidir.	Bus RS485 -	Modbus Slave (Supervision)
	23	485+	Bidir.	Bus RS485 +	Modbus Slave (Supervision)
	22	+12V	Output	Not used	
	21	SDA	Bidir.	Not used	
	20	SCL	Bidir.	Not used	
	19	GND	Bidir.	Shield 485	Shield 485
	18	485-	Bidir.	Bus RS485 -	Modbus Master (STA61M Sensors)
	17	485+	Bidir.	Bus RS485 +	Modbus Master (STA61M Sensors)

NR9003 "SLAVE"

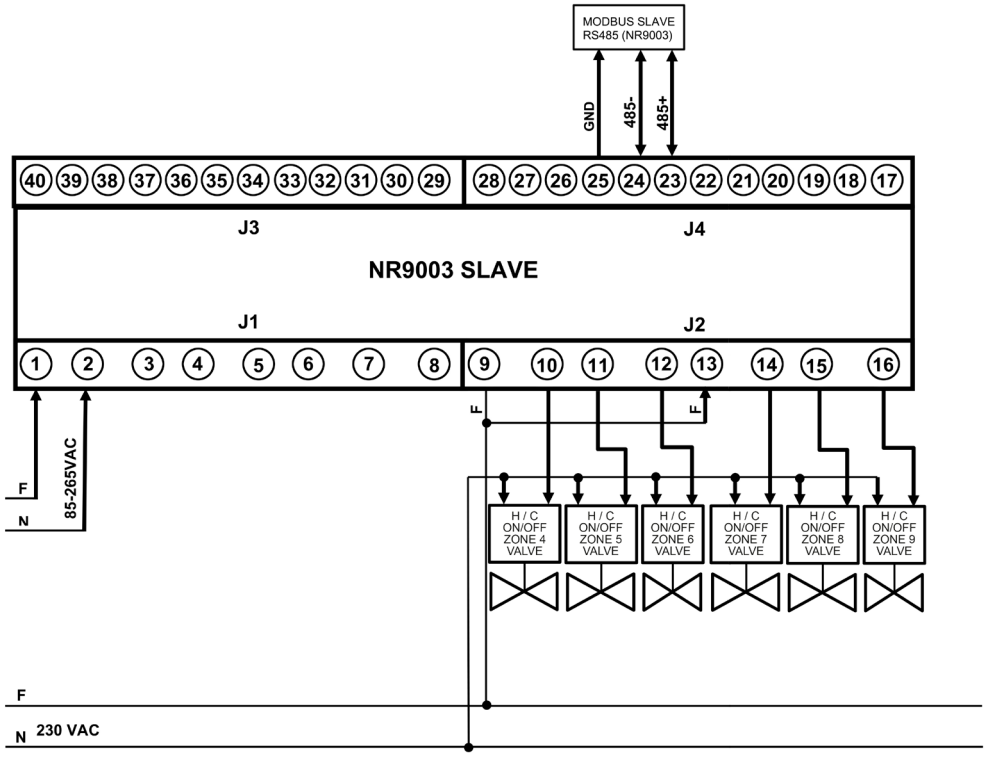
Only the terminals shown in the table are used.

CONN	# pin	Signal	Direction	Type of signal	Description
J1	1	F	Input	85-265Vac line phase	Power supply
	2	N		85-265Vac line neutral	
J2	9	Com R123	Output	COM Relay 123	COM Relay 1, 2, 3
	10	R1	Output	Relay 24…230Vac 8A	Zone 4 Electrothermal Head
	11	R2	Output	Relay 24…230Vac 8A	Zone 5 Electrothermal Head
	12	R3	Output	Relay 24…230Vac 8A	Zone 6 Electrothermal Head
	13	Com R456	Output	COM Relay 456	COM Relay 4, 5, 6
	14	R4	Output	Relay 24…230Vac 8A	Zone 7 Electrothermal Head
	15	R5	Output	Relay 24…230Vac 8A	Zone 8 Electrothermal Head
	16	R6	Output	Relay 24…230Vac 8A	Zone 9 Electrothermal Head
J4	25	GND	Bidir.	Shield 485	Shield 485
	24	485-	Bidir.	Bus RS485 -	Modbus Slave (NR9003)
	23	485+	Bidir.	Bus RS485 +	Modbus Slave (NR9003)

NR9003 "MASTER"



NR9003 "SLAVE

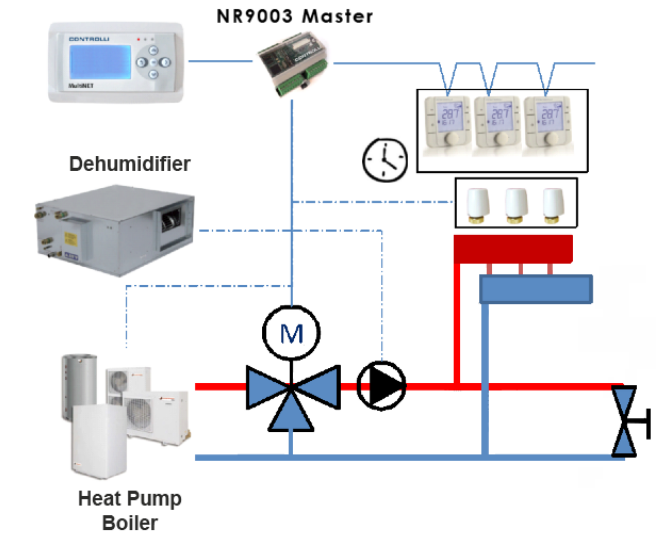


OPERATION

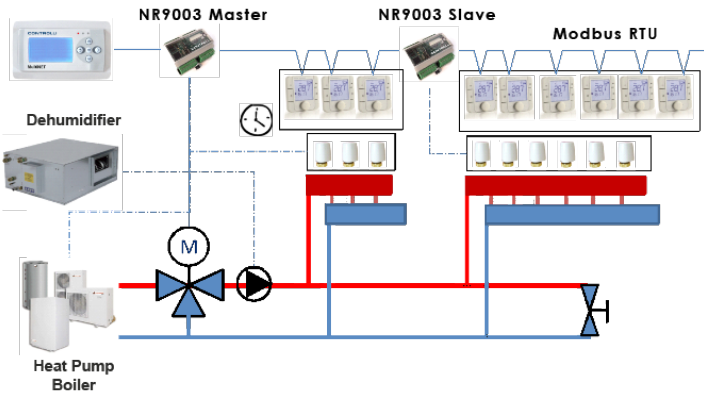
The controller works with internally stored parameters that can be modified by supervision or a specific configuration tool (Modbus protocol).
The NR9003 Controller can be configured to manage the primary fluid, through the control of a mixing valve and a circulation pump, and three electrothermal heads to manage as many zones.
The addition of NR9003 configured as "Slave" will allow managing 6 additional zones for a total of 9.
A communication bus will allow to acquire local information of the zones (temperature, humidity and relative Set) through the STA61M sensors and manage, consequently, the opening/closing of the electrothermal heads of the radiant panels of each zone.
It will also be possible to enable different functions based on the devices present on the system.

The system can be configured as shown in the following figures:

Flow management and 3 zones



Flow management and 9 zones



Controller configuration

The controller has 8 DIP switches for:
- Configure a controller as "Slave"
- Set the Modbus address
- Define the number of zones to be managed

The complete description of the DIP is in the paragraph "DIP SWITCHES NR9003".

STA61M sensor configuration

As described in the "STA61M SENSOR" paragraph, the sensors must be preconfigured for:

- Set the communication speed (baud rate 9600);
- Set the Modbus address (1 - 9);
- Set the time;
- Set the time program if required.

Supervision

To control the NR9003 controllers, use the MT-NET-PON3 operator panel.
The MT-NET-PON3 can manage up to 8 NR9003 controllers via an RS485 serial line and the Modbus RTU (master) protocol.
Micronet View (PC), the GTO/GTW series Touch Screen or the BlueID system, appropriately engineered for the specific installation, by connecting through the MT-NET-PON3 operator panel via an Ethernet network.
STA61M to modify the set, activate the zone pressure and activate the measurement sequence. All the parameters related to the NR9003 control will be manageable.

Modbus-RS485 connection

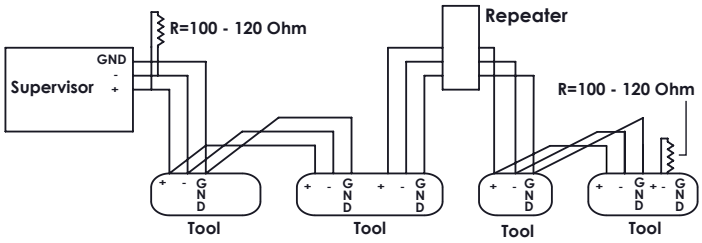
The RS485 network is made with a 3-conductor cable, which will be recognized as "+" (pin 23), "-" (pin 24) and "GND" (pin 25). For the wiring we suggest the Belden® cable, model 8762. In particularly "disturbed" environments we suggest the Belden® cable, model 3106A connecting the twisted pair to the "+" and "-" signals, respectively, the reference conductor to GND and the screen on the ground. Alternatively, a cable with the following electrical and mechanical characteristics can be used:
- AWG 20/22;
- characteristic impedance of 120Ω;
- with copper wires, twisted type, twisted;
- with sheathed shielding and protective insulation.

The shield must be connected to the GND signal (pin 25) of the controller. The network must be wired only according to the following principle, called "daisy chain" (the device consists of a single RS485 Slave port). Star connections are not allowed.

CONNECTION WARNINGS
For proper network cabling is recommended to take the following precautions:
1. Do not use different types of cable to achieve the same network, but always use only the same type of cable;
2. The network cable carries out safety voltage signals (SELV) and must not be wired together with dangerous voltage signals (eg 230V) or carriers of high currents, especially if in alternating current. Also avoid parallel paths to these power cables;
3. Wire the cable lying avoiding kinks, narrow bending radii and unnecessary wrapping in hanks or skeins;
4. Do not twist the cable cord around the power conductors and, if they should cross, consider an intersection at 90 ° between the cable and these conductors;
5. Keep away from sources of electromagnetic field in particular by large motors, electrical cabinet, reactors for neon, all types of antennas;
6. Do not pull the power cable exceeds 110 N (11.3 kg) to prevent ironing;
7. Assess in advance the route so that it will be as short as possible and note addresses of connected instruments with particular reference to its location in the orderly sequence. This can be very useful in maintenance; we recommend to note the Modbus Address on the product label.
8. Do not reverse the polarity "+" and "-" of the connection terminals;
9. Avoid short lengths of cable terminations in connection tools to make a maintenance without tearing or flues of the cables possible;
10. Identify start and ending terminations and avoid cuts "open".

Termination resistors and network polarization

The "slew-rate" control, common to all our converters, and the baud rate limited to 9600baud (bit/sec) make the termination resistors unnecessary.
The RS485 network requires bias typically applied to the Master device; the controller does not have polarization resistors.
The tranceiver used by the controller allows to drive up to 256 knots.
The RS485 standards have a maximum length of 1200m and/or 32 devices in the network. However, it should be noted that the more "standard" limits are exceeded (maximum limit of 32 devices or cable lengths greater than 1200m), the higher the probability of communication problems.
The phenomenon is not systematic and may not even show up. Vice versa, if present, and none of the points indicated in this paragraph has allowed to solve the problem, it is suggested the connection of a repeater (code CONV-RS485-RIP), as shown below:



N.B: Connect the repeater if the length of the network cables exceeds 1200 m or if the devices are more than 32.

CONTROLLER FUNCTIONS

Primary fluid control

NR9003 controller manages a 2-pipe system for regulating the temperature on the flow manifold (sensor input S1) through a 3-way valve controlled by a 3-point or 0-10V actuator and a circulation pump.
The system can be switched on or off by local input (DI1), by supervision, or both.
In the latter case, the system is switched on or off by following the last command received both by a switchover of the digital input and by supervision.
The flow temperature set can be determined in one of the following ways (configurable):

- Fixed point for hot and cold fluid;
- Climatic for the winter season (hot fluid), compensated with external sensor (TE). The summer season will be managed at a fixed point;
- Dew point for the summer season (cold fluid), with safety offset of -2 ÷ 4 ° C (default equal to 0), calculated as an average value considering the temperature and humidity values detected by the STA61M sensors present in the zones.
- The winter season will be managed at a fixed point.
- Climatic + Dew Point.

On the flow pipe will be present (default input disabled) a safety thermostat for the detection of the maximum temperature, while on the flow manifold will be present (default input disabled) a dew sensor.
In case of intervention of one of the two sensors the pump will be stopped and the mixing valve closed.
The external temperature sensor can be of the passive type (NTC), active (0-10V) or it is possible to use the external temperature measurement carried out by other controllers and shared by the supervision system.

Zones control

NR9003 will manage, through the electrothermal heads, directly 3 zones. Another 6 zones can be managed by the NR9003 controller configured as Slave.
Each zone has a STA61M sensor which, connected via Bus, communicates the following information to the NR9003 controller:

- Ambient temperature setpoint
- Room temperature
- Ambient humidity setpoint
- Ambient humidity
- ON/OFF status of the zone, defined by hourly programming or manually by sensor button.

The system will identify the STA61M sensor number 1 as a reference sensor for setting the time and will be recognized for the presence of the "key" symbol on the display.
The STA61M number 1 will have the function of "Time Master" and will synchronize all the other sensors present at every hour or on the time variation by the user.
Of the 4 buttons on the STA61M only the ON-OFF keys (power button symbol) and "Clock" will be active. The FAN (fan symbol) and MODE keys are disabled.
The room temperature will be displayed on the main page and by turning the knob it will be possible to change the room temperature Set (minimum and maximum value that can be set, default 10-35 ° C).
In the secondary page (accessible by pressing the knob) the room humidity will be displayed and by turning the knob it will be possible to change the room humidity set (minimum and maximum settable value, default 50-80%).
In the following pages of the sensor navigation menu (accessible by pressing the knob) it will also be possible to display the outside temperature and an error code (see ERRORS paragraph).
All hourly commutations will be active (for a total of 6 commutations) that can only be set locally to the sensor (by setting the time and operating set for each time switch).
For the time table settings, see the paragraph "NAVIGATION".
The NR9003 controller will process this information to manage the zone circuit by means of an electrothermal actuator.
For each zone the dew set (which corresponds to the dew point) will be dynamically calculated.
In Summer, if the temperature of the supply fluid is lower than the value of the calculated Dew Set of the single zone, the zone valve will be closed to prevent local condensation.
The humidity value will help to define the dew point and to manage the dehumidifier for dehumidification (depending on the set set).
The temperature value will contribute to the management of the dehumidifier for the integration of heat (winter) and cold (summer).

On/Off

The controller can be switched on or off via digital input DI1, via supervision (ModBus protocol) or both. Input DI1 is managed to recognize the change in status. In this way it is possible to manage in parallel enabling and disabling from digital input and from supervision (in this case the last setting is the valid one).
When the system is disabled (OFF) if the season is winter the controller will work in "frost protection" with room temperature set for the various zones set at a fixed value of 8°C.
With the system switched off, the flow set will be to antifreeze (default value 8°C). In this condition the control valve will be closed and the circulation pump switched off. If the flow temperature falls below the antifreeze set, the control valve will open and the circulation pump will be activated.
In case of intervention of the "Zone Antifreeze Protection" (minimum temperature of the zones lower than 8°C) the control of the primary flow fluid will be enabled with the same set flow for the heating regime and will enable the output to control the Heat Pump / Boiler as long as the minimum room temperature does not exceed 8°C.

Summer/winter changeover

Seasonal switching can be performed by digital input (DI2), by Supervision or by exceeding external temperature thresholds (settable values).

Maximum flow temperature thermostat

Optionally, to protect the system, a maximum temperature thermostat may be present on the supply connected to the digital input DI3.
In the event that the flow temperature exceeds the maximum allowed value, the mixing valve is forced to close and the pump stopped (without delay).

Micro end cap stroke/dew detector input

The digital input DI4 can be configured with two possible functions:

1. Fine-stroke microswitch: it is a cumulative input of the status of the end-of-run microswitches of the zone electrothermal heads. The status of the input informs the controller if at least 1 head has opened and therefore at least 1 circuit is open; this information is used as consent to the control of the mixing valve and to the start of the circulation pump.

2. Dew detector: in summer, with cold fluid, if condensation principles are present, the cooling of the entire system is blocked, closing the mixing valve, stopping the circulation pump and closing all the electrothermal heads.

Flow temperature sensor

The flow temperature sensor is positioned near the flow manifold.
The read value is used by a Loop P + I to determine the position of the mixing valve to satisfy the flow set.

External sensor

The external temperature sensor can be of the passive type (NTC), active (0-10V) or it is possible to use the external temperature measurement from other controllers and shared through the supervision and selection system in the presence and following priority:

- Passive external sensor (S2);
- Active external sensor (S4);
- External supervision sensor.

The external sensor is used to define the compensated flow temperature set (climatic), the interruption of the control of the temperature limit and winter (if function enabled) enabled).

The external supervisor sensor in writing the memory value in the RAM memory of the controller via the Modbus protocol.
The value of the sensor is the value in memory has been written at least once. It must be different from 0x8000.

Flow temperature set

The flow temperature set can be defined as:

- Fixed point: in memory a Hot Set and a Cold Set are set;

- Climatic: in winter the flow set is determined according to the outside temperature. To define the compensation curve, set 4 points: Set Max - Te min and Set min - Te max. The climate set parameters will also be Limits;

- Dew Point (Dew Point): in Summer the flow set is determined as the average of the Dew Point calculated for the various zones plus a settable correction (values between -2 ÷ + 4, default equal to 0). The calculation of the Dew Point of the individual zones is done considering the value of the temperature and relative humidity detected by the STA61M sensors present in the various zones.

The method for calculating the flow is set during the configuration phase of the plant via the configurator.

Flow mixing valve

The mixing valve can be controlled by a 3-point proportional servocontrol (controlled with 2 Triac outputs TR1 and TR2) or by a proportional servo control 0-10 volts (controlled by analogue output AO1).
In the case of 3-point servocontrol, every time the controller is powered, an initial positioning is performed when a time equal to 33% (default 60 seconds) occurs.
Moreover, for the 3-point servocontrol, the Cut-off function is provided which interrupts the driving of the actuators after a time equal to the stroke time of the valves plus 33%, in order to ensure the correct closing of the valve, to reduce the noise and consumption. The function can be disabled by supervision and in this case the actuator is controlled indefinitely when it is at the ends of the travel (by default the function is enabled).
The mixing valve is forced to close due to safety intervention (if enabled):

- Electrothermal heads all closed;
- Intervention Thermostat Maximum flow temperature (DI3);
- Dew detector intervention (DI4) on the flow (in summer);
- Plant interdiction.

Circulation pump

The flow circulation pump (controlled by the Relay R3 output) will be managed according to the switching on or off of the system.
When the system is switched on, the pump is activated following the opening of the mixing valve, while when it is switched off, or when the valve is closed (for satisfied set), a delay time can be set to deactivate it (to dispose of the accumulated energy in the plant).
The delay is not considered when the pump is deactivated due to the intervention of safety functions:

- All closed electrothermal heads (DI4);
- Intervention Thermostat Maximum flow temperature (DI3);
- Dew detector intervention (DI4) on the flow (winter);
- Interdiction adjustment.

Electrothermal heads

The Master controller can manage 3 of the 9 possible Zones (6 Zones are managed by the Slave controller). The ON/OFF valves are positioned on the return manifold and are controlled by electrothermal heads activated through the Relays (R1, R2 and TRIAC TR3) of NR9003 controller and (R1, R2, R3, R4, R5, R6) of NR9003 configured as a Slave.
Their function is to activate/deactivate the hydraulic circuit (radiant panel) of a specific area.
Optionally (default active function) the controller has a digital input to detect the status (open/closed) of the heads.
If all the heads are closed (set is satisfied in all zones) the flow control is stopped (closed valve and circulation pump stop without delay).

Boiler / heat pump enabling

Optionally (default function not active) a consent can be managed to a boiler or heat pump (through relay output R6) to provide an enabling to the hot or cold fluid source depending on the summer or winter operating mode.
The activation of the boiler / heat pump normally follows the system status (ON / OFF).
When the system is OFF and the antifreeze condition has been activated in one of the zones (room temperature lower than 8 ° C), the boiler or the heat pump (in winter operation) will be activated.

In the case of heat pump management, it is necessary to provide the summer or winter operation mode through the Open Collector OPC1 output that will control a contact relay to make a digital contact available.

Wipes heat management

Optionally (function not active by default) and only in Winter, it is possible to manage a possible radiator to heat a certain room (e.g. bathroom). Only in heating mode the hydraulic circuit relative to the radiator will be enabled through an electrothermal head activated with the TRIAC TR4 output.
If the temperature sensor S3 is also present in the room, an ON/OFF loop with an editable set in the controller memory and fixed hysteresis 1°C will be managed, otherwise the TRIAC TR4 will always be active.
If the system is switched off (OFF), the TRIAC TR4 is deactivated by closing the electrothermal head.
In summer mode the TRIAC TR4 output is always disabled.

Interdiction configuration

This function can be optionally enabled and is used to save energy if external environmental conditions allow it.
This function blocks the primary control if the outside temperature is higher than the winter threshold in Winter or less than the summer sensor in Summer. The value of the thresholds can be set by Supervision.

Dehumidifier

Optionally (function not active by default) the controller can manage, through 2 dedicated digital outputs, the activation status of the following functions implemented by the "dehumidifier machine":

- INTEGRATION
- DRY

These states can both be active.

INTEGRATION

The integration consists in activating the "dehumidifier machine" (management of hydronic batteries) to produce primary hot/cold air to be introduced into the various environments in order to accelerate the setting in place of the environment.
The activation is given by a digital output (relay R5) of NR9003 and the logic is as follows:

In winter mode, the room temperature zone set (configurable minimum, medium, maximum) and an intervention band (XP) of the integrator are used.
If the ambient temperature is lower than Set - XP, the electrothermal heads + the integration (hot air) is managed.
If the ambient temperature is higher than the Set - XP, only the electrothermal heads are managed.

Ex .: Set = 20°C, XP = 5°C.
For ambient temperatures below 15°C → active both thermostatic head and integration.
For ambient temperature between 15 ÷ 20°C → active only thermostatic head.

With the system OFF, the integration is not active.

In summer operation, if the ambient temperature is higher than Set + XP, the electrothermal heads + the integration (cold air) is managed.
If the ambient temperature is lower than Set + XP, only the electrothermal heads are managed.
Ex .: Set T = 20°C, XP = 5°C.

For ambient temperature above 25°C → active both thermostatic head and integration.
For ambient temperature between 20 ÷ 25°C → active only thermostatic head.

DRY

Dehumidification can only be activated in Summer and consists in activating the "dehumidifier machine" to produce dry air to reduce humidity in the environment. The activation is given by a digital output (relay R4) of the controller.
Dehumidification can be "Global" (active by default) or "Local".

Global dehumidification compares the humidity set (unique for all zones) set in the controller with the value (minimum configurable choice, average, maximum) of the humidity detected in the various zones by the STA61M sensors. If the humidity is greater than the set, dehumidification is activated. It is deactivated if lower than Set H - Hysteresis H.

Local dehumidification will compare the humidity set of each individual room (set on the sensor) with the measured humidity value.
To activate the dehumidifier it will be sufficient that at least one sensor has humidity higher than the local set.
To deactivate the dehumidifier, all the zones must have the humidity lower than the local H set - Hysteresis H.

When the system is OFF, dehumidification is not active.

Initial position of the actuator 3 points

In order to correctly control the valves with the 3-point actuators, initial positioning must be carried out. Each time NR9003 is powered it controls the actuator in the closed position for a time equal to the stroke time of the valves plus 33%.

Controller configuration

The controller to be configured requires a configuration software (free download from www.controlli.eu) connected to the RS485 communication port via a special USB-RS-485 converter (LIBO-USB). This software allows an easy and intuitive configuration of the controller and in a completely invisible way it sends the configuration to the controller through 3 status words that define the operating modes.

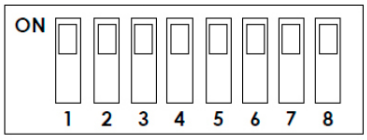
If you do not want to use the configurator, here are the tables that identify the meaning of the individual bits of the 3 status words PSW (Byte) to be able to make a configuration also from another program via Modbus RTU protocol.
More active functions generate a configuration code resulting from the sum of the various weights.

Controller configuration values

PSW 1	BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	PESO	DESCRIPTION
SUMMER / WINTER CHANGEOVER	0	0							0	FROM DIGITAL INPUT DI2
	1	0							1	FROM SUPERVISION (MODBUS)
	0	1							2	FROM EXTERNAL TEMP. (EXCEEDING THRESHOLDS)
	1	1							3	N.O.
FLOW SETPOINT			0	0					0	FIXED POINT
			1	0					4	CLIMATIC SET C (EXT. TEMP.)
			0	1					8	SET F DEW POINT CALC. AVERAGE
			1	1					12	CLIMATIC + DEW POINT
DEHUMIDIFICATION TYPE					0				0	GLOBAL - PLANT
					1				16	LOCAL - ZONE
PRESENCE TOWEL WARMER						0			0	NO
						1			32	YES
ON / OFF PLANT							0	0	0	DI1 INPUT
							1	0	64	MODBUS CONTROL
							0	1	128	BOTH ACTIVE
							1	1	192	N.O.
PSW 2	**BIT 0**	**BIT 1**	**BIT 2**	**BIT 3**	**BIT 4**	**BIT 5**	**BIT 6**	**BIT 7**	**PESO**	**DESCRIPTION**
DIGITAL INPUT N.A. / N.C.	0								0	INPUT OF 1 N.O.
	1								1	INPUT OF 1 N.O.
		0							0	INPUT OF 2 N.O.
		1							2	INPUT OF 2 N.C.
			0						0	INPUT OF 3 N.O.
			1						4	INPUT OF 3 N.C.
				0					0	INPUT DI 3 N.O.
				1					8	INPUT DI 4 N.C.
FLOW THERMOSTAT TEMP. MAX					0				0	ABSENT
					1				16	PRESENT
DIGITAL INPUT DI4						0			0	CONTACT F. C. TESTINE
						1			32	DEW DETECTIONS
INTERDICTION CONFIGURATION							0			NO
							1		64	YES
PRESENCE HEAT PUMP								0	0	NO
								1	128	YES
PSW 3	**BIT 0**	**BIT 1**	**BIT 2**	**BIT 3**	**BIT 4**	**BIT 5**	**BIT 6**	**BIT 7**	**PESO**	**DESCRIPTION**
DEHUMIDIFIER	0	0							0	ABSENT
	1	0							1	INTEGRATION
	0	1							2	DEHUMIDIFICATION
	1	1							3	INTEGRATION AND DEHUMIDIFICATION
ZONA TEMPERATURE AMBIENT SENSOR			0	0					0	MINIMUM VALUE
			1	0					4	AVERAGE VALUE
			0	1					8	MAXIMUM VALUE
			1	1					12	N.O.
ZONA HUMIDITY AMBIENT SENSOR	0	0			0	0			0	MINIMUM VALUE
	1	0			1	0			16	AVERAGE VALUE
	0	1			0	1			32	MAXIMUM VALUE
	1	1			1	1			48	N.O.
ROOM TEMPERATURE SETPOINT							0	0	0	MINIMUM VALUE
							1	0	64	AVERAGE VALUE
							0	1	128	MAXIMUM VALUE
							1	1	192	N.O.

DIP SWITCHES NR9003

The controller is equipped with a DIP switch that allows to set the Modbus address and the number of Zones that it must manage.
It also allows to define the NR9003 Controller as SLAVE.



DIP 1, 2, 3 set a Modbus address from 1 to 7.
The Modbus address of the device is determined by the sum of the value of the DIP 1, 2 and 3 + the value set in EEProm memory (default = 0).

Modbus Address	DIP 1	DIP 2	DIP 3
1	ON	OFF	OFF
2	OFF	ON	OFF
3	ON	ON	OFF
4	OFF	OFF	ON
5	ON	OFF	ON
6	OFF	ON	ON
7	ON	ON	ON
NR9003 SLAVE	OFF	OFF	OFF

DIP 4, 5, 6, 7 set the number of zones to be managed.

Zone number	DIP 4	DIP 5	DIP 6	DIP 7
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
NR9003 SLAVE	ON	ON	ON	ON

DIP 8 must be OFF (used for testing).

The controller is supplied with all DIPs in OFF, except DIP 1 in ON.

ERRORS

The system allows you to monitor the status of the various components. The errors can be displayed either on the STA61M sensors (as a code in the sub-level menu) or through the Supervision.
The table below identifies the meaning of the individual bits of the status word (Byte).
More active errors generate an error code resulting from the sum of the various weights.

Bit	Errors Management	Weight ON	Weight OFF
0	Flow sensor (S1)	1	0
1	External sensor (S2, S4, Mem)	2	0
2	Towel warmer sensor (Bathroom)	4	0
3	Not used	8	0
4	Communication STA61M sensors	16	0
5	Slave Controller Communication	32	0

Example:
Flow sensor error (weight 1) + error Communication Slave controller (weight 32) = 33

This value will be visible from the supervision and on the display of the STA61M sensor.

ACTIVE FUNCTIONS

The system allows to view the Active Functions in order to facilitate the understanding of certain operating states.
Active Functions can be viewed through Supervision.
The table below identifies the meaning of the individual bits of the status word (Byte).
More active functions generate a code resulting from the sum of the various weights.

Bit	Funzione	Peso ON	Peso OFF
0	Max thermostat	1	0
1	Dew detector	2	0
2	Hot fluid heat pump	4	0
3	Cold fluid heat pump	8	0
4	Interdiction configuration	16	0
5	Hot/Cold integration	32	0
6	Cold dehumidification	64	0
7	Antifreeze	128	0

Example:
Fluid Heat Pump Function Hot (weight 4) + Antifreeze function (weight 128) = 132

This value will be visible from supervision.

FAIL COMMUNICATION SENSOR

The system allows monitoring the communication status of the various Slave components.
In addition to the STA61M sensors, the status of the NR9003 Slave controller is monitored.
The communication status can be detected through supervision.
The table below identifies the meaning of the individual bits of the status word (Byte).
Multiple active communication errors generate an error code resulting from the sum of the various weights.

Bit	Label	Weight ON	Weight OFF
0	Slave controller	1	0
1	STA61M Mod. Addr. 1	2	0
2	STA61M Mod. Addr. 2	4	0
3	STA61M Mod. Addr. 3	8	0
4	STA61M Mod. Addr. 4	16	0
5	STA61M Mod. Addr. 5	32	0
6	STA61M Mod. Addr. 6	64	0
7	STA61M Mod. Addr. 7	128	0
8	STA61M Mod. Addr. 8	256	0
9	STA61M Mod. Addr. 9	512	0

Example:
Fail communication STA61M addr 3 (weight 8) + Fail communication STA61M addr 4 (weight 16) + Fail communication STA61M addr 8 (weight 256) = 280
This value will be visible from supervision.

LEDS CONTROLLER

The Controller has two Leds (red and green) that can be seen in the upper part through the transparent protective cover.
The table shows the meaning of the status of the NR9003 MASTER controller:

STATUS	GREEN LED	RED LED
FAIL Master Controller	OFF	OFF
OK Master Controller	ON	OFF
FAIL Slave Controller	OFF	ON
STA61M sensor errors	ON	ON
Local Sx Sensor Errors	BLINKING	ON

The NR9003 SLAVE controller, when powered, will always have the Green LED on and the Red LED Off.

READING STA61M SENSOR (Modbus Master communication)

NR9003 Master, every 20 seconds transmits to the STA61M sensors the parameters detected in the room (temperature and humidity), the set ones (Temperature button), the time and the ON status (ON/OFF by button or Schedule).
NR9003 Slave transmits the status of the electrothermal heads of zones 4 ... 9.

In case of modification of temperature and value data for 20 sec. This timing may increase in the presence of supervision.

DEFAULT PARAMETERS

The controller is supplied with the DIP switches in position (DIP 1 = ON: Modbus Address 1, DIP 4 = ON: Zone number 1) and with the adjustment parameters of the following table:

Parameter		Vmin	Vmax	Default
FLOW SUPPLY	Winter Fixed Setpoint Temperature	200 (20.0°C)	500 (50.0°C)	350 (35.0°C)
	Summer Fixed Setpoint Temperature	100 (10.0°C)	200 (20.0°C)	150 (15.0°C)
	Proportional Band Heat Loop	0 (0.0°C)	100 (10.0°C)	20 (2.0°C)
	Proportional Band Cold Loop	0 (0.0°C)	100 (10.0°C)	20 (2.0°C)
	Integration Time Loop Hot (min)	1 min.	30 min.	5 min.
	Integration Time Loop Cold (min)	1 min.	30 min.	5 min.
	ON/OFF controller	0 (OFF)	1 (ON)	0 (OFF)
	Loop P o P+I	0 (P)	1 (P+I)	0 (P)
	Pump Off Time Delay (min.)	0 min.	10 min.	5 min.
	3 points Actuator stroke time	30 s.	480 s.	56 s.
	Extra-stroke Limited to 33% of the 3 Points Actuator	0 (no)	1 (yes)	1 (yes)
COMPENSATE SET	Temperature Setpoint Flow 1 - Compensation curve	100 (10.0°C)	500 (50.0°C)	350 (35.0°C)
	External Temperature Setpoint 1 - Compensation curve	-500 (-50.0°C)	+500 (50.0°C)	50 (5°C)
	Set Temperatura Mandata 2 Curva di compensazione	100 (10.0°C)	500 (50.0°C)	250 (25.0°C)
	Temperature Setpoint Flow 2 - Compensation curve	-500 (-50.0°C)	+500 (50.0°C)	180 (18.0°C)
ACTIVE EXTERNAL Sensor	External Temperature at 0V	-500 (-50.0°C)	+500 (50.0°C)	-500 (-50.0°C)
	External Temperature at 10V	-500 (-50.0°C)	+500 (50.0°C)	+500 (50.0°C)
S/W CHANGEOVER	S/W Changeover	0 (Winter)	1 (Summer)	0 (Winter)
	Auto - Summer Threshold External Temperature	200 (20.0°C)	250 (25.0°C)	230 (23.0°C)
	Auto - Winter Threshold External Temperature	150 (15.0°C)	200 (20.0°C)	180 (18.0°C)
PLANT DEACTIVATION	Summer Threshold External Temperature	200 (20.0°C)	300 (30.0°C)	250 (250°C)
	Winter Threshold External Temperature	150 (15.0°C)	250 (25.0°C)	200 (20.0°C)
STA61M SENSOR	Minimum ambient temperature setpoint	100 (10.0°C)	350 (35.0°C)	100 (10.0°C)
	Max ambient temperature setpoint	100 (10.0°C)	350 (35.0°C)	350 (35.0°C)
	Minimum ambient humidity setpoint	10 %	90 %	50 %
	Max ambient humidity set	10 %	90 %	80 %
	Dew Setpoint Correction	-20 (-2°C)	+40 (4°C)	0 (0°C)
	Hysteresis Heads Zone	5 (0.5°C)	20 (2.0°C)	10 (1.0°C)
TEMPERATURE INTEGRATION	Summer Hysteresis for Cold Air	0 (0°C)	50 (5°C)	10 (1°C)
	Winter hysteresis for hot air	0 (0°C)	50 (5°C)	10 (1°C)
DEHUMIDIFICATION - COLD	Summer humidity threshold to activate Dehumidification %	60 %	90 %	70 %
	Summer humidity hysteresis to activate Dehumidification %	2 %	20 %	5 %
BATHROOM	"Towel-warmer" Temperature Setpoint	250 (25.0°C)	300 (30.0°C)	280 (28.0°C)

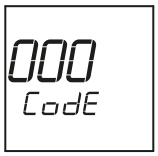
STA61M SENSOR

The STA61M sensor is an environment terminal that allows the user to regulate temperature and humidity in a residential environment. It communicates with the Modbus protocol and can be connected to a network where Master controllers can operate that can configure such sensors.
Depending on the model, the power supply can be 24 Vac/dc or 230 Vac.

Configuration

The STA61M sensor, in order to be connected to the 485 bus of the NR9003 controller, requires a preconfiguration with regard to the communication speed and the Modbus address.

Procedure:

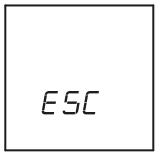


1. Press the FAN and POWER buttons simultaneously for 3 sec. to enter the Parameter Menu.
2. Turn the knob to set the number 22 above the wording and press the knob to confirm. The word “Addr” appears.

3. Press the knob to confirm the desire to set the Modbus address.
4.
5. Turn the knob to set the address (1 - 9) and press the knob to confirm.

6. Turn the knob until the word “Baud” appears
7. Press the knob to confirm the desire to set the communication speed.

8. Turn the knob to set the value 1 (9600 baud) and press the knob to confirm.
9. Turn the knob until the word “esc” appears and press the knob to exit the configuration.

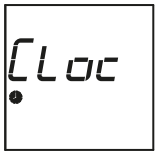


Note: the sensor address must be univocal, sequential and start from 1.

Clock setting

The STA61M sensor has a clock inside that therefore needs to be set.

Procedure:



1. Press the Clock button for 3 seconds. The word “Cloc” appears.
2. Press the knob to confirm the desire to set the time. The cursor flashes on the time.

3. Turn the knob to set the desired value and press the knob to confirm. The cursor flashes on the minutes.
4. Turn the knob to set the desired value and press the knob to confirm. The cursor flashes on the day of the week.

5. Turn the knob to set the desired day and press the knob to confirm. The word “Cloc” appears again.
6. Turn the knob until the word “esc” appears and press the knob to exit the configuration.

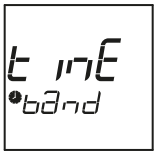
Set time schedules

The STA61M sensor features a time program with the possibility, for each day, to set a maximum of 6 time slots.

The compilation of the time table consists in setting the desired temperature set for each band.
In addition to the Set there is also the possibility to set the OFF status that for the NR9003 controller has the meaning of antifreeze protection.

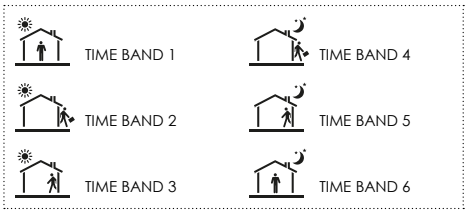
Procedure:

1. Press the Clock button for 3 seconds. Appears “Cloc”.
2. Turn the knob until appears “time band”.



3. Press the knob to confirm the will set the time schedules. Appears “Sel days”.
4. Turn the knob to select the groups of days or the single day for which you want to set the time band.

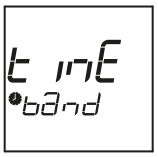
5. Press the knob to set the first time band: a symbol representing it will flash on the right.



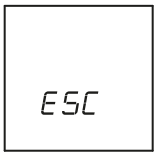
6. Turn the knob to select the desired time and press the knob to confirm. The cursor flashes on the time.
7. Turn the knob to set the desired value and press the knob to confirm. The cursor flashes on the minutes.
8. Turn the knob to set the desired value and press the knob to confirm. The cursor flashes in the field of the set.

9. Turn the knob to set the desired temperature value and press the knob to confirm. The cursor flashes on the symbol representing the time band.
10. Repeat the steps from point 6 to set the following time band (max 6).

11. To end the settings, turn the knob clockwise until the word “esc” appears and press the knob to confirm the desire to exit. “Sel days” appears.



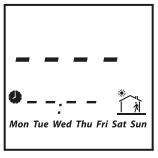
12. Turn the knob counter-clockwise until the message “esc” and press the knob to confirm the desire to exit. “time band” appears.



13. Turn the knob clockwise until the message “esc” is displayed and press the knob to exit the time programming.

Disable time band

To disable a time band, repeat the setting procedure and at point 6 (time setting) select the dash screen with the knob.



Navigation

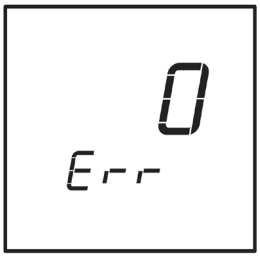
The sensor number 1 represents the sensor that holds the Time Master function and is recognized by the presence of the "key" symbol on the display.

Stationing page
Room Temperature and Clock Display
Knob rotation: Set environment setting
Knob pressure: Humidity display

Humidity page
Display Ambient humidity
Knob rotation: Ambient humidity setting
Knob pressure: page display outside temperature

External temperture page
External temperature display
Knob pressure: page display Errors

Errors page
Display of Error Code
Knob pressure: display station page



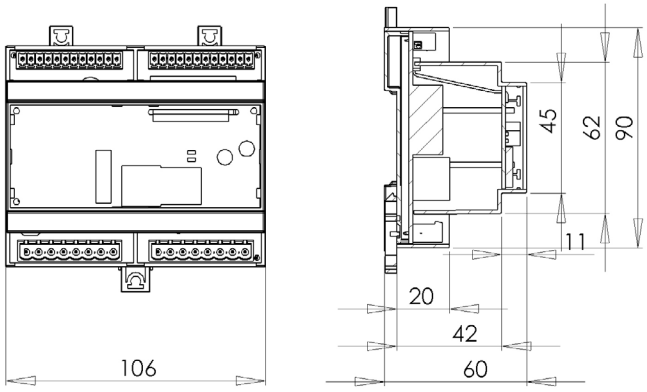
Permanence on a page with no action for more than 10 seconds returns to the station page.

KEYS:
The FAN and MODE buttons are not active.
Pressing the ON / OFF key switches the zone status from operation to antifreeze protection: OFF is displayed instead of the temperature.

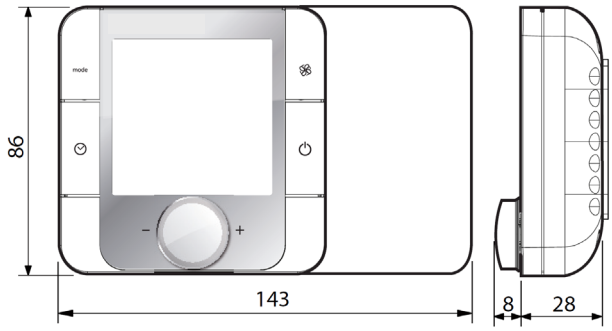
Pressing the Clock button activates the time tables previously set.
This operating mode is shown on the display of the clock symbol.

DIMENSIONS [mm]

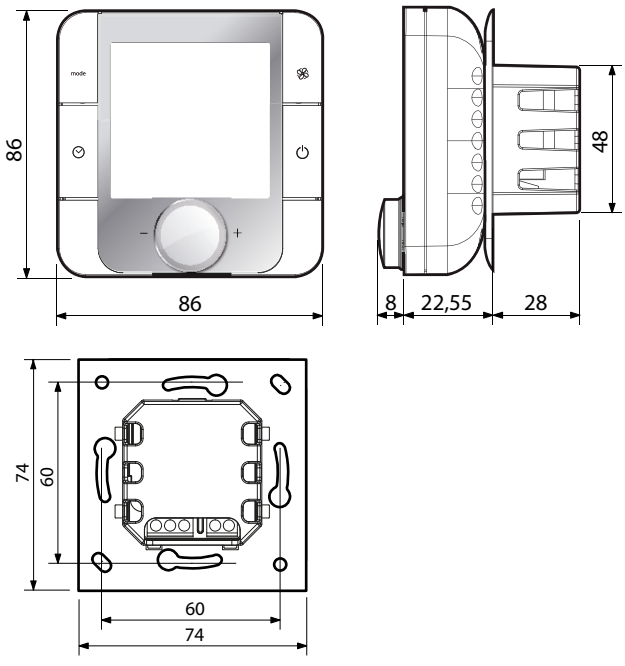
NR9003



STA61M



STA61MP



The performances stated in this sheet can be modified without any prior notice