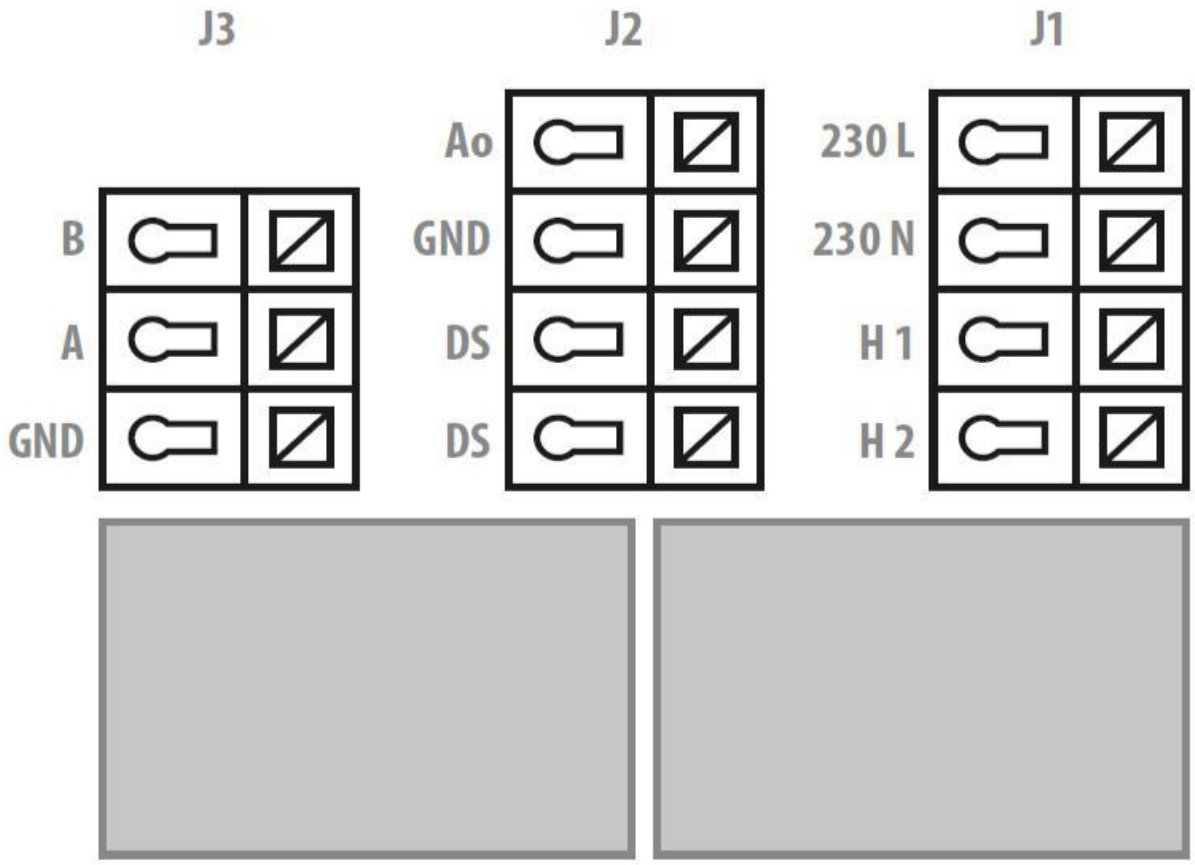
HMI-WING EC

Device Integration Manual on Modbus RTU Bus

Ver. 1.3

1. Outputs

Picture 1: device outputs View



Picture 1: device outputs View

Terminal block J3	Terminal block J2	Terminal block J1
-	Analogue output	L - 230 VAC
B - RS 485Line	Analogue output mass	N - 230 VAC
A - RS 485 Line	Door sensor	Heating level 1 Heating level 2
RS 485 mass	Door sensor	Heating level 2

Table 1. Device outputs table.

2. Device-operated functions

Function code		Description
Dec	Hex	
1	0x01	Binary output status read
2	0x02	Binary input status read
3	0x03	Memory register read
4	0x04	Input register read
5	0x05	Record of one binary output
6	0x06	Record of one memory register
15	0x0F	Record of many binary outputs
16	0x10	Record of many memory registers

Table 2: Device-operated functions.

Binary output status read (code 1) - The function allows, with one message, to read many subsequent binary output reads. The attempt to read the non-existing binary output leads to error message.

Example: output 7-18 read

Request		Response	
Field name	Hex	Field name	Hex
Function Code	0x01	Function Code	0x01
Register address – high part	0x00	Bytes	0x02
Register address – low part	0x06	14-7 outputs status	0xAC
Number of binary outputs – high part	0x00	18-15 output status	0x0B
Number of binary outputs – low part	0x0C		

Table 3: Exemplary binary output read.

Output No.		14	13	12	11	10	9	8	7	-	-	-	-	18	17	16	15
Value Read	Hex	0xAC								0x0B							
	Bit	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	1
Input Status		ON	OFF	ON	OFF	ON	ON	OFF	OFF	-	-	-	-	ON	OFF	ON	ON

Table 4: Interpretation of binary output statuses

Binary output status read (code 2) - Function allows, with one message, to read many subsequent addressed binary output statuses. The attempt to read an non-existing binary input leads to error message

Example: 1-5 output read

Request		Response	
Field name	Hex	Field name	Hex
Function code	0x02	Function code	0x02
Register address – high part	0x00	Bytes	0x01
Register address – low part	0x00	5-1 input status	0x19
Number of binary inputs – high part	0x00		
Number of binary inputs – low part	0x05		

Table 5: Exemplary binary input read

Input No.,		-	-	-	5	4	3	2	1
Value read	Hex	0x19							
	Bit	0	0	0	1	1	0	0	1
Input status		-	-	-	ON	ON	OFF	OFF	ON

Table 6: Interpretation of binary input statuses

Memory Register read (code 3) – the Function allows, with one message, to read subsequently addressed registers . An attempt to read a non-existing register leads to an error message.

Example: 108-110 register read

Request		Response	
Field name	Hex	Field name	Hex
Function Code	0x03	Function Code	0x03
Register address – high part	0x00	Bytes	0x06
Register address – low part	0x6B	Register value – high part (108)	0x02
Number of registers – high part	0x00	Register value – low part (108)	0x2B
Number of registers – low part	0x03	Register value – high part (109)	0x00
		Register value – low part (109)	0x00
		Register value – high part (110)	0x00
		Register value – low part (110)	0x64

Table 7: Exemplary memory register read.

Input Register Read (code 4) – the Function allows, with one message, to read subsequently addressed registers . An attempt to read a non-existing register leads to an error message.

Example: Register 9 read

Request		Response	
Field name	Hex	Field name	Hex
Function code	0x04	Function code	0x04
Register address – high part	0x00	Bytes	0x02
Register address – low part	0x08	Register value – high part (9)	0x00
Number of registers – high part	0x00	Register value – low part (9)	0x0A
Number of registers – younger part	0x01		

Table 8: Exemplary input register read

Record of one binary output (code 5) – Function allows to record one binary output. Allowable values 0xFF00 (ON), 0x0000 (OFF).. Attempt to record a non-existing binary output leads to an error message.

Example: output 2 record (ON)

Request		Response	
Field name	Hex	Field name	Hex
Function code	0x05	Function code	0x05
Register address - high part	0x00	Register address - high part	0x00
Register address - low part	0x01	Register address - low part	0x01
Register value - high part	0xFF	Register value - high part	0xFF
Register value - low part	0x00	Register value - low part	0x00

Table 9: Exemplary record of one binary output

Record of one memory register (code 6) - Function allows to record one register. Attempt to record a non-existing register leads to an error message

Example: Register 2 record

Request		Response	
Field name	Hex	Field name	Hex
Function code	0x06	Function code	0x06
Register address - high part	0x00	Register address - high part	0x00
Register address - low part	0x01	Register address - low part	0x01

Register value - high part	0x00	Register value - high part	0x00
Register value - low part	0x03	Register value - low part	0x03

Table 10: Exemplery record of one memory register

Record of many binary outputs (code 15) - Function that allows, with one message, to record many subsequently addressed binary outputs. An attempt to record a non-existing binary output leads to an error message

Example: 20 – 29 outputs record

Request		Response	
Field name	Hex	Field name	Hex
Function code	0x0F	Function code	0x0F
Register address - high part	0x00	Register address - high part	0x00
Register address - low part	0x13	Register address - low part	0x13
Number of binary outputs - high part	0x00	Number of binary outputs - high part	0x00
Number of binary outputs - low part	0x0A	Number of binary outputs - low part	0x0A
Bytes	0x02		
27 – 20 output status	0xCD		
29 – 28 output status	0x01		

Table 11: Exemplary record of many binary registers

Input No,		27	26	25	24	23	22	21	20	-	-	-	-	-	-	29	28
Value read	Hex	0xCD								0x01							
	Bit	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	1
Input status		ON	ON	OFF	OFF	ON	ON	OFF	ON	-	-	-	-	-	-	OFF	ON

Table 12: Interpretation of binary output statuses

Record of many memory registers (code 16) - The function allows, with one message, to read many subsequently addressed binary output reads. The attempt to read the non-existing binary output leads to error message.

Example: Register 256-257 read

Request		Response	
Field name	Hex	Field name	Hex
Function code	0x10	Function code	0x10
Register address - high part	0x00	Register address - high part	0x00

Register address - low part	0xFF	Register address - low part	0xFF
Number of registers – high part	0x00	Number of registers – high part	0x00
Number of registers – low part	0x02	Number of registers – low part	0x02
Bytes	0x04		
Register value - high part (256)	0x00		
Register value - low part (256)	0x0A		
Register value - high part (257)	0x00		
Register value - low part (257)	0x03		

Table 13: Exemplary record of many memory registers

3. Data blocks used by the device

2.1. Memory registers

Variable	Address		Default value
	For PDU		
	Dec	Hex	
MB_ADDR_BAUDRATE *	0	0x0000	960
MB_ADDR_PARITY_MODE *	1	0x0001	'e'
MB_ADDR_SLAVE_ADDR *	2	0x0002	1
MB_ADDR_NTC_1_CORRECT *	3	0x0003	0
MB_ADDR_NTC_PERIOD	4	0x0004	10
MB_ADDR_RTC_WEEK_DAY	5	0x0005	-
MB_ADDR_RTC_YEAR	6	0x0006	-
MB_ADDR_RTC_MONTH	7	0x0007	-
MB_ADDR_RTC_DAY	8	0x0008	-
MB_ADDR_RTC_HOUR	9	0x0009	-
MB_ADDR_RTC_MINUTE	10	0x000A	-
MB_ADDR_RTC_SECOND	11	0x000B	-
MB_ADDR_FAN_ACTUAL_POWER_VOLT	12	0x000C	-
MB_ADDR_FAN_POWER_1_VOLT	13	0x000D	650
MB_ADDR_FAN_POWER_2_VOLT	14	0x000E	800
MB_ADDR_FAN_POWER_3_VOLT	15	0x000F	900
MB_ADDR_FAN_ADDITIONAL_VOLT	16	0x0010	0
MB_ADDR_FAN_DELAY_OFF_TIME	17	0x0011	40
MB_ADDR_ZONE_AVAILABLE_MODE	18	0x0012	3
MB_ADDR_ZONE_PROGRAM	19	0x0013	0
MB_ADDR_ZONE_MODE_CONDITION	20	0x0014	0
MB_ADDR_ZONE_MODE	21	0x0015	0
MB_ADDR_ZONE_FAN_SPEED	22	0x0016	1
MB_ADDR_ZONE_TEMPERATURE_TARGET	23	0x0017	2200
MB_ADDR_ZONE_TEMPERATURE_DELTA	24	0x0018	50
MB_ADDR_ZONE_TEMPERATURE_MIN	25	0x0019	500
MB_ADDR_ZONE_TEMPERATURE_MAX	26	0x001A	4000
MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_1_START	27	0x001B	480

MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_1_STOP	28	0x001C	780
MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_2_START	29	0x001D	840
MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_2_STOP	30	0x001E	1080
MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_START	31	0x001F	480
MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_STOP	32	0x0020	780
MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_START	33	0x0021	840
MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_STOP	34	0x0022	1080
MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_START	35	0x0023	480
MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_STOP	36	0x0024	780
MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_START	37	0x0025	840
MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_STOP	38	0x0026	1080

*registers of single record (one message must include a record of only one register)

Table 14: Memory register type data block organization.

Caution !!! Recording registers with addresses from 0 to 3 must contain a record of only one variable. For example, to set the rate of MODBUS transmission, the parity mode and device address must send three separate messages. The attempt to record two or three registers at the same time leads to an error message.

MB_ADDR_BAUDRATE ^ variable determining a transmission rate with which the device operates on MODBUS bus. Allowable values for variable are 480, 960, 1920, 3840 (4800[bps], 9600[bps], 19200[bps], 38400[bps]). Attempt to record other value leads to an error message. Upon sending correct value, other than the current one, a record will take place of new transmission rate in backed up EEPROM memory, and triggering of device reset procedure.

Transmission rate = MB_ADDR_BAUDRATE * 10[bps].

MB_ADDR_PARITY_MODE - Parity mode for MODBUS transmission. Allowable values for variable and a number of alloy bits (according to MODBUS specification):

Parity mode	Variable value		Number of alloy bits
	Mark	Hex	
even parity	'e'	0x65	1
odd parity	'o'	0x6F	1
no parity	'n'	0x6E	2

Table 15: Parity mode

An attempt to record values beyond the table leads to an error message. Upon sending a proper value, other than current one, new parity mode will be recorded in in backed up

EEPROM memory, and the device reset procedurę will be triggered

MB_ADDR_SLAVE_ADDR - address of the device on MODBUS bus. Allowed values for variable within a range from 1 to 247. Attempt to record other number will lead to an error message. Upon sending a correct value, other than the current one, new address will be recorded in the backed-up EEPROM memory, and the device reset procedure will be triggered

MB_ADDR_NTC_1_CORRECT - Register allowing setting the correction value for temperatures read from the in-built NTC10K sensor. Allowable values fro variable within a range from -800 to 800 (-8 [°C] do 8 [°C]). Attempt to record a number beyond the allowable values will lead to an error message. Variable stored in the backed-up EEPROM memory

$T_C$orr = (MB_ADDR_NTC_1_CORRECT / 100)[°C].

MB_ADDR_NTC_PERIOD - Variable determining a time period between subsequent temperature measurements. Allowable values for a variable within a range from 0 to 65535, whereas zero means switching off the temperature read. Variable stored in a backed-up EEPROM memory. Measurement period is determined on the basis of the formula:

Tpom = (MB_ADDR_NTC_PERIOD * 0.1) [s].

MB_ADDR_RTC_WEEK_DAY - variable that determine a currently set day of the week. Particular days correspond to following numbers:

Register value	Day of the week
0	Monday
1	Tuesday
2	Wednesday
3	Thursday
4	Friday
5	Saturday
6	Sunday

Table 16: days of the week.

Caution !!! Day of a week is set automatically by the device on the basis of current date (see MB_ADDR_RTC_YEAR,MB_ADDR_RTC_MONTH,MB_ADDR_RTC_DAY). Attempt to enter invalid day in relation to current date leads to an error message.

MB_ADDR_RTC_YEAR - a variable that determines a currently set year. Allowable values for the variable fall within a range from 0 to 99. Attempt to record a number beyond allowable values leads to an error message.

MB_ADDR_RTC_MONTH - a variable that determines currently set month. Allowable values for the variable fall within a range from 1 to 12. Attempt to record a number beyond allowable values leads to an error message.

MB_ADDR_RTC_DAY - A variable that determines a currently set day of a month. Allowable values fall within a range from 1 to 28/29/30/31 (depending on a set month or in case of simultaneous record of MB_ADDR_RTC_MONTH,MB_ADDR_RTC_DAY of a month given in a message sent). Attempt to record a number beyond allowable values leads to an error message.

MB_ADDR_RTC_HOUR - a variable that determines a currently set hour. Allowable values for the variable fall within the range from 0 to 23. Attempt to record a number beyond allowable values leads to an error message.

MB_ADDR_RTC_MTNUTE - a variable that determines a currently set minutes. Allowable values for the variable fall within the range from 0 to 59. Attempt to record a number beyond allowable values leads to an error message.

MB_ADDR_RTC_SECOND - a variable that determines a currently set seconds. Allowable values for the variable fall within the range from 0 to 59. Attempt to record a number beyond allowable values leads to an error message.

MB_ADDR_FAN_ACTUAL_POWER_VOLT - a variable that determines the current level of occurrence of analogue output connected with a fan. Recording in this register is locked.

U_{FAN} = (MB_ADDR_FAN_ACTUAL_POWER_VOLT / 100)[V].

MB_ADDR_FAN_POWER_1_VOLT - a variable that determines a voltage value that will be exposed to analogue output connected with a fan for a first gear

USPEED1 = (MB_ADDR_FAN_POWER_1_VOLT / 100)[V].

MB_ADDR_FAN_POWER_2_VOLT - a variable that determines a voltage value that will be exposed to the analogue output connected with a fan for second gear. Recording in this register is locked.

U_{SPEED2} = (MB_ADDR_FAN_POWER_2_VOLT / 100)[V].

MB_ADDR_FAN_POWER_3_VOLT - a variable that determines a voltage value that will be exposed to the analogue output connected with a fan for a third gear. Recording in this register is locked

U_{SPEED3} = (MB_ADDR_FAN_POWER_3_VOLT / 100)[V].

MB_ADDR_FAN_ADDITIONAL_VOLT - a variable that allows to set an additional constant value added to the voltage exposed to the analogue output assigned to the fan. Allowable values for the variable fall within the range from 0 to 400 400 (0.00[V] - 4.00[V]). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

U_{ADD_FAN} = (MB_ADDR_FAN_ADDITIONAL_VOLT / 100)[V].

MB ADDR FAN DELAY OFF TIME - a variable that determines a duration of delay of fan switch-off with respect to heater switch-off. Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_AVAILABLE_MODE - a variable that allows to set allowable device operating modes. Acceptable values for the variable:

Variable value	Operating mode
1	Ventilation only
2	Heating only
3	Ventilation and heating

Table 17: Operating mode

Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

Caoution !!!

Shifting parameters from ventilation to heating will lead to automatically change gear to 1 if it was on 0.

MB_ADDR_ZONE_PROGRAM - a variable that allows to set a operating mode of the device. Acceptable values for the variable:

Variable value	Operating mode	Descritpion
0	Continuous	Constant (not time-limited) control of room atmosphere
1	Schedule	Environment control in rooms dependent on schedule (see from MB ADDR ZONE SCHEDULE MON FRI WORK 1 START to. MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_STOP).

Table 18. Operating mode

Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_MODE_CONDITION - a variable that allows to set operating conditions of the device. Acceptable values for the variable:

Variable value	Operating condition	Work characteristics			
		Door status	Temperature	Heater	Fan
0	Door	Open	$T_{ACT} > T_{TAR}$	OFF	ON
			$T_{ACT} < T_{TAR}$	ON	ON
		Closed	$T_{ACT} > T_{TAR}$	OFF	OFF
			$T_{ACT} < T_{TAR}$	OFF	OFF
1	Room	n/a	$T_{ACT} > T_{TAR}$	OFF	OFF
			$T_{ACT} < T_{TAR}$	ON	ON
2	Door and room	Open	$T_{ACT} > T_{TAR}$	OFF	ON
			$T_{ACT} < T_{TAR}$	ON	ON
		closed	$T_{ACT} > T_{TAR}$	OFF	OFF
			$T_{ACT} < T_{TAR}$	ON	ON

T_{ACT} - Current temperature of a room in which the device is located
T_{TAR} – target (set) temperature

Table 19. Operating conditions.

Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB ADDR ZONE MODE - a variable that allows to determine a current device operating condition. Allowable values for the variable:

Variable value	Operating mode	Characteristics		
		Heater	Fan	Target temperature
0	Air supply	Off	Depedning on value of MB_ADDR_FAN_SPEED	n/a
1	Heating 1	ALG one output is set to the heater (terminal block J1-H)	ALG	MB ADDR ZONE TEMPERATURE_TARGET
2	Heating II	ALG Two outputs are set for the heater (J1-H1+H2 terminal block)	ALG	MB ADDR ZONE TEMPERATURE_TARGET

Table 20. Operating mode

Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_FAN_SPEED – depending on operating condition (see MB_ADDR_ZONE_MODE):

- For „heating I" and „heating II" mode – variable that determines a fan rotation, that will be set in case of setting the heater through two-state algorithm
- For "air supply" mode – a variable that determines a current fan rotation.

Allowable values for the variable fall within a range from 0 to 3. The variable is stored in backed-up EEPROM memory.

Fan rotation	Register from which the value will be set at analogue output
0*	n/a
1	MB_ADDR_FAN_POWER_1_VOLT
2	MB_ADDR_FAN_POWER_2_V OLT
3	MB_ADDR_FAN_POWER_3_V OLT

* value record possible only in „supply" mode

Table 21: Dependency between a selected gear and occurrence of analogue output connected with a fan

Caution !!!

- Voltage at the analogue value calculated from the formula:
  U_{AO} = (MB_ADDR_FAN_POWER_x_VOLT + MB_ADDR_FAN_ADDITIONAL_V OLT)/ 100[V].

MB_ADDR_ZONE_TEMPERATURE_TARGET - A variable that determines a currently set target temperature. Allowable values for the variable fall within the range from MB_ADDR_ZONE_TEMPERATURE_MIN to MB_ADDR_ZONE_TEMPERATURE_MAX. Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

T_{TARGET} = (MB_ADDR_ZONE_TEMPERATURE_TARGET / 100)[°C] / [ºF].

Caution !!!

- Values recorded in the register are rounded to 0.5[°C]/[°F].. E.g. sending a number equal to 2234 (22.34[°C]) to the register leads to setting a value of 2200 (22.00[°C]), analogical for [°F].

MB_ADDR_ZONE_TEMPERATURE_DELTA - a Variable that determines a hysteresis of temperature for two-state algorithm controlling the environment. Allowable values for the variable fall within a range:

-[°C]:

from 50 to 200 (0.50[°C] do 2.00[°C]). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

-[°F]:

from 50 to 200 (0.50[°F] do 2.00[°F]). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

T_{DELTA} = (MB_ADDR_ZONE_TEMPERATURE_DELTA / 100)[°C] / [ºF].

Caution !!!

- Values recorded in the register are rounded to 0.5[°C].. E.g. sending a number equal to 59 (0.59[°C]) to the register leads to setting a value of 50 (0.50[°C]), analogical for [°F].

MB_ADDR_ZONE_TEMPERATURE_MIN - a variable that determines a minimal temperature that will be possible to be set in MB_ADDR_ZONE_TEMPERATURE_TARGET.
. Allowable values for the variable fall within a range:

-[ºC]:

From 500 to ((MB_ADDR_ZONE_TEMPERATURE_MAX - 500) (from 5.00[°C] to MAX-5.00[°C])

- [ºF]:

From 4100 to ((MB_ADDR_ZONE_TEMPERATURE_MAX - 900) (from 41.00[°F] to MAX-9.00[°F])

Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

T_{MIN} = (MB_ADDR_ZONE_TEMPERATURE_MIN / 100)[°C].

Caution !!!

- Values recorded in the register are rounded to 0.5[°C].. E.g. sending a number equal to 2254 (22.54[°C]) to the register leads to setting a value of 2250 (22.50[°C]).
- Should the recorded value of the minimal temperature be higher than currently set target temperature (MB_ADDR_ZONE_TEMPERATURE_TARGET), the value of target temperature will be overwritten by the minimal temperature value .

MB_ADDR_ZONE_TEMPERATURE_MAX - A variable that determines a maximal temperature that will be possible to be set in MB_ADDR_ZONE_TEMPERATURE_TARGET. Allowable values for the variable fall within a range

-[°C]:

from (MB_ADDR_ZONE_TEMPERATURE_MIN + 500) to 4000 (from MIN+5.00[°C] to 40.00[°C]).

-[°F]:

from (MB_ADDR_ZONE_TEMPERATURE_MIN + 900) to 10400 (from MIN+9.00[°F] to 104.00[°F]).

Caution !!!

- Values recorded in the register are rounded to 0.5[°C].. E.g. sending a number equal to 2254 (22.54[°C]) to the register leads to setting a value of 2250 (22.50[°C]).
- Should the recorded value of the minimal temperature be lower than currently set target temperature (MB_ADDR_ZONE_TEMPERATURE_TARGET), the value of target temperature will be overwritten by the maximal temperature value .

MB AD DR ZONE SCHEDULE MON FRI WORK 1 START

Allows to set a date of commencement of first daily heating period for following days in the schedule: Monday, Tuesday, Wednesday, Thursday, Friday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_1_START = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 532(08:52) to the register will lead to set the value equal to 525 (8:45).
- Value in MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_1_START must be lower than the value in
  MB ADDR ZONE SCHEDULE MON FRI WORK 1 STOP.

MB AD DR ZONE SCHEDULE MON FRI WORK 1 STOP

Allows to set a date of end of first daily heating period for following days in the schedule: Monday, Tuesday, Wednesday, Thursday, Friday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_1_STOP = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 803(13:23) to the register will lead to set the value equal to 795 (13:15)
- The value in MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_1_STOP must be higher than the value in
  MB ADDR ZONE SCHEDULE MON FRI WORK 1 START.

MB ADDR ZONE SCHEDULE MON FRI WORK 2 START

Allows to set a date of commencement of second daily heating period for following days in the schedule: Monday, Tuesday, Wendesday, Thursday, Friday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB ADDR ZONE SCHEDULE MON FRI WORK 2 START = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 905(15:05) to the register will lead to set the value equal to 900 (15:00)
- The value in MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_2_START must be lower than the value in
  MB ADDR ZONE SCHEDULE MON FRI WORK 2 STOP.

MB AD DR ZONE SCHEDULE MON FRI WORK 2 STOP

Allows to set a date of end of second daily heating period for following days in the schedule: Monday, Tuesday, Wednesday, Thursday, Friday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_2_STOP = h * * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 1330 (22:10) to the register will lead to set the value equal to 1320 (22:00)
- The value in MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_2_STOP must be higher than the value in
  MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_2_START.

MB ADDR ZONE SCHEDULE SAT WORK 1 START - allows to set a date of commencement of first daily heating period for Saturday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_START = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 532 (08:52) to the register will lead to set the value equal to 525 (8:45).

- The value in MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_START must be lower than the value in MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_STOP.

MB ADDR ZONE SCHEDULE SAT WORK 1 STOP - allows to set a date of end of the first daily heating period for Saturday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_STOP = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 803 (13:23) to the register will lead to set the value equal to 795 (13:15)

• The value in MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_STOP must be higher than the value in MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_START.

MB AD DR ZONE SCHEDULE SAT WORK 2 START - - allows to set a date of commencement of second daily heating period for Saturday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_S CHEDULE_SAT_W ORK_2_S TART = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 905(15:05) to the register will lead to set the value equal to 900 (15:00)
- The value in MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_START must be lower than the value in MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_STOP.

MB AD DR ZON E SCHEDULE SAT WORK 2 STOP - allows to set a date of end of second daily heating period for Saturday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_STOP = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 1330 (22:10) to the register will lead to set the value equal to 1320 (22:00)
- The value in MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_STOP must be higher than the value in MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_START.

MB AD DR ZONE SCHEDULE SUN WORK 1 START - allows to set a date of commencement of first daily heating period for Sunday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_START = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 532 (08:52) to the register will lead to set the value equal to 525 (8:45).
- The value in MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_START must be lower than the value in MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_STOP.

MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_STOP - allows to set a date of end of first daily heating period for Sunday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_STOP = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 803 (13:23) to the register will lead to set the value equal to 795 (13:15)
- The value in MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_STOP must be higher thean the value in MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_START.

MB ADDR ZONE SCHEDULE SUN WORK 2 START - allows to set a date of commencement of the second daily heating period for Sunday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_START = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 905(15:05) to the register will lead to set the value equal to 900 (15:00)
- The value in MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_START must be lower than the value in MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_STOP.

MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_STOP - allows to set a date of end of the second daily heating period for Sunday. Allowable values for the variable fall within a range from 0 to 1425 (00:00 to 23:45). Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_STOP = h * 60 + m.

Caution !!!

- Values recorded in the register are rounded to 15[min]. E.g. sending a number equal to 1330 (22:10) to the register will lead to set the value equal to 1320 (22:00)
- The value in MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_STOP must be higher than the value in MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_START.

MB ADDR DOOR OPTIMUM – variable that define how many gears of air output will be turn up when the door start to open. Allowable values for the variable fall within a range from 0 to 3. Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

MB ADDR FAN COOLING VOLT – variable that define how much voltage will by turn up in the moment of cooling coils (Only if voltage corresponding to the value of gear that is currently set up is lower than value of this parameter). Allowable values for the variable fall within a range from 500 to 1000 (5.00[V]-10.00[V]. Attempt to record a number beyond the allowable values leads to an error message. The variable is stored in backed-up EEPROM memory.

2.2. Input registers

Variable	Address		Default value
	For PDU		
	Dec	Hex	
MB_ADDR_ZONE_TEMPERATURE_ACTUAL	0	0x0000	-
MB_ADDR_ZONE_ACTUAL_PROGRAM_STATE	1	0x0001	0

Table 22: input register type data block organization

MB_ADDR_ZONE_TEMPERATURE_ACTUAL - register that contains information on current temperature of a room in which the device is located. As a result of the register read, the vaue is obtained, from which the temperature is determined through the following formula:

T measured = (MB_ADDR_ZONE_TEMPERATURE_ACTUAL / 100)[°C]

Caution !! In case of damage to the sensor, the value obtained due to read, will equal to -32768, which gives a temperature of 327.68[°C]. Moreover, in MB_ADDR_NTC_1_ACTIVE (see subsection. 2.3) am activity marker for this sensor will disappear.

MB_ADDR_ZONE_ACTUAL_PROGRAM_STATE - Register that contains information on device operating status deriving from the schedule.

Variable value	Operating status	Description
0	Continuous	Schedule off
1	On 1	Device is in first heating period
2	Off 1	The device is beyond the first but before the second heating period
3	On 2	The device is in the second heating period.
4	Off 2	The device is beyond the second but before the first heating period.

Table 23: Current operating condition (see. From MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORKJ_START to. MB ADDR ZONE SCHED ULE_SUN_ WORK 2 STOP).

2.3. Binary inputs

Variable	Address For PDU		Default value
	Dec	Hex	
MB_ADDR_INPUT_1	0	0x0000	0
MB_ADDR_NTC_1_ACTIVE	1	0x0001	0

Table 24: Binary input type data block organization

MB_ADDR_INPUT_1 - binary input that informs of a digital input status (door sensor). The input acquires the following values:

- 1 – door opened.
- 0 – door closed.

MB_ADDR_NTC_1_ACTIVE - binary input informing of activity status of in-built temperature sensor. The input takes the following values:

- 1 – sensor active.
- 0 – sensor inactive.

2.4. Binary inputs

Variable	Address		Default value
	For PDU		
	Dec	Hex	
MB_ADDR_STATE_OUTPUT_1	0	0x0000	0
MB_ADDR_STATE_OUTPUT_2	1	0x0001	0
MB_ADDR_POWER_ON_OFF	2	0x0002	1
MB_ADDR_GO_TO_DEFAULT	3	0x0003	0
MB_ADDR_LOCK_KEYPAD	4	0x0004	0
MB ADDR TEMP UNIT	5	0x0005	0
MB ADDR CLOCK FORMAT	6	0x0006	0

Table 25: Binary output type data block organization

MB_ADDR_STATE_OUTPUT_1 - binary input that informs of a status of first transmitter output (terminal block J1 – H1). Recording of the output is locked. Output takes the following values

- 1 – output triggered
- 0 – output not triggered.

MB_ADDR_STATE_OUTPUT_2 - binary input that informs of a status of the second transmitter output (terminal block J1 – H2). Recording of the output is locked. Output takes the following values

- 1 – output controlled
- 0 – output not controlled.

MB_ADDR_POWER_ON_OFF - binary output that allows to turn off and turn on the device (simulation of power supply button pressure). The output takes the following values:

- 1 – device turned on.
- 0 – device turned off.

Status is stored in backed up EEPROM memory.

MB_ADDR_GO_TO_DEFAULT - controlling the output leads to commencement of a process of retrieving default values for the following registers

Variable	Address For PDU		Default value
	Dec	Hex	
MEMORY REGISTERS			
MB_ADDR_BAUDRATE	0	0x0000	960
MB_ADDR_PARITY_MODE	1	0x0001	'e'
MB_ADDR_SLAVE_ADDR	2	0x0002	1
MB_ADDR_NTC_1_CORRECT	3	0x0003	0
MB_ADDR_NTC_PERIOD	4	0x0004	10
MB_ADDR_FAN_ADDITIONAL_VOLT	16	0x0010	0
MB_ADDR_FAN_DELAY_OFF_TIME	17	0x0011	40
MB_ADDR_ZONE_AVAILABLE_MODE	18	0x0012	3
MB_ADDR_ZONE_PROGRAM	19	0x0013	0
MB_ADDR_ZONE_MODE_CONDITION	20	0x0014	0
MB_ADDR_ZONE_MODE	21	0x0015	0
MB_ADDR_ZONE_FAN_SPEED	22	0x0016	1
MB_ADDR_ZONE_TEMPERATURE_TARGET	23	0x0017	2200
MB_ADDR_ZONE_TEMPERATURE_DELTA	24	0x0018	50
MB_ADDR_ZONE_TEMPERATURE_MIN	25	0x0019	500
MB_ADDR_ZONE_TEMPERATURE_MAX	26	0x001A	4000
MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_1_START	27	0x001B	480
MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_1_STOP	28	0x001C	780
MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_2_START	29	0x001D	840
MB_ADDR_ZONE_SCHEDULE_MON_FRI_WORK_2_STOP	30	0x001E	1080
MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_START	31	0x001F	480
MB_ADDR_ZONE_SCHEDULE_SAT_WORK_1_STOP	32	0x0020	780
MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_START	33	0x0021	840
MB_ADDR_ZONE_SCHEDULE_SAT_WORK_2_STOP	34	0x0022	1080
MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_START	35	0x0023	480
MB_ADDR_ZONE_SCHEDULE_SUN_WORK_1_STOP	36	0x0024	780
MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_START	37	0x0025	840
MB_ADDR_ZONE_SCHEDULE_SUN_WORK_2_STOP	38	0x0026	1080

BINARY OUTPUTS			
MB ADDR POWER ON OFF	2	0x0002	1
MB_ADDR_LOCK_KEYPAD	4	0x0004	0
MB ADDR TEMP UNIT	5	0x0005	0
MB ADDR CLOCK FORMAT	6	0x0006	0

Table 26: Registers returned to default values

MB_ADDR_LOCK_KEYPAD - binary output that allows to turn off and turn on the device button lock. The output takes the following values:

- 1 – buttons locked.
- 0 – buttons unlocked.

Status is stored in backed up EEPROM memory.

MB_ADDR TEMP UNIT – binary output that allows to change units of temperature on °C or °F. The output takes the following values:

- 1 – temperature in °C .
- 0 – temperature in °F.

Status is stored in backed up EEROM memory.

MB_ADDR_CLOCK_FORMAT – binary output that allows to change clock format on 12h or 24h. The output takes the following values:

- 1 – 24h format.
- 0 – 12h format (AM/PM).

Status is stored in backed up EEROM memory.