

# User's Manual

## RBMF Rectangular Electric Duct Heater



NTC  
Pt100  
Pt1000



0 ... 10 VDC  
2 ... 10 VDC  
4 ... 20 mA  
MODBUS

PWM (<0,02 Hz)

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### IMPORTANT:

Please read this manual before installation, connection and putting the product into use.  
Save the manual for future use.

It is possible that the document include technical inaccuracies or typographical errors.  
Systemair make improvements and/or changes in the products and/or the brochure at  
any time without notice.

## SAFETY INFORMATION

1. This appliance may be used by children aged 8 years or above, people with physical and mental disabilities as well as those who lack any experience, provided that they have received detailed instructions about the functionality of the appliance and any risks. Children must not play with the appliance. Cleaning and maintenance must not be performed by children without proper supervision.  
Children under 3 years of age should not be near the appliance without constant supervision. Children between 3 and 8 years old may only turn on/shut off the appliance if it is located in a suitable position and they have received instructions about the proper course of action, or are being supervised. They shall also be informed about possible dangers. Children between 3 and 8 years old may not connect the device, change its settings or perform care/maintenance.
2. The installation must be carried out by qualified and authorized personnel.
3. The heater supply voltage and loading specifications appears on the circuit diagram on the inside of the lid and on the ratings plate on the outside of the lid.  
The circuit diagram also contains information about the thermal cut-outs.
4. The allowed ambient temperature is -20°C ... +30°C.  
The heater is made for a highest outgoing air temperature of 50°C.
5. The heater must be connected to the mains using permanently installed cables. The fixed installation must include an all-pole switch. The cable glands must be selected such that the IP class of the heater is maintained. The protection class of the heater is stated on the ratings plate.
6. The air velocity through heaters of type RBMF must be at least 1.5 m/s. RBMF Heater automatically reduces the power, if the air velocity falls below 1.5 m/s and automatically shuts off the heating if the air velocity falls below 0.7 m/s. Inlet air to heaters of **RBMF** heater must be filtered to avoid contamination of the airflow measuring sensor. Some fan after-blow time is recommended, to avoid tripping of the thermal cut-outs due to the remaining heat.
7. The heater is CE marked and made in accordance with these standards:  
EN 60335-1 / EN 60335-20 / EN 61000-6-2 / EN 61000-6-3 / EN 62233.

## INSTALLATION

1. If the heater is not to be used within three months, it must be stored in a dry room (max. 40% RH).  
Heater type VFLPG/VFL/VTL is designed for installation in duct systems.  
Heater type VRA is designed for installation in an air handling unit.
  2. The airflow direction through the heater must follow the arrow on the heater lid.
  3. The heater may be installed in a horizontal or a vertical duct, with the junction box sideways.  
Installation with the junction box upwards or downwards is NOT allowed.  
If the installation is carried out differently, the installer/assembler must ensure that the air in the duct is distributed evenly over the heater and that flammable materials, e.g. filters, cannot be ignited during operation or in the event of a fault.
  4. Inlets into rooms must be covered with a fixed grilles or air inlet unit that prevents the heating elements from being touched, in the case a grille is not installed on the heater.
  5. A warning text regarding not covering the heater should be placed next to the outlet air opening.
  6. The minimum distance to duct bends, dampers, filters, etc. must be at least the same as the diagonal measure of the heater, Otherwise there is a risk for irregularities in the air through the heater, which may trigger the overheat protection.
  7. The heater may be insulated in accordance with applicable regulations for ventilation ducts/ventilation devices.  
The insulation must consist of fireproof insulation material. The insulation may not cover the lid as the ratings plate and warning sign must be visible and the lid must be accessible for opening.
  8. The heater must be accessible for replacement and inspection.
  9. The distance from the metal surface of the heater to wood or other flammable materials, may NOT be less than 100mm.
- 10. Maximum allowed ambient temperature is -20°C to 30°C.**
- 11. Maximum allowed outgoing air temperature is 50°C. The requirement is met by the installer.**

## MAINTENANCE

1. Normally, no maintenance is needed. A periodic function check, and re-tightening of the power terminals, must be carried out at least once a year.
2. To maintain the insulation characteristics of the heating coils, they must be activated for 24h, at least every 3 months.

## OVERHEATING

If the manually reset cut-out has tripped, the following must be considered:

1. Switch the power supply off.
2. The lid of the heater may only be opened by qualified and authorized personnel.
3. Carefully investigate the cause of the tripping of the cut-out.
4. When the fault has been rectified, the overheating cut-out may be reset.

## TROUBLESHOOTING

- Check that the airflow through the heater is sufficient.  
The airflow is insufficient in heaters of **RBMF** if the red LED next to the flow sensor is lit up constantly.  
Alternatively, the LED may be flashing, indicating that the controller is limiting the allowed output power.

## TEMPERATURE CONTROL

- Check that the sensor is of the correct type and that it is terminated correctly.
- Check the resistance of the sensor and the set value potentiometer.  
Disconnect them from the terminals before any measurements are taken.  
NTC sensors for 0...30°C should have a resistance of 10kΩ @ 30°C, 11.7kΩ @ 20°C and 15kΩ @ 0°C.  
The external set value potentiometer should have a resistance of 0...5kΩ.

### Full heating power but no regulation

- Disconnect the sensor/sensors.

If this results in the heating now being turned off, then the fault is in the external sensor circuitry.

If this doesn't turn the heating off and no LED is lit up on the PCB, then there may be a short in a triac.

### No heating

- Check that there is mains voltage at the heater supply terminals, and that the manual reset overheating cut-out, has not tripped.
- Check the interlocking devices, fuses, breakers, etc.
- Check the sensor resistance according to the manufacturer's specifications.

## CAPACITY CONTROL

- Make sure that the control signal has the correct polarity.

### Full heating power but no regulation

- Disconnect the control signal wiring and strap/short-circuit the control signal input terminals.

If this results in the heating now being turned off, then the fault is in the excitation signal.

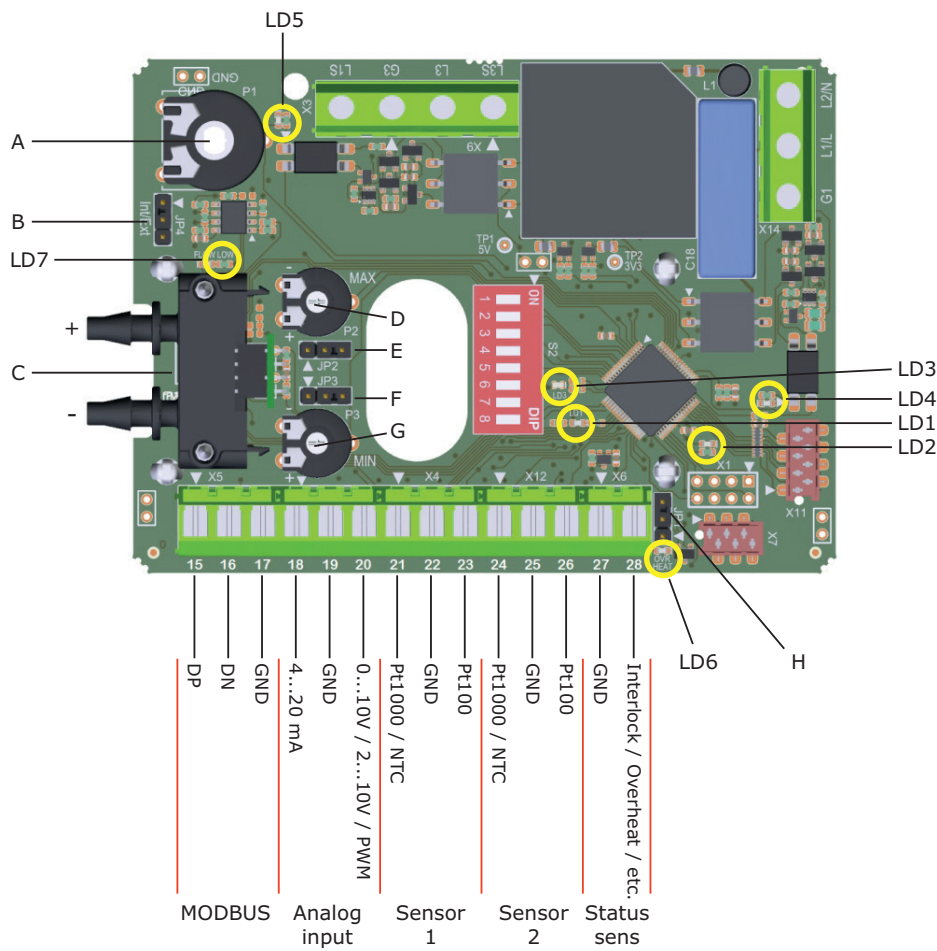
If this doesn't turn the heating off and no LED is lit up on the PCB, then there may be a short in a triac.

### No heating

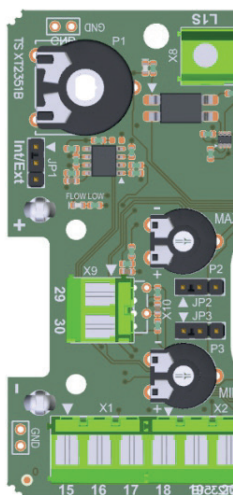
- Check that there is mains supply voltage, and that the manual reset overheating cut-out has not tripped.
- Check the interlocking devices, fuses, breakers, etc.
- Disconnect the control signal wiring and connect a 9V battery-cell or another suitable voltage source as an excitation signal.

If the heater doesn't start now, then the fault is in the controller.

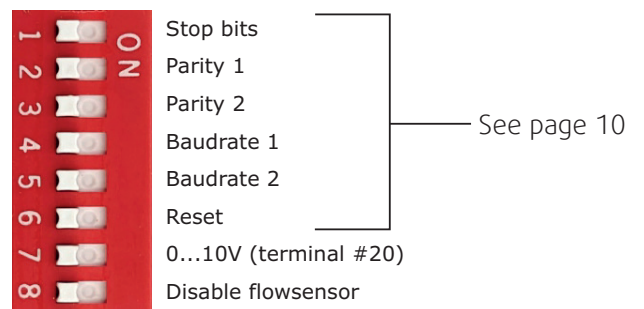
## With Flow Sensor



## Without Flow Sensor



## DIP-Switches



A = Internal setpoint potentiometer.

B = Jumper JP1 (Int/Ext) to activate and deactivate the internal setpoint potentiometer.



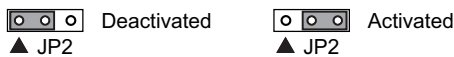
The internal setpoint potentiometer works in conjunction with the Sensor 1 (terminals #21, #22 and #23) and works regardless of sensor type NTC, Pt1000 or Pt100. External setpoint potentiometer works only with sensor type NTC.

C = Flow sensor. Appears in heaters type **ViCi-QOL** and **ViCi-QAL**.

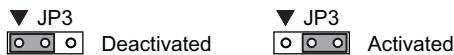
Heaters without the flow sensor, instead has the terminals #29 and #30 on the PCB, to connect a pressure switch or other interlocking device.

D = Setpoint potentiometer for MAX limitation.

E = Jumper JP2 to activate and deactivate the setpoint potentiometer for the MAX limitation.



F = Jumper JP3 to activate and deactivate the setpoint potentiometer for the MIN limitation.



G = Setpoint potentiometer for MIN limitation.

Sensor 2 is the limitation sensor (terminals #24, #25 and #26).

If there is no sensor connected to the terminals, then an activation has no effect.

H = Jumper JP4 to activate and deactivate Status Alarm.



Typical use of Status Alarm is to indicate Overheating (see further LD6) but may be used to indicate other status of choice.

**LD1 = LED (Operation)** Flashes green  when the heater is running normally.

Flashes red  once and then 2 seconds intermission, to indicate a fault in Sensor 1.

Flashes red  twice and then 2 seconds intermission, to indicate a fault in Sensor 2.

**LD2 = Not used.**

**LD3 = LED (MODBUS reset)** with green light  when SW6 is activated, and that resets the MODBUS ID address to 114.

**LD4 = LED (Triac L1)** with green light  when the triac for L1 is turned on.

**LD5 = LED (Triac L3)** with green light  when the triac for L3 is turned on. Only in 3 phase heaters.

**LD6 = LED (Status indication)** with red light  to indicate Status (for example, overheating), if H (jumper JP4) is activated and the connection between terminals #27 and #28 is broken. Then, heating is precluded.

**LD7 = Red LED (Flow sensor)**

If a flowsensor is present, the LED is off if the air velocity is  $\geq 1.5$  m/s.

If a flowsensor is present, the LED is flashing  if the air velocity is  $< 1.5$  m/s but  $\geq 0.7$  m/s.

Then, the power is reduced.

If a flowsensor is present, the LED is lit up continuously  if the air velocity is  $< 0.7$  m/s.

Then, heating is precluded.

PCB without flowsensor, has the terminals #29 and #30 instead, to connect a pressure switch or other interlocking device.

Then the LED is off, when there is a connection between terminals #29 and #30.

The LED is lit up continuously  if the connection between terminals #29 and #30 is broken, and then heating is precluded.

NOTE that this is true, as long as SW8 is "OFF" 

If SW8 is "ON"  the interlocking ability for both the flowsensor and the pressure switch is superseded,

hence interlocking must be done otherwise.

The controller auto detects which terminals are used, but it cannot determine if it is 0...10V or 2...10V that is applied to terminals #19 and #20. är 0...10V eller 2...10V. Hence SW7 must be set to "ON"  when 0...10V is used.

In all other cases, let SW7 be "OFF" 

If the heater has energy monitoring, then it must be controlled by MODBUS or 0...10V, and then SW7 must be set to "ON".

## MODBUS INPUT REGISTERS

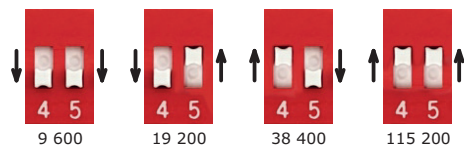
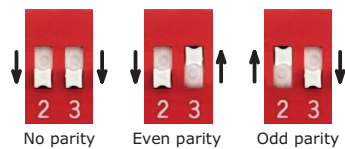
| Register No. | sw variable             | read datatype | write | Description                                                                           | Range                    |
|--------------|-------------------------|---------------|-------|---------------------------------------------------------------------------------------|--------------------------|
| 1            | SENSOR1_DEG_NTC1        | int16         | NA    | Temperature measured from sensor1 NTC, NTC type 1                                     |                          |
| 2            | SENSOR1_DEG_NTC2        | int16         | NA    | Temperature measured from sensor1 NTC, NTC type 2                                     |                          |
| 3            | SENSOR1_DEG_NTC3        | int16         | NA    | Temperature measured from sensor1 NTC, NTC type 3                                     |                          |
| 4            | SENSOR1_DEG_NTC4        | int16         | NA    | Temperature measured from sensor1 NTC, NTC type 4                                     |                          |
| 5            | SENSOR1_DEG_NTC5        | int16         | NA    | Temperature measured from sensor1 NTC, NTC type 5                                     |                          |
| 6            | SENSOR1_DEG_NTC6        | int16         | NA    | Temperature measured from sensor1 NTC, NTC type 6                                     |                          |
| 7            | SENSOR1_DEG_PT1000      | int16         | NA    | Temperature measured from sensor1 PT1000                                              |                          |
| 8            | SENSOR1_DEG_PT100       | int16         | NA    | Temperature measured from sensor1 PT100                                               |                          |
| 9            | SENSOR1_RES_NTC         | int16         | NA    | Resistance measured from sensor1 NTC                                                  |                          |
| 10           | SENSOR1_ERROR_STATE     | uint8         | NA    | Sensor1 Error state. NTC=1,PT1000=2,PT100=3,SHORT NTC/PT1000=4,SHORT PT100=5          |                          |
| 21           | SENSOR2_DEG_NTC1        | int16         | NA    | Temperature measured from sensor2 NTC, NTC type 1                                     |                          |
| 22           | SENSOR2_DEG_NTC2        | int16         | NA    | Temperature measured from sensor2 NTC, NTC type 2                                     |                          |
| 23           | SENSOR2_DEG_NTC3        | int16         | NA    | Temperature measured from sensor2 NTC, NTC type 3                                     |                          |
| 24           | SENSOR2_DEG_NTC4        | int16         | NA    | Temperature measured from sensor2 NTC, NTC type 4                                     |                          |
| 25           | SENSOR2_DEG_NTC5        | int16         | NA    | Temperature measured from sensor2 NTC, NTC type 5                                     |                          |
| 26           | SENSOR2_DEG_NTC6        | int16         | NA    | Temperature measured from sensor2 NTC, NTC type 6                                     |                          |
| 27           | SENSOR2_DEG_PT1000      | int16         | NA    | Temperature measured from sensor2 PT1000                                              |                          |
| 28           | SENSOR2_DEG_PT100       | int16         | NA    | Temperature measured from sensor2 PT100                                               |                          |
| 29           | SENSOR2_RES_NTC         | int16         | NA    | Resistance measured from sensor2 NTC                                                  |                          |
| 30           | SENSOR2_ERROR_STATE     | uint8         | NA    | Sensor2 Error state. NTC=1,PT1000=2,PT100=3,SHORT NTC/PT1000=4,SHORT PT100=5          |                          |
| 50           | Main_FsPdiff            | int32         | NA    | Momentaryairflow value                                                                |                          |
| 51           | Main_FlowSensMedian     | int32         | NA    | Median airflow value                                                                  |                          |
| 52           | Main_FlowSensAvg        | int32         | NA    | Average airflow value, affected byfilter "Main_FlowSensFltr.time"                     |                          |
| 53           | Main_FsDisabled         | uint8         | NA    | State of dip switch 8. 0=Flowsensor active, 1=Flowsensor deactivated                  |                          |
| 61           | PS_state                | uint8         | NA    | State of external pressure switch (terminal 29&30)                                    | 0/1                      |
| 90           | ePSENT_4-20mA_IN        |               |       | Value of 4-20mA input (terminal 18)                                                   | 0-1000                   |
| 91           | ePSENT_0-10V_IN         |               |       | Value of 0-10V input (terminal 20)                                                    | 0-1000                   |
| 92           | ePSENT_2-10V_IN         |               |       | Value of 2-10V input (terminal 20)                                                    | 0-1000                   |
| 100          | OUTPUT_CTRL_TRIAC_STATE | uint8         | NA    | TRIAC_STATES (bit0=triac1,bit1=triac3)                                                |                          |
| 101          | OUTPUT_CTRL_RLY1_STATE  | uint8         | NA    | Relay1 OFF = 0, Relay1 ON = 1                                                         |                          |
| 102          | OUTPUT_CTRL_RLY2_STATE  | uint8         | NA    | Relay2 OFF = 0, Relay2 ON = 1                                                         |                          |
| 103          | OUTPUT_CTRL_RLY3_STATE  | uint8         | NA    | Relay3 OFF = 0, Relay3 ON = 1                                                         |                          |
| 104          | OUTPUT_CTRL_RLY4_STATE  | uint8         | NA    | Relay4 OFF = 0, Relay4 ON = 1                                                         |                          |
| 105          | OUTPUT_CTRL_RLY5_STATE  | uint8         | NA    | Relay5 OFF = 0, Relay5 ON = 1                                                         |                          |
| 106          | OUTPUT_CTRL_RLY6_STATE  | uint8         | NA    | Relay6 OFF = 0, Relay6 ON = 1                                                         |                          |
| 110          | OUTPUT_CTRL_REQ         | uint16        | NA    | Inputted setpoint                                                                     | range 0-1000 == (0-100%) |
| 111          | OUTPUT_CTRL_FINAL       | uint16        | NA    | Output after limitation by airflow and MIN/MAX potentiometers                         | range 0-1000 == (0-100%) |
| 112          | CtrlMux_PowerLevel      |               |       | Power level requestes from Ain/temp/modbus                                            | range 0-1000 == (0-100%) |
| 115          | OUTPUT_CTRL_TRIAC       | uint16        | NA    |                                                                                       | range 0-1000 == (0-100%) |
| 120          | OUTPUT_CTRL_MODE        | uint8         | NA    | SEQ=0,BIN=1 set from relay board dip switch                                           |                          |
| 121          | OUTPUT_CTRL_STEP_COUNT  | uint8         | NA    | 0-6 set from relay board dip switch                                                   |                          |
| 200          | TempReg_Setpoint        | int16         | NA    |                                                                                       |                          |
| 201          | TempReg_InpValue        | int16         | NA    | Temp from sensor 1                                                                    | Value in °C*10           |
| 202          | TempLim_InpValue        | int16         | NA    | Temp from sensor 2                                                                    | Value in °C*10           |
| 203          | TempLim_InpSetpointLo   | int16         | NA    | Value from "MIN" potentiometer if enabled by jumper                                   |                          |
| 204          | TempLim_InpSetpointHi   | int16         | NA    | Value from "MAX" potentiometer if enabled by jumper                                   |                          |
| 205          | TempLim_status          | int8          | NA    | NotSet=0,Running=1,Running_Lo_act=2,Running_Hi_act=3,Error1_Timeout=-1,ModuleError=-2 |                          |
| 206          | TempReg_status          | int8          | NA    | ?                                                                                     |                          |

## MODBUS INPUT REGISTERS

|     |                      |        |    |                                                                           |                             |
|-----|----------------------|--------|----|---------------------------------------------------------------------------|-----------------------------|
| 220 | Sensor1ActType       |        |    | (0=NONE, 1=NTC, 2=PT1000, 3=PT100)                                        |                             |
| 221 | Sensor1Error         |        |    | (0=no errors, 1=NTC, 2=PT1000, 3=PT100, 4=shortNTC/PT1000, 5=short PT100) |                             |
| 222 | Sensor2ActType       |        |    | (0=NONE, 1=NTC, 2=PT1000, 3=PT100)                                        |                             |
| 223 | Sensor2Error         |        |    | (0=no errors, 1=NTC, 2=PT1000, 3=PT100, 4=shortNTC/PT1000, 5=short PT100) |                             |
| 331 | &nv.FlowUpperLimit   | int16  | NA |                                                                           |                             |
| 332 | &nv.FlowLowLimit     | int16  | NA |                                                                           |                             |
| 333 | &Main_FlowPowerLimit | uint16 | NA | Maximum output due to flow reduction                                      | range 0-1000 == (0-100%)    |
| 700 | OVRH_state           | uint8  | NA | OVRH state (0=normal,1=overheat)                                          | 0/1                         |
| 800 | CtrlMux_PowerLevel   | uint8  | NA | Same as reg "112" but scaled 0-255                                        | range 0-255                 |
| 801 | CtrlMux_Timeout      | uint8  | NA | Watchdog timeout in seconds                                               | 10                          |
| 803 | CtrlMux_status       | int8   | NA |                                                                           |                             |
| 804 | AinHdlr_ActInp       | int8   | NA |                                                                           |                             |
| 805 | AinHdlrOutput_0_255  | uint16 | NA |                                                                           | range 0-1000 == 10x(0-100%) |
| 806 | AinHdlr_Timeout      | uint8  | NA |                                                                           |                             |
| 807 | AinHdlrOutput_0_255  | uint8  | NA |                                                                           | range 0-255                 |
| 808 | TempLim_InpTimeout   | uint8  | NA |                                                                           |                             |
| 809 | TempLim_power_inp    | uint8  | NA |                                                                           |                             |
| 810 | TempLim_power_lo     | uint8  | NA |                                                                           |                             |
| 811 | TempLim_power_hi     | uint8  | NA |                                                                           |                             |
| 812 | TempLim_power_output | uint8  | NA | Same as reg "3009" but scaled 0-255                                       | range 0-255                 |
| 813 | TempReg_power        | uint8  | NA | Same as reg "5005" but scaled 0-255                                       | range 0-255                 |
| 900 | Fw version A-x-xxx   |        | NA | Fw version Major                                                          |                             |
| 901 | Fw version x-A-xxx   |        | NA | Fw version Minor                                                          |                             |
| 902 | Fw version x-x-AAA   |        | NA | Fw version Build                                                          |                             |

## MODBUS HOLDING REGISTERS

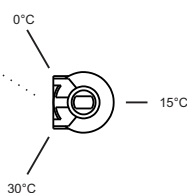
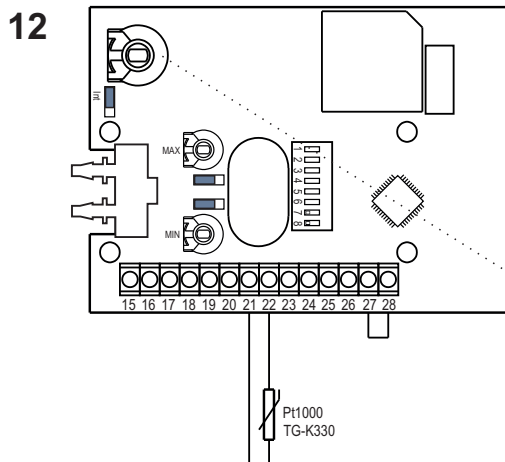
| Register No. | sw variable             | read datatype | write  | Description                                         | Range  | Default value |
|--------------|-------------------------|---------------|--------|-----------------------------------------------------|--------|---------------|
| 1001         | CtrlMux_ActChannel      | int8          | uint8  | Not set=-1, No Source=0, TempReg=1, Ain=2, Modbus=3 |        |               |
| 1002         | CtrlMux_PowerLevel      | uint16        | uint16 | range 0-1000 == 10x(0-100%)                         | 0-1000 | 0             |
| 1003         | Main_FlowSensFiltr.time | int32         | int16  | Filter that affects input register"FlowSens Avg"    |        | 0             |
| 1004         | MB_AIN_CONF             | uint8         | uint8  | Ain_CONF (0=AUTO, 1=PWM)                            |        | 0             |
| 1005         | MB_Slave_Address        | uint8         | uint8  | MB_Slave_Address                                    | 1-255  | 114           |
| 1012         | MB_SENSOR1_CONF         | uint8         | uint8  | MB_SENSOR1_CONF (0=AUTO, 1=NTC, 2=PT1000, 3=PT100)  |        | 0             |
| 1013         | MB_SENSOR2_CONF         | uint8         | uint8  | MB_SENSOR2_CONF (0=AUTO, 1=NTC, 2=PT1000, 3=PT100)  |        | 0             |



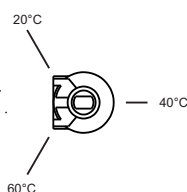
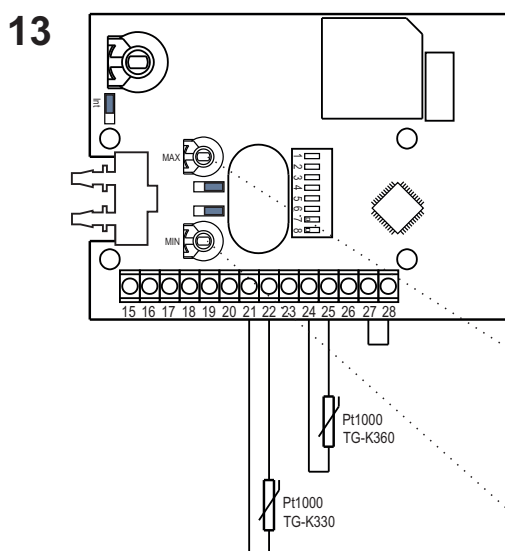
## Wiring schemes when using the internal potentiometer(A)

Please, note that only NTC sensors: 15...10 k $\Omega$ , PT100, PT1000 will work correctly.

The primary sensor can be a duct or a room sensor and the temperature is set via the potentiometer A. The scale of the potentiometer A will correspond to the range of the primary sensor (automatically detected). For example if the primary sensor has a measuring range of 0-30 °C, then the Min setting of the potentiometer A (turned completely anti-clockwise) will correspond to 0 °C and the Max setting (turned completely clockwise) will correspond to 30 °C.



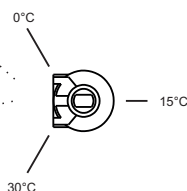
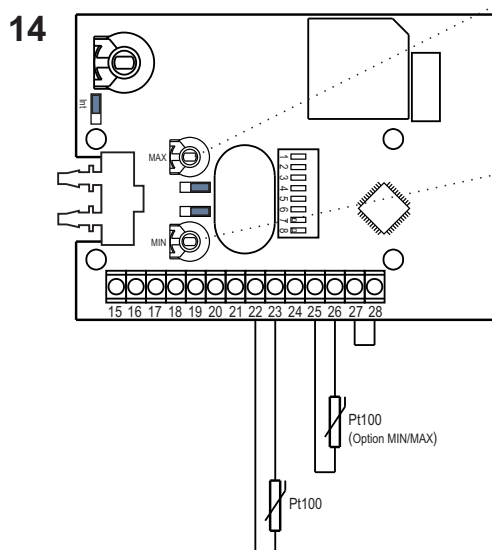
The scale is set by the sensor.



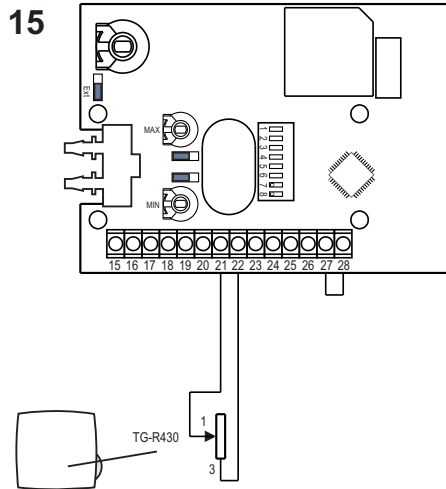
## The secondary sensor is usually duct mounted and the temperature is set on the Min/Max potentiometers on the PCB:

D is used to set Max temperature and the temperature range is from 20 °C (completely turned anti clockwise) to 60 °C (completely turned clockwise). It is activated with Jumper E.

G is used to set Min temperature and the temperature range is from 0 °C (completely turned anti clockwise) to 30 °C (completely turned clockwise). It is activated with Jumper F.



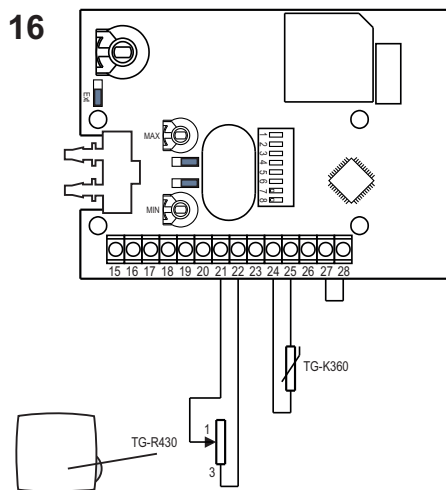
## TEMPERATURE CONTROL WITH EXTERNAL SETTING



### Wiring scheme using external potentiometer

Please, note that only NTC sensors: 15...10 k $\Omega$ , will work correctly.

The external potentiometer can only be the TG-R430 from Regin.



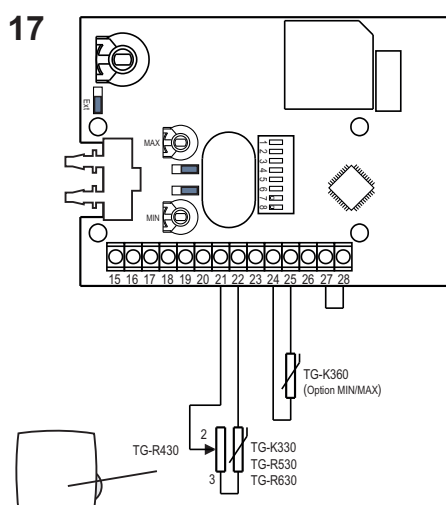
### The secondary sensor is usually duct mounted and the temperature is set on the Min/Max potentiometers on the PCB:

In this case, the secondary sensor must also be NTC 15...10 k $\Omega$ ; the most suitable is TG-K360 and the temperature is set on the potentiometers on the PCB: D is used to set Max temperature and the temperature range is from 20 °C (completely turned anti clockwise) to 60 °C (completely turned clockwise). It is activated with Jumper E.

G is used to set Min temperature and the temperature range is from 0 °C (completely turned anti clockwise) and 30 °C (completely turned clockwise). It is activated with Jumper F.

It is also possible to use only one of the two limitations.

See previous page for more information.



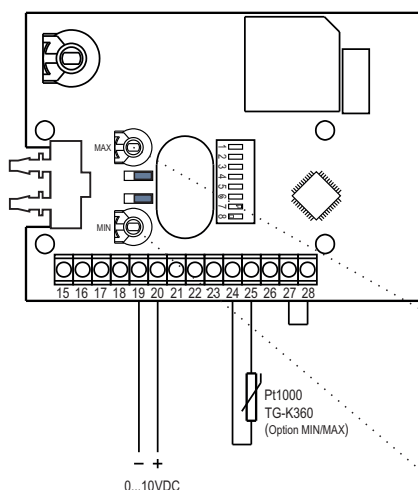
### Priority order (highest to lowest):

Max potentiometer D

Min potentiometer G

External potentiometer TG-R430

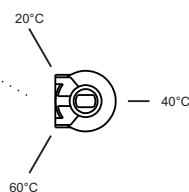
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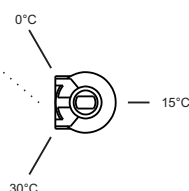
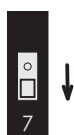
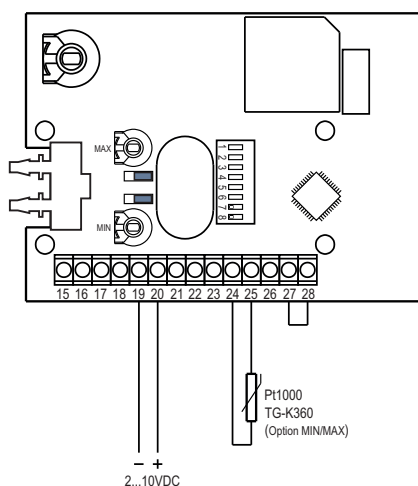
**The secondary sensor is usually duct mounted and the temperature is set on the Min/Max potentiometers on the PCB:**

D is used to set Max temperature and the temperature range is from 20 °C (completely turned anti clockwise) to 60 °C (completely turned clockwise). It is activated with Jumper E.

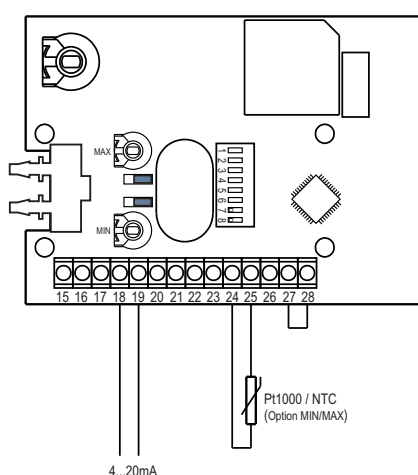
G is used to set Min temperature and the temperature range is from 0 °C (completely turned anti clockwise) to 30 °C (completely turned clockwise). It is activated with Jumper F.



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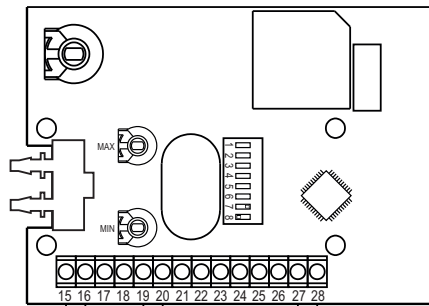


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## CAPACITY CONTROL WITH MODBUS CONNECTION

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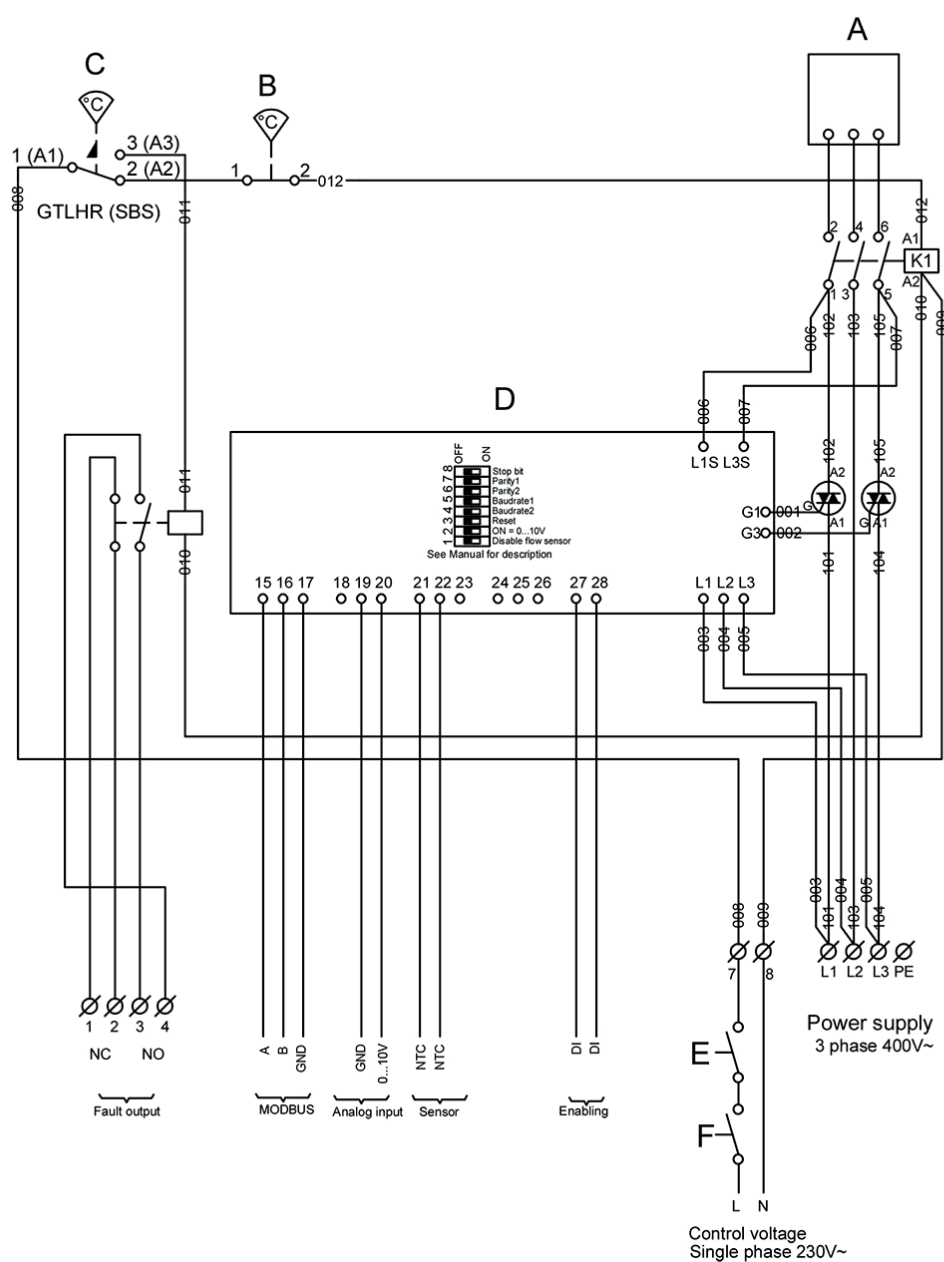
0-10V / 2-10V / 4-20mA / PWM is optional in combination with MODBUS.

MODBUS is prioritized over 0-10V / 2-10V / 4-20mA / PWM

*(If the signal is 0...10 V,  
the DIP switch should be in the ON position.)*

B A  
MODBUS  
- +  
0...10VDC

## RBMF WIRING DIAGRAM





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