



iSMA-B-W0202

Modbus

User Manual

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1. Introduction

iSMA-B-W0202 has been built to allow extension of RS485 bus using wireless technology wherever use of network cable is impossible or unprofitable. Use of two iSMA-B-W0202 allows to build the wireless 'bridge' for the RS485 by building wireless remote island (one or more) for devices communicate via Modbus RTU / ASCII - e.g. iSMA-B-MIX18 or iSMA-B-MIX38 . iSMA-B-W0202 in addition to the RS-485 port and wireless port is equipped with 2SI (Special Inputs) and 2DO (Digital Outputs max. 230 VAC / 30VDC 3A), which allows to use device as an I/O module or light controller communicating in Modbus RTU / ASCII . Implemented algorithm in the processor allows user to choice one of 3 different modes:

- a) Modbus Bridge
- b) Modbus Bridge and I/O module
(both DO work independent of the state of the inputs SI)
- c) Modbus Bridge and light controller
(DO work in direct connection with SI) - there are 3 sub-modes of operation:
Monostabile Relay, Bistable Relay, Time Relay.

iSMA-B-W0202 is also equipped with a micro USB port which allows to configure the device without the use of an external power supply (the device is powered through the USB port). This solution gives you an easy way , using 2 laptops, carry out the tests within the existing facility.

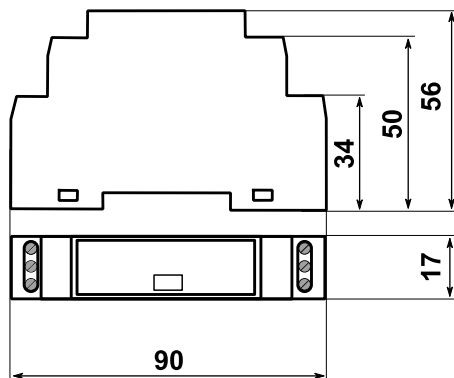
2. Safety rules

- Note incorrect wiring of this product can damage it and lead to other hazards. Make sure the product has been correctly wired before turning the power ON.
- Before wiring, or removing / mounting the product, be sure to turn the power OFF. Failure to do so might cause electric shock.
- Do not touch electrically charged parts such as the power terminals. Doing so might cause electric shock.
- Do not disassemble the product. Doing so might cause electric shock or faulty operation.
- Use the product within the operating ranges recommended in the specification (temperature, humidity, voltage, shock, mounting direction, atmosphere etc.). Failure to do so might cause fire or faulty operation
- Firmly tighten the wires to the terminal. Insufficient tightening of the wires to the terminal might cause fire.

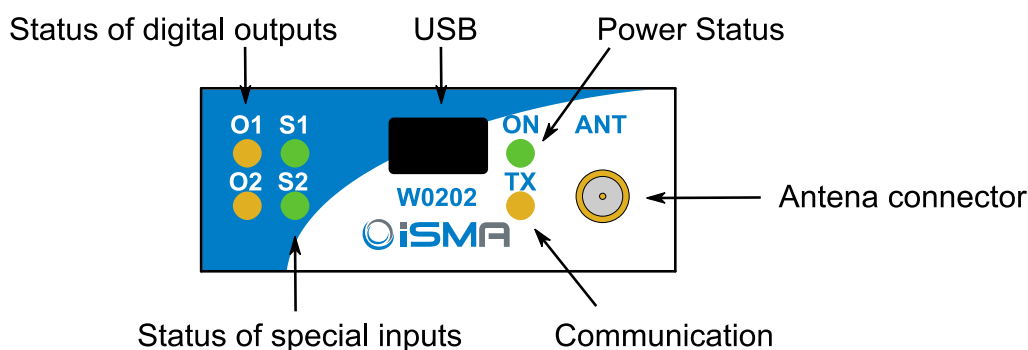
3. Technical specifications

Power supply	Voltage	24V AC/DC \pm 20%
	Power consumption	2W @ 24VDC; 4.5VA @ 24VAC
Special Inputs	No. of inputs	2
	Temperature input	Measurement with attached RTDs accuracy $\pm 0.1^{\circ}\text{C}$ at 25°C
	Voltage input	Voltage measurement from 0 to 10V Input impedance 100k Ω measurement accuracy $\pm 50\text{mV}$
	Resistive input	Measurement of resistance from 0 to 1000k Ω
	Resistance measurement method	The voltage divider
	Dry contact input	Output current $\sim 1\text{mA}$
	Measurement resolution	12 bits
	Fast counters	50Hz/100Hz
	Digital Outputs (relays)	No. of outputs
Resistive load		3A @ 230VAC or 3A @ 30VDC
Inductive load		75VA @ 230VAC or 30W @ 30VDC
Interface	Mini USB	For power up and configuration
	RS485	Up to 128 devices
	Communication protocol	Modbus RTU, Modbus ASCII
	Baud rate	From 1200 to 115200 bits/s
Radio	Address	0 to 127
	Frequency	868 MHz
	Max output power	+20 dBm (100mW)
	Sensitivity	-120 dBm
	Radio Channels	1 \div 8
	Encryption	AES-128
	Baud Rate	From 1200 to 200000 bits/s
	External antenna	SMA socket
	Ingress protection	IP
Temperature		Storage
	Operating	-10°C to $+50^{\circ}\text{C}$
Humidity	Relative	5 to 95%
Connectors	Type	Rising Clamp
	Maximum cable size	2.5 mm ²
Dimension	Width	17 mm
	Length	56 mm
	Height	90 mm

4. Dimension



5. LED Indication



- The power LED is ON (green) when the module is running properly.
- Communication LED is ON (orange) for 20 ms after sending each message. If the module receives / sends a lot of messages LED can be lit continuously.
- LEDs indicate the status of the special inputs are lit when resistance connected to the input is less than 1k Ω (Dry Contact input is active). Caution! The LED also lights up when voltage connected to the input has a very low potential.
- LEDs indicate the status of the digital outputs are lit when output is enabled.

6. Grounding and shielding

In most cases, IO modules will be installed in an enclosure along with other devices which generate electromagnetic radiation. Examples of these devices are relays, contactors, transformers, motor invertors etc. This electromagnetic radiation can induce electrical noise into both power and signal lines, as well as direct radiation into the module causing negative effects on the system. Appropriate grounding, shielding and other protective steps should be taken at the installation stage to prevent these effects. These protective steps include control cabinet grounding, cable shield grounding, protective elements for electromagnetic switching devices, correct wiring as well as consideration of cable types and their cross sections.

7. Network Termination

Transmission line effects often present a problem on data communication networks. These problems include reflections and signal attenuation.

To eliminate the presence of reflections from the end of the cable, the cable must be terminated at both ends with a resistor across the line equal to its characteristic impedance. Both ends must be terminated since the direction of propagation is bidirectional. In the case of an RS485 twisted pair cable this termination is typically 120 Ω .

7.1. Module configuration

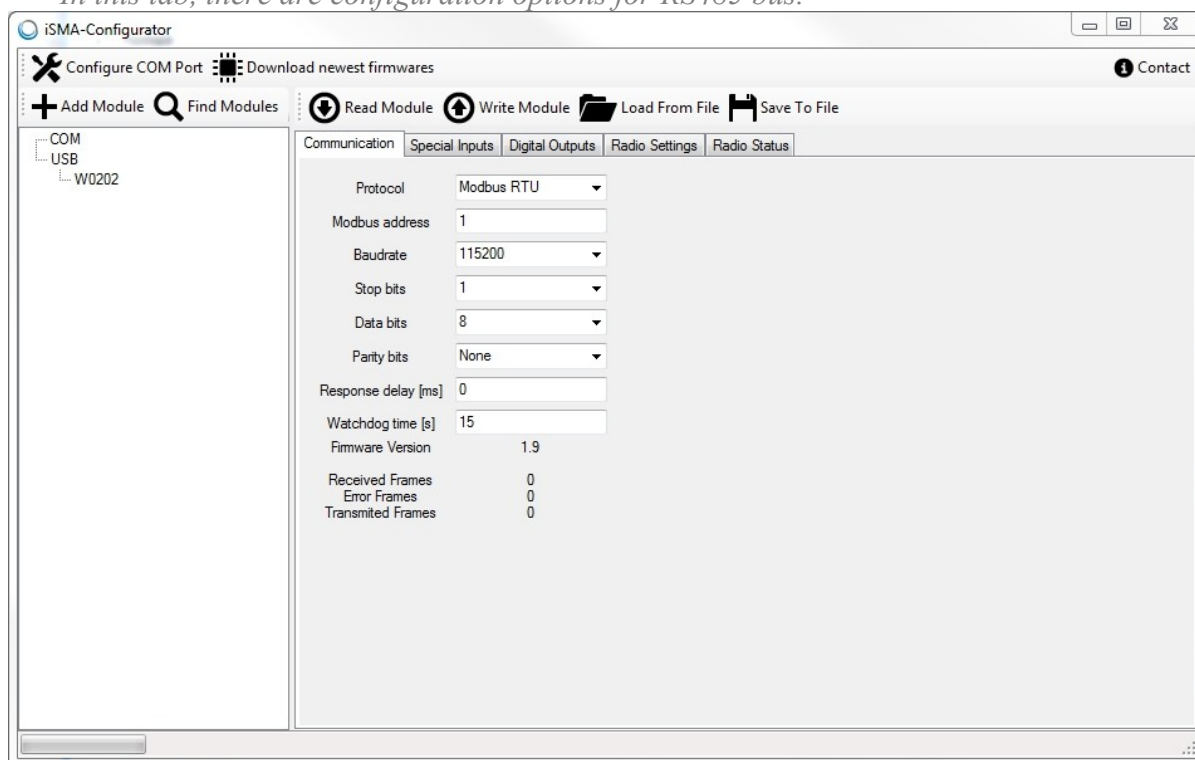
W0202 can be configured by RS485 Modbus registers or directly by USB connection and iSMA-Configurator software. The software can be downloaded from www.support.gc5.pl. After the module is connected, it will appear in the left part of the window, under USB. The next step is to read module configuration using the button "Read Module" or read configuration from file "Load From File".

If you want to save changes in the module, you need to use the "Write Module" button. This command will send parameters from all tabs.

Warning!: Radio settings will only take effect after restarting the module.

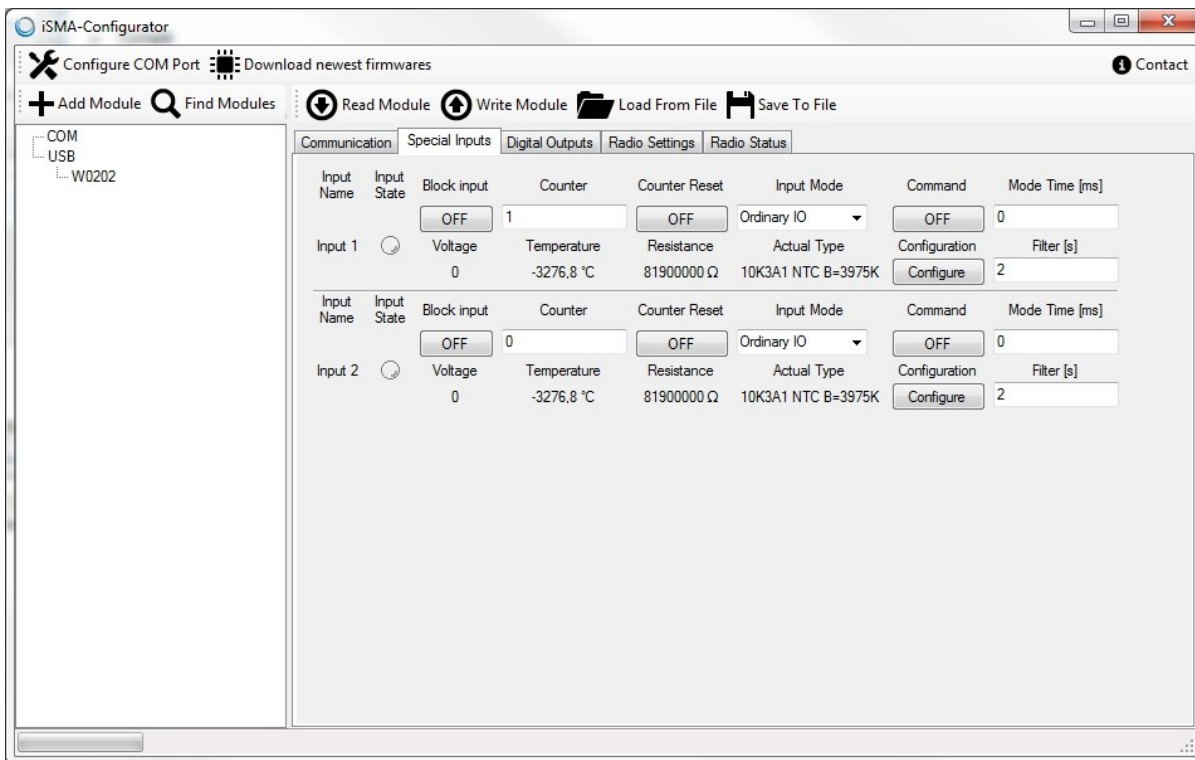
7.2. Communication

In this tab, there are configuration options for RS485 bus.



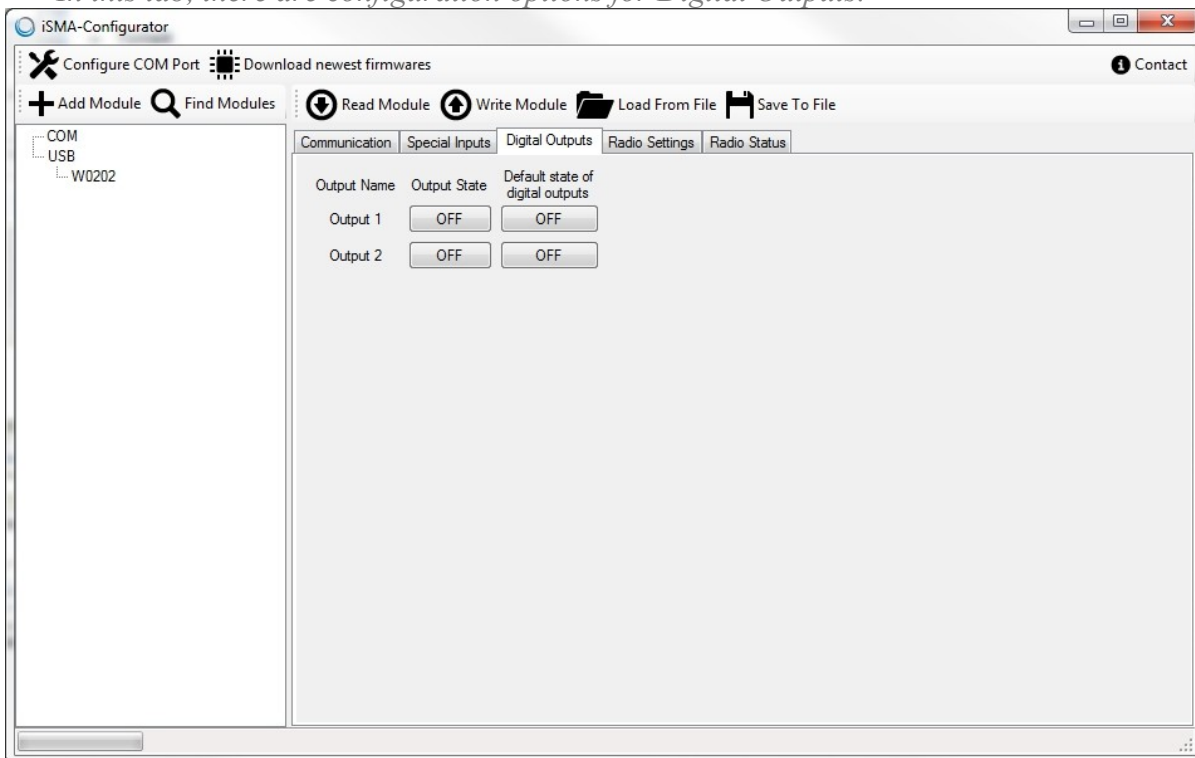
7.3. Special Inputs

In this tab, there are configuration options for Special Inputs.



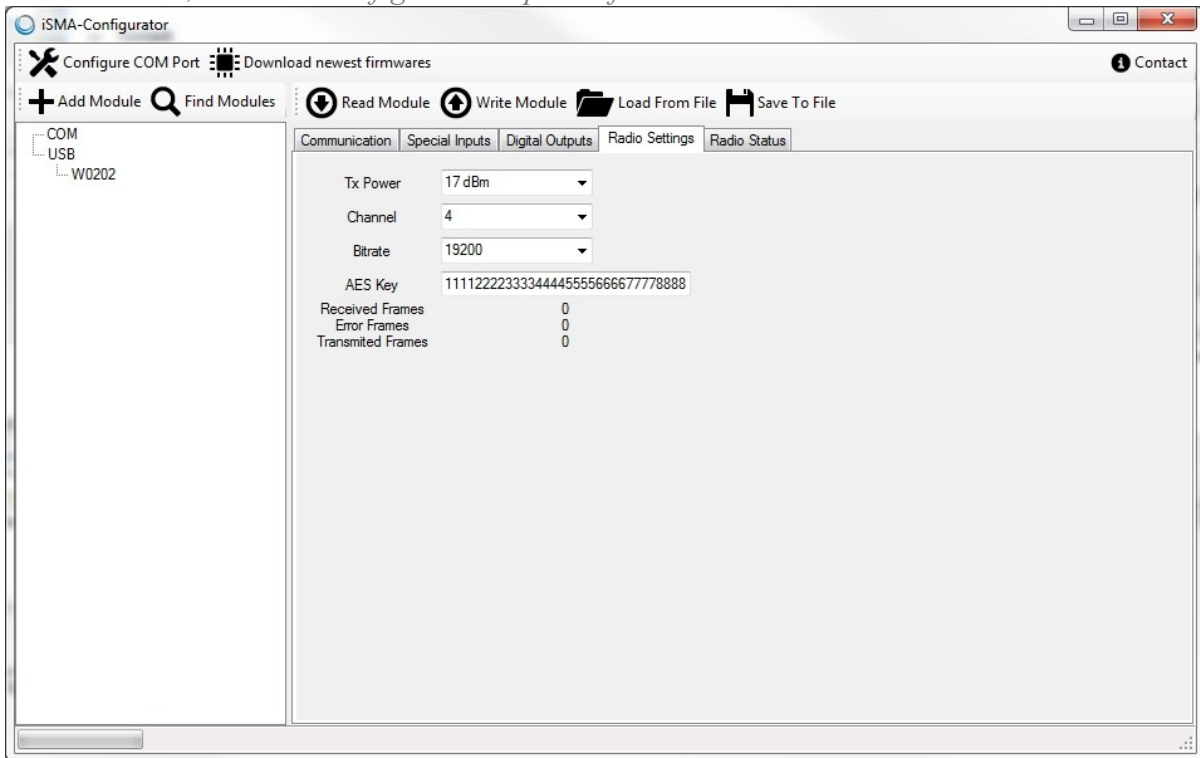
7.4. Digital Outputs

In this tab, there are configuration options for Digital Outputs.



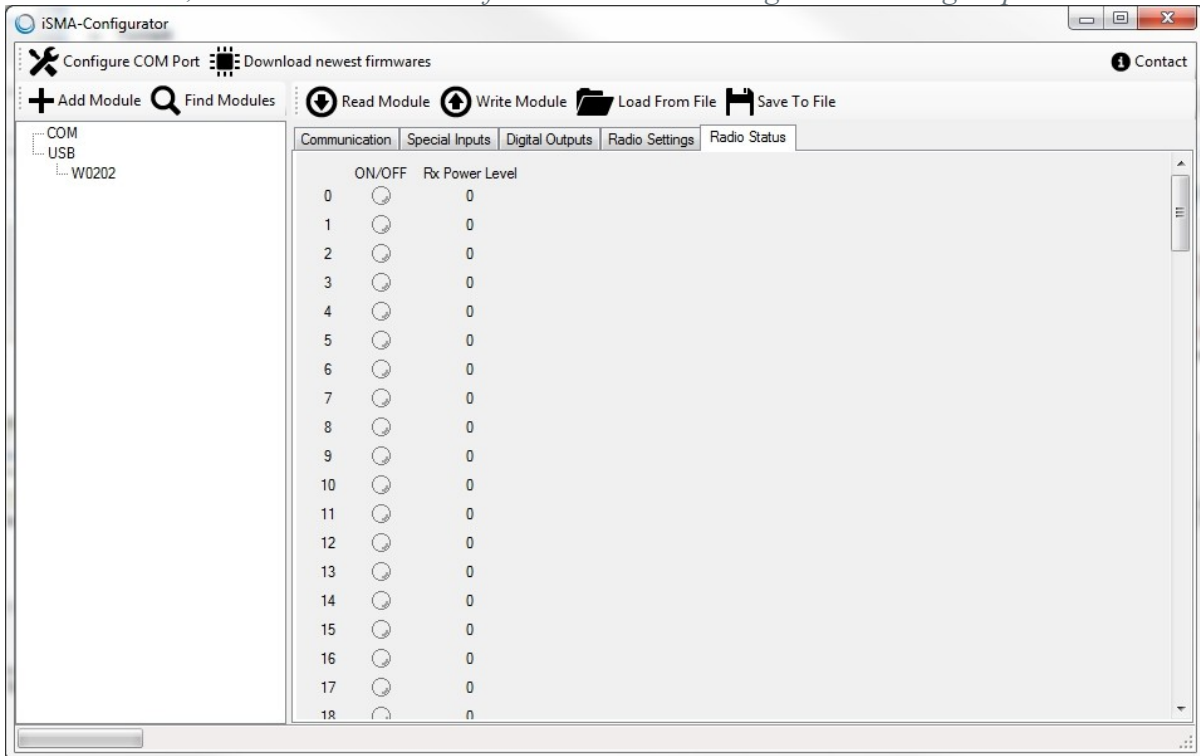
7.5. Radio Settings

In this tab, there are configuration options for Radio.

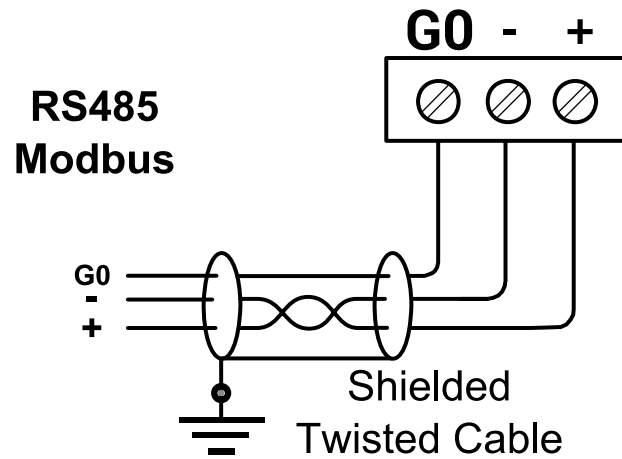


7.6. Radio Status

In this tab, there are radio status for all devices working in the same group.

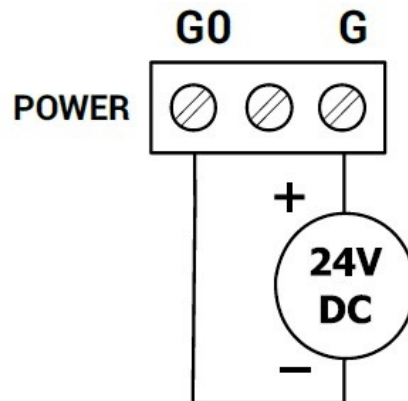


8. Connecting the communication bus

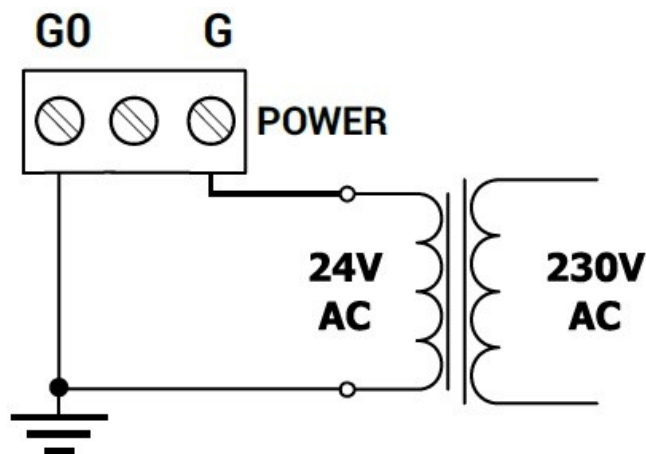


9. Power supply connection

9.1. DC power connection



9.2. AC power connection



10. Module and RS485 configuration registers

Warning!: Changing the parameters configuring transmission will only take effect after restarting the module or reload settings –register (40001).

10.1. Firmware version and module type (30001)

In this register are encoded type and firmware version of module. Low byte contains information about the type of module in accordance with table:

Value	Type
80 ₁₀ (0x50 ₁₆)	iSMA-B-W0202

High byte contains the module firmware version multiplied by 10

Example:

In register 30001 is number 20490₁₀ = 0x500A₁₆. This means that it is a module iSMA-B-W0202 (0x50) with firmware in version 1.0 (0x0A₁₆ = 10₁₀)

10.2. Reset device, reload settings and set to default (40001)

Setting relevant value allows to activate the following actions for device in accordance with table:

Value	Type of action
0x01FF	Reset of device
0x02FF	Reload settings (RS485, Radio)
0x03FF	Set device to default

10.3. Counter of received messages (30004)

32-bit register with the number of valid Modbus received messages by the module from last powered up. The value is reset after power cycle or after changing transmission parameters (baud rate, stop bits, parity, etc.).

10.4. Counter of error messages (30006)

32-bit register with the number of error Modbus received messages by the module from last powered up. The value is reset after power cycle or after changing transmission parameters (baud rate, stop bits, parity, etc.).

10.5. Counter of sent messages (30008)

32-bit register with the number of Modbus sent messages by the module from last powered up. The value is reset after power cycle or after changing transmission parameters (baud rate, stop bits, parity, etc.).

10.6. Modbus protocol type (40134)

This register contains parameters which defines Modbus protocol type RTU or ASCII.

Value	Protocol Type
0 (default)	Modbus RTU
1	Modbus ASCII

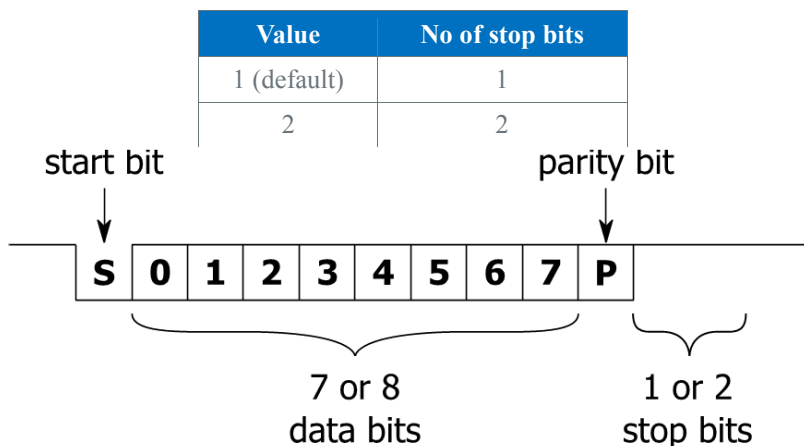
10.7. RS485 baud rate (40136)

The register setup baud rate in RS485 bus.

Value	Baud rate
0	1200
1	2400
2	4800
3	9600
4	19200
5	38400
6	57600
7	115200

10.8. Stop bits (40137)

Number of stop bits is determined on the basis of this register in accordance with the following table:



10.9. Data bits (40138)

Number of data bits transmitted in a single byte is determined according to the following table:

Value	No of data bits
7	7
8 (default)	8

10.10. Parity bit (40139)

Each byte of data being transferred may have additional protection as a parity bit added before stop bit (bits).

The method of calculating parity bit determines the table below:

Register value	Type of parity bit
0 (default)	none
1	Odd (number of all ones in a byte is odd)
2	Even (number of all ones in a byte is even)
3	Always 1
4	Always 0

10.11. Response delay time (40140)

The value of this register determines the number of milliseconds to wait before the unit answers the question. This time is used to extend the interval between question and answer. The default value of 0 means no delay (the answer is sent once during the 3.5 character required by the protocol Modbus RTU).

10.12. Watchdog time (40141)

This register specifies the time in seconds to watchdog reset. If module does not receive any valid message within that time, digital outputs (only in “Ordinary IO” mode) will be set to default status, which are determined by value in 40142 register.

This feature is useful if for some reason there is an interruption in data transmission and for security reasons output states must be set to the appropriate state endanger the safety of persons or property.

Setting of 0 value will disable the watchdog. The default value is 15 seconds.

11. Radio configuration registers

Warning!: Changing the parameters configuring transmission will only take effect after restarting the module or reload settings –register (40001).

11.1. Radio TX Power (40242)

This register contains radio transmission signal power. The signal strength is dependent on the distance of devices from each other and the conditions of the environment.

Value	Radio TX Power [dBm]	Radio TX Power [mW]
0	-18	0,0158
1	0	1
2	7	5
3	10	10
4	14	25
5	17	50
6	20	100

11.2. Radio Channel (40243)

This register setup radio channel. All modules working with one group required the same channel. We can use more than one wireless network but on different channels not influences on each other (see chapter Radio Baud Rate).

Value	Channel	Frequency
0	DISABLE	-
1	Channel 1	869,415 MHz
2	Channel 2	869,445 MHz
3	Channel 3	869,475 MHz
4	Channel 4	869,505 MHz
5	Channel 5	869,535 MHz
6	Channel 6	869,565 MHz
7	Channel 7	869,595 MHz
8	Channel 8	869,625 MHz

11.3. Radio Baud Rate (40244)

The register setup baud rate in Radio protocol. All devices working in the same group (channel) must have the same baud rate value. We can use different baud rate on RS485 bus and Radio.

Value	Baud rate
0	1200
1	2400
2	4800
3	9600
4	19200
5	38400
6	57600
7	115200
8	200000

Higher baud rate requires more bandwidth which can occur on adjacent channels. Table below shows the dependencies between these parameters.

Baud rate	No of channels	Channels
1200	1	1-8
2400	1	1-8
4800	1	1-8
9600	1	1-8
19200	1	1-8
38400	2	2-7
57600	3	3-6
115200	4	4
200000	4	4

11.4. Radio AESKEY (40249 – 40256)

All packed sanded by wireless transmission is encrypted by AES-128 algorithm. This protect network against unauthorized access. The encryption use 128 bits key, written in 8 registers (8 x 16 bits). Each device working in one group must have the same encryption key.

Register	Device
40249	Radio AESKEY D1-D0
40250	Radio AESKEY D3-D2
40251	Radio AESKEY D5-D4
40252	Radio AESKEY D7-D6
40253	Radio AESKEY D9-D8
40254	Radio AESKEY D11-D10
40255	Radio AESKEY D13-D12
40256	Radio AESKEY D15-D14

11.5. Radio Received Frames Counter (40257)

32-bit register with the number of valid Radio received messages by the module from last powered up. The value is reset after power cycle or after changing transmission parameters (baud rate, stop bits, parity, etc.).

11.6. Radio ERROR Frames Counter (40259)

32-bit register with the number of error Radio received messages by the module from last powered up. The value is reset after power cycle or after changing transmission parameters (baud rate, stop bits, parity, etc.).

11.7. Radio Transmitted Frames Counter (40261)

32-bit register with the number of Radio sent messages by the module from last powered up. The value is reset after power cycle or after changing transmission parameters (baud rate, stop bits, parity, etc.).

11.8. Wireless Device Status (40263 – 40390)

This registers contains information about the signal strength of the other W0202 modules operating on the same channel. Each device has its own register status. Number of device is defined as a Modbus address.

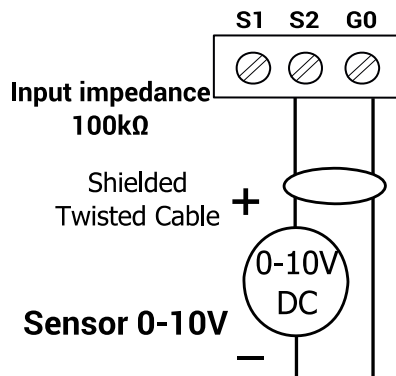
Register	Device
40263	WIRELESS DEVICE STATUS 1
40264	WIRELESS DEVICE STATUS 2
40265	WIRELESS DEVICE STATUS 3
40266	WIRELESS DEVICE STATUS 4
....
40389	WIRELESS DEVICE STATUS 127
40390	WIRELESS DEVICE STATUS 128

The register contains information about signal strength in dBm and remote device status.

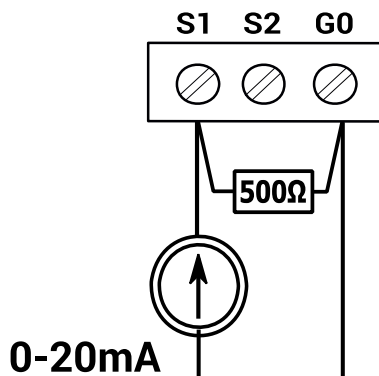
No of bit in register	Function
0 ÷ 7	RX POWER [dBm]
8	0-> DOWN; 1-> OK

Special inputs

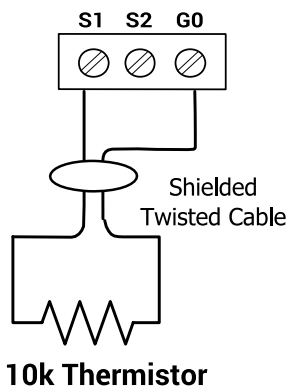
12.1. Connection of special input to measure voltage 0 – 10V



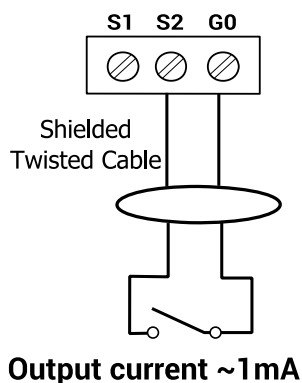
12.2. Connection of special input to measure current 0 – 20mA



12.3. Connection of special input to measure temperature



12.4. Connection of universal input as a digital input (Dry Contact)



12.5. Status of special inputs working as digital inputs (30017)

This register contains information about the status of special inputs (dry contact). Short the input to ground will set the corresponding bit in the register in accordance with the following table:

No of input	No of bit in register
1	0
2	1

12.6. Special input measure voltage 1 – 2 (30071, 30073)

In these registers are the results of measuring the voltage for each input. The result is expressed in millivolts.

12.7. Special input measure temperature 1 – 2 (30072, 30074)

In these registers are the results of temperature measurement for each input. The result is expressed in Celsius degrees • 10

12.8. Special input measure resistance 1 – 2 (30103-30104, 30105-30106)

In these 32-bit registers are the results of the resistance measurement for each input. The result is expressed in Ω . In the register with lower number is storage lower part of result.

12.9. Fast counter (40023-40024, 40025-40026)

The module has two 32-bit counters, one for each special input. Counters value is stored in non-volatile memory.

Input	Registers
S1	LO – 40023, HI - 40024
S2	LO – 40025, HI - 40026

In the case you would like to change the value of the register you can write any value (called preset) for pulse counting registers. In the particular case, you can reset the counter by entering 0. Reset counter is also possible by switching-on relevant bits in the registry 40022.

Warning!: By default fast counters works on 50Hz to change to 100Hz please refer to registers (40151 – 40152).

12.10. Resetting counters value (40022)

Set bit in the register resets (sets to 0) its corresponding counter in accordance with the following table:

No of bit in register	No of resetting counter
0	1
1	2

Set bit in register causes continuously reset the counter. Setting the bit to 0 restores normal operation.

12.11. Special input configuration 1 – 2 (40151 – 40152)

These registers are used to configure special inputs in accordance with the following table:

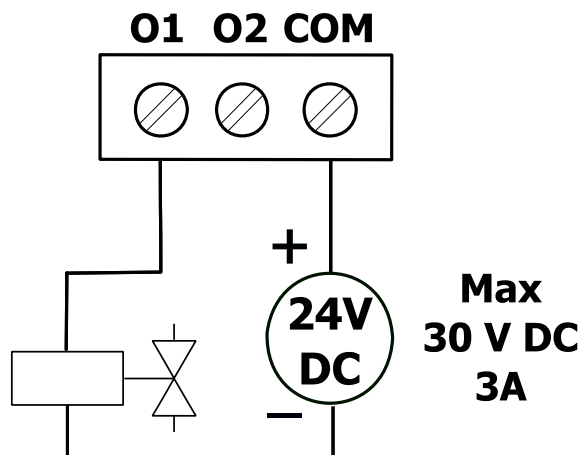
Register value	Description
0	Off resistance measurement (only measuring the voltage, dry contact off)
1 (default)	The temperature sensor 10K3A1 NTC B=3975K
2	The temperature sensor 10K4A1 NTC B=3695K
3	The temperature sensor 10K NTC B=3435K Carel
4	The temperature sensor 20K6A1 NTC B=4262K
5	The temperature sensor 2,2K3A1 NTC B=3975K
6	The temperature sensor 3K3A1 NTC B=3975K
7	The temperature sensor 30K6A1 NTC B=4262K
8	The temperature sensor SIE1
9	The temperature sensor TAC1
10	The temperature sensor SAT1
+128 (set 7. bit of register)	Off voltage measurement and fast counters working on 100Hz

12.12. Filter time of the special input 1 – 2 (40159 – 40160)

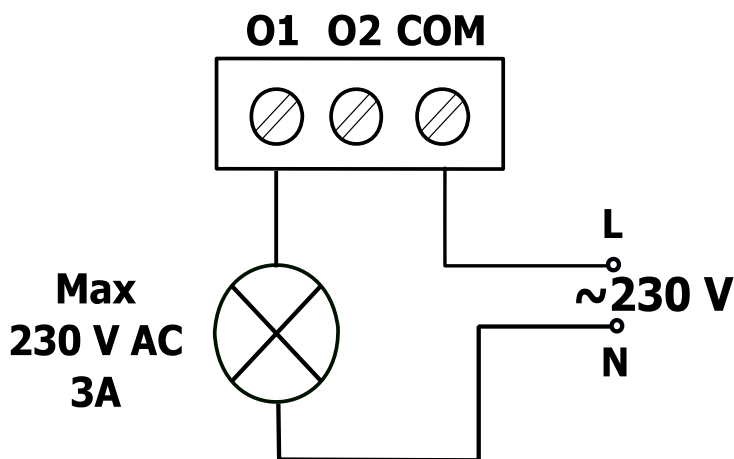
Registers with a time constant low pass filter. The value is expressed in seconds. Valid values must be between 1 and 60 seconds. The default filter value is 2 seconds. Setting value 0 will disable the filter.

Digital outputs (relays)

13.1. Connecting the solenoid valve to the digital output



13.2. Connecting a resistive load to the digital output



13.3. State of digital outputs (40018)

The register contains the state of the digital outputs. Set bit in the register enables the corresponding digital output according to the following table:

No of bit in register	No of digital output
0	1
1	2

13.4. Default state of digital outputs (40143)

The register contains the default state of the digital output device after the start or watchdog reset (only in “Ordinary IO” mode). Register bits correspond to the digital outputs according to the table in the chapter “State of digital outputs (40018)”.

I/O modes

The special inputs can be set to work in 4 different modes. There are dedicated registers for operation mode (40176, 40180) and for time parameters (40177, 40181).

Register	
40176	Input S1 OPERATION MODE
40177	Input S1 TIME VALUE
40180	Input S2 OPERATION MODE
40181	Input S2 TIME VALUE

Operating mode can be changed by writing value in the configuration register. The table below shows the records of the relevant modes.

Value (40176, 40178)	Operating Mode
0	Ordinary IO
1	Monostabile Relay
2	Bistabile Relay
3	Time Relay

14.1. Ordinary IO

In this mode, module works as a standard IO, inputs and outputs are not related which each other.

14.2. Monostabile Relay

In this mode both rising and falling edge on special input change output state. The output of the module is related with input. Output O1 is related with input S1, and output O2 is related with input S2. The action of monostabile relay can be executed remotely by changing the state of bit from false to true in COMMAND register (40020). Outputs can be also overwritten by DIGITAL OUTPUT register (40018), which allows remote control from BMS.

14.3. Bistabile Relay

In this mode only rising edge on special input change output state. The output of the module is related with input. Output O1 is related with input I1, and output O2 is related with input I2. The action of bistabile relay can be executed remotely by changing the state of bit from false to true in COMMAND register (40020). Outputs can be also overwritten by DIGITAL OUTPUT register (40018), which allows remote control from BMS.

14.4. Time Relay

In this mode rising edge on special input set output for time defined in time value register. Switch-on time is counted from last rising edge. The output of the module is related with input. Output O1 is related with input I1, and output O2 is related with input I2. The action of time relay can be executed remotely by changing the state of bit from false to true in COMMAND register (40020). Outputs can be also overwritten by DIGITAL OUTPUT register (40018), which allows remote control from BMS.

14.5. Command and blocking register

The module has two special registers: COMMAND (40020) and BLOCKING (40021). The command register is used to remotely execute an action (simulate light switch/PIR). The action is executed by changing the state of the relevant bit (changing from false to true).

No of bit in register (40020)	Command input number
0	1
1	2

The blocking register is used to block physical input signals to take action in logic (all modes excluding "Ordinary IO" mode). By switching on the relevant bit, the module blocks input and no action will be executed. Setting the bit to 0 restores normal operation.

No of bit in register (40021)	Blocking input number
0	1
1	2

Registers of the module

Modbus Address	Dec Address	Hex Address	Register name	Access	Description								
30001	0	0x00	VERSION AND MODULE TYPE	Read Only	Firmware version and module type (30001)								
30004	3	0x03	RS485 COUNTER OF RECEIVED FRAMES (32 – bits)	Read Only	Counter of received messages (30004) Default state is 0 Reset at the unit start and change of transmission parameters.								
30006	5	0x05	RS485 COUNTER OF FRAMES WITH ERROR (32 – bits)	Read Only	Counter of error messages (30006) Default state is 0 Reset at the unit start and change of transmission parameters.								
30008	7	0x07	RS485 COUNTER OF SENT FRAMES (32 – bits)	Read Only	Counter of sent messages (30008) Default state is 0 Reset at the unit start and change of transmission parameters.								
30017	15	0x0F	STATUS OF SPECIAL INPUTS WORKING AS DIGITAL INPUT	Read Only	Status of special inputs working as digital inputs are represented by bits 0 and 1 in register (30017)								
40001	0	0x00	VERSION AND MODULE TYPE PLUS ENABLE OF ACTIONS	Read & Write	Firmware version and module type plus enable of actions <table border="1" data-bbox="1023 976 1422 1238"> <thead> <tr> <th>Value</th> <th>Type of action</th> </tr> </thead> <tbody> <tr> <td>0x01FF</td> <td>Reset of device</td> </tr> <tr> <td>0x02FF</td> <td>Reload settings (RS485, Radio)</td> </tr> <tr> <td>0x03FF</td> <td>Set device to default</td> </tr> </tbody> </table>	Value	Type of action	0x01FF	Reset of device	0x02FF	Reload settings (RS485, Radio)	0x03FF	Set device to default
Value	Type of action												
0x01FF	Reset of device												
0x02FF	Reload settings (RS485, Radio)												
0x03FF	Set device to default												
40018	17	0x11	STATE OF DIGITAL OUTPUTS	Read & Write	State of digital outputs (40018)								
40020	19	0x12	SPECIAL INPUTS COMMAND REGISTER	Read & Write	Special inputs command register (40020)								
40021	20	0x14	SPECIAL INPUTS BLOCKING	Read & Write	Special inputs blocking (40021) default set to 0								
40022	21	0x15	COUNTER RESET	Read & Write	Resetting counters value (40022) Set bit in register to reset corresponding counter.								
40023	22	0x16	COUNTER 1 LSB	Read & Write Memory	32-bit counters for each special input counting pulses.								
40024	23	0x17	COUNTER 1 MSB										
40025	24	0x18	COUNTER 2 LSB										
40026	25	0x19	COUNTER 2 MSB										
30071	70	0x46	SPECIAL INPUT 1 VOLTAGE	Read Only	Special input measure voltage 1 – 2 (30071, 30073) and Special input measure temperature 1 – 2 (30072, 30074) Voltage measurement value is								
30072	71	0x47	SPECIAL INPUT 1 TEMPERATURE	Read Only									
30073	72	0x48	SPECIAL INPUT 2 VOLTAGE	Read Only									
30074	73	0x49	SPECIAL INPUT 2 TEMPERATURE	Read Only									

Modbus Address	Dec Address	Hex Address	Register name	Access	Description												
30087	86	0x56	SPECIAL INPUT 1 VOLTAGE	Read Only	<p>expressed in mV.</p> <p>For current measurements, the formula for the current:</p> $I = \frac{U}{500}$ <p>where: U – register value, 500 – value of attached resistance</p> <p>Temperature is expressed in Celsius degrees * 10</p> <p>For a result, divide the registry value by 10:</p> $T = \frac{\text{registervalue}}{10}$ <p>Selection of the type sensor is done using registers from 40151 to 40152 for each input separately</p>												
30088	87	0x57	SPECIAL INPUT 2 VOLTAGE	Read Only													
30095	94	0x5E	SPECIAL INPUT TEMPERATURE 1	Read Only													
30096	95	0x5F	SPECIAL INPUT TEMPERATURE 2	Read Only													
30103	102	0x66	RESISTIVE INPUT 1 LSB	Read Only													
30104	103	0x67	RESISTIVE INPUT 1 MSB	Read Only	<p>Special input measure resistance 1 – 2 (30103-30104, 30105-30106)</p> <p>Resistance measurement result expressed in Ω</p>												
30105	104	0x68	RESISTIVE INPUT 2 LSB	Read Only													
30106	105	0x69	RESISTIVE INPUT 2 MSB	Read Only													
40134	133	0x85	MODBUS PROTOCOL TYPE	Read & Write Memory		RS485 Modbus protocol type 0 -> RTU, 1->ASCII											
40136	135	0x87	RS485 BAUD RATE	Read & Write Memory	RS485 baud rate (40136)												
40137	136	0x88	RS485 STOP BITS	Read & Write Memory	Stop bits (40137) Supported values are 1 and 2 The default value 1												
40138	137	0x89	RS485 DATA BITS	Read & Write Memory	Data bits (40138) Supported values are 7 and 8 The default value 7												
40139	138	0x8A	RS485 PARITY BIT	Read & Write Memory	<p>Parity bit (40139) The default value is 0 (no parity) Allowed values:</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0 (default)</td> <td>none</td> </tr> <tr> <td>1</td> <td>Odd</td> </tr> <tr> <td>2</td> <td>Even</td> </tr> <tr> <td>3</td> <td>Always 1</td> </tr> <tr> <td>4</td> <td>Always 0</td> </tr> </tbody> </table>	Value	Description	0 (default)	none	1	Odd	2	Even	3	Always 1	4	Always 0
Value	Description																
0 (default)	none																
1	Odd																
2	Even																
3	Always 1																
4	Always 0																
40140	139	0x8B	RESPONSE DELAY	Read & Write Memory	Response delay time (40140) Delay in ms before sending response The default value is 0.												
40141	140	0x8C	WATCHDOG TIME	Read & Write Memory	Watchdog time (40141) Time in second before watchdog reset in case no transmission.												

Modbus Address	Dec Address	Hex Address	Register name	Access	Description																										
					Setting value of 0 disables Watchdog. The default value is 15s																										
40143	142	0x8E	DEFAULT STATE OF DIGITAL OUTPUTS	Read & Write Memory	Default state of digital outputs (40143) State of digital outputs assigned at the start of the module and watchdog reset. The default value is 0.																										
40151	150	0x96	SPECIAL INPUT 1 CONFIGURATION	Read & Write Memory	Configuration of special input and type of temperature sensor. The default value is 1.																										
40152	151	0x97	SPECIAL INPUT 2 CONFIGURATION	Read & Write Memory																											
					<table border="1"> <thead> <tr> <th>Value</th> <th>Description / Sensor</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Resistance measurement off</td> </tr> <tr> <td>1</td> <td>10K3A1 NTC</td> </tr> <tr> <td>2</td> <td>10K4A1 NTC</td> </tr> <tr> <td>3</td> <td>10K NTC Carel</td> </tr> <tr> <td>4</td> <td>20K6A1 NTC</td> </tr> <tr> <td>5</td> <td>2,2K3A1 NTC B=3975K</td> </tr> <tr> <td>6</td> <td>3K3A1 NTC</td> </tr> <tr> <td>7</td> <td>30K6A1 NTC</td> </tr> <tr> <td>8</td> <td>SIE1</td> </tr> <tr> <td>9</td> <td>TAC1</td> </tr> <tr> <td>10</td> <td>SAT1</td> </tr> <tr> <td>+128</td> <td>Voltage measurement off and fast counters working on 100Hz</td> </tr> </tbody> </table>	Value	Description / Sensor	0	Resistance measurement off	1	10K3A1 NTC	2	10K4A1 NTC	3	10K NTC Carel	4	20K6A1 NTC	5	2,2K3A1 NTC B=3975K	6	3K3A1 NTC	7	30K6A1 NTC	8	SIE1	9	TAC1	10	SAT1	+128	Voltage measurement off and fast counters working on 100Hz
Value	Description / Sensor																														
0	Resistance measurement off																														
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6	3K3A1 NTC																														
7	30K6A1 NTC																														
8	SIE1																														
9	TAC1																														
10	SAT1																														
+128	Voltage measurement off and fast counters working on 100Hz																														
40159	158	0x9E	FILTER TIME CONSTANT OF THE SPECIAL INPUT 1	Read & Write Memory	Filter time of the special input 1 – 2 (40159 – 40160) Filter time constant, expressed in seconds in the range from 0 to 60 seconds. The default value is 2s, set to 0s disable the filter.																										
40160	159	0x9F	FILTER TIME CONSTANT OF THE SPECIAL INPUT 2	Read & Write Memory																											
40176	175	0xAF	SPECIAL INPUT 1 CONFIGURATIO MODE	Read & Write Memory	<table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Ordinary IO</td> </tr> <tr> <td>1</td> <td>Monostabile Relay</td> </tr> <tr> <td>2</td> <td>Bistabile Relay</td> </tr> <tr> <td>3</td> <td>Time Relay</td> </tr> </tbody> </table> TIME VALUE [ms]	Value	Description	0	Ordinary IO	1	Monostabile Relay	2	Bistabile Relay	3	Time Relay																
Value	Description																														
0	Ordinary IO																														
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40177	176	0xB0	SPECIAL INPUT 1 TIME VALUE	Read & Write Memory																											
40180	179	0xB3	SPECIAL INPUT 2 CONFIGURATIO MODE	Read & Write Memory																											
40181	180	0xB4	SPECIAL INPUT 2 TIME VALUE	Read & Write Memory																											

Modbus Address	Dec Address	Hex Address	Register name	Access	Description																
40242	241	0xF1	RADIO TX POWER	Read & Write Memory	<table border="1"> <thead> <tr> <th>Value</th> <th>Radio TX Power</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>-18 dBm</td> </tr> <tr> <td>1</td> <td>0 dBm</td> </tr> <tr> <td>2</td> <td>7 dBm</td> </tr> <tr> <td>3</td> <td>10 dBm</td> </tr> <tr> <td>4</td> <td>14 dBm</td> </tr> <tr> <td>5</td> <td>17 dBm</td> </tr> <tr> <td>6</td> <td>20 dBm</td> </tr> </tbody> </table>	Value	Radio TX Power	0	-18 dBm	1	0 dBm	2	7 dBm	3	10 dBm	4	14 dBm	5	17 dBm	6	20 dBm
Value	Radio TX Power																				
0	-18 dBm																				
1	0 dBm																				
2	7 dBm																				
3	10 dBm																				
4	14 dBm																				
5	17 dBm																				
6	20 dBm																				
40243	242	0xF2	RADIO CHANNEL	Read & Write Memory	Radio Channel (40243)																
40244	243	0xF3	RADIO BAUD RATE	Read & Write Memory	Radio baud rate (20249)																
40249	248	0xF8	RADIO AESKEY D1-D0	Read & Write Memory	Radio transmission 128bit encryption key (40249 – 40256) Default value 1111 2222 3333 4444 5555 6666 7777 8888																
40250	249	0xF9	RADIO AESKEY D3-D2	Read & Write Memory																	
40251	250	0xFA	RADIO AESKEY D5-D4	Read & Write Memory																	
40252	251	0xFB	RADIO AESKEY D7-D6	Read & Write Memory																	
40253	252	0xFC	RADIO AESKEY D9-D8	Read & Write Memory																	
40254	253	0xFD	RADIO AESKEY D11-D10	Read & Write Memory																	
40255	254	0xFE	RADIO AESKEY D13-D12	Read & Write Memory																	
40256	255	0xFF	RADIO AESKEY D15-D14	Read & Write Memory																	
40257	256	0x0100	RADIO COUNTER OF RECEIVED FRAMES (32 – bits)	Read & Write Memory		Counter of received messages (30004) Default state is 0 Reset at the unit start and change of transmission parameters.															
40259	258	0x0102	RADIO COUNTER OF ERROT FRAMES (32 – bits)	Read & Write Memory	Counter of error messages (30006) Default state is 0 Reset at the unit start and change of transmission parameters.																

Modbus Address	Dec Address	Hex Address	Register name	Access	Description
40261	260	0x0104	RADIO COUNTER OF TRANSMITTED FRAMES (32 – bits)	Read & Write Memory	Counter of sent messages (30008) Default state is 0 Reset at the unit start and change of transmission parameters.
40263 - 40390	262 - 389	0x0106 – 0x0185	WIRELESS DEVICE STATUS 1 ÷ 128	Read Only	Bit 7:0 - Int8 RX POWER [dBm] Bit 8 - 0-> DOWN; 1-> OK

List of supported temperature sensors

No	1	No	2
Sensor	10K3A1	Sensor	10K4A1
β coefficient	3975K	β coefficient	3695K
Manufacturers	Aquatrol, Cylon, Honeywell, Johnson, Satchwell, Seachange	Manufacturers	Andover, Delta Controls, Siebe, York
$^{\circ}\text{C}$	Ω	$^{\circ}\text{C}$	Ω
-50	667828	-50	441667
-45	491749	-45	330749
-40	335671	-40	239831
-35	241840	-35	181532
-30	176683	-30	135233
-25	131251	-25	105081
-20	96974	-20	78930
-15	72895	-15	61030
-10	55298	-10	47549
-5	42314	-5	37316
0	32650	0	29490
5	25396	5	23462
10	19904	10	18787
15	15714	15	15136
20	12494	20	12268
25	10000	25	10000
30	8056	30	8197
35	6530	35	6754
40	5325	40	5594
45	4367	45	4656
50	3601	50	3893
55	2985	55	3271
60	2487	60	2760
65	2082	65	2339
70	1751	70	1990
75	1480	75	1700
80	1256	80	1458
85	1070	85	1255
90	916	90	1084
95	787	95	939
100	678	100	817
105	587	105	713
110	510	110	624
115	444	115	547

No	1	No	2
120	388	120	482
125	340	125	426

No	3	No	4
Sensor	10K Carel	Sensor	20K6A1
β coefficient	3435K	β coefficient	4262K
-50	329500	Manufacturers	Honeywell
-45	247700	°C	Ω
-40	188500	-40	806800
-35	144100	-35	574400
-30	111300	-30	413400
-25	86430	-25	300400
-20	67770	-20	220600
-15	53410	-15	163480
-10	42470	-10	122260
-5	33900	-5	92220
0	27280	0	70140
5	22050	5	53780
10	17960	10	41540
15	14690	15	32340
20	12090	20	25340
25	10000	25	20000
30	8313	30	15886
35	6940	35	12698
40	5827	40	10212
45	4912	45	8260
50	4161	50	6718
55	3536	55	5494
60	3020	60	4518
65	2588	65	3732
70	2228	70	3098
75	1924	75	2586
80	1668	80	2166
85	1451	85	1823
90	1266	90	1541
95	1108	95	1308
100	973	100	1114
105	857	105	953
110	758	110	818
115	672	115	704
120	597	120	609
125	531	125	528

No	5	No	6
Sensor	2.2K3A1	Sensor	3K3A1
β coefficient	3975K	β coefficient	3975K
Manufacturers	Ambiflex, Johnson	Manufacturers	Alerton
$^{\circ}\text{C}$	Ω	$^{\circ}\text{C}$	Ω
-50	329500	-50	200348
-45	247700	-45	150524
-40	188500	-40	100701
-35	144100	-35	76853
-30	111300	-30	53005
-25	86430	-25	41048
-20	67770	-20	29092
-15	53410	-15	21868
-10	42470	-10	16589
-5	33900	-5	12694
0	27280	0	9795
5	22050	5	7619
10	17960	10	5971
15	14690	15	4714
20	12090	20	3748
25	10000	25	3000
30	8313	30	2417
35	6940	35	1959
40	5827	40	1598
45	4912	45	1310
50	4161	50	1080
55	3536	55	896
60	3020	60	746
65	2588	65	625
70	2228	70	526
75	1924	75	444
80	1668	80	377
85	1451	85	321
90	1266	90	275
95	1108	95	236
100	973	100	204
105	857	105	176
110	758	110	153
115	672	115	133
120	597	120	117
125	531	125	102

No	7	No	8
Sensor	30K6A1	Sensor	SIE1
β coefficient	4262K	Manufacturers	Barber Colman, Siebe
Manufacturers	Drayton	$^{\circ}\text{C}$	Ω
$^{\circ}\text{C}$	Ω	-50	10732
-30	622911	-45	10624
-25	477393	-40	10517
-20	331876	-35	10344
-15	245785	-30	10172
-10	183697	-25	9913
-5	138502	-20	9654
0	105305	-15	9320
5	60713	-10	8933
10	62347	-5	8496
15	48511	0	8044
20	38019	5	7489
25	30000	10	6938
30	23828	15	6370
35	19046	20	5798
40	15317	25	5238
45	12390	30	4696
50	10079	35	4185
55	8243	40	3707
60	6777	45	3271
65	5600	50	2875
70	4650	55	2521
75	3879	60	2206
80	3251	65	1929
85	2737	70	1685
90	2313	75	1472
95	1963	80	1287
100	1672	85	1127
105	1430	90	986
110	1228	95	866
115	1058	100	760
120	915	105	670
125	793	110	590
		115	522
		120	462
		125	410
		No	8

No	9	No	10
Sensor	TAC1	Sensor	SAT1
β coefficient	3500K	Manufacturers	Satchwell
Manufacturers	TAC	$^{\circ}\text{C}$	Ω
$^{\circ}\text{C}$	Ω	-50	9719
-40	39024	-45	9652
-35	29358	-40	9584
-30	22284	-35	9467
-25	17073	-30	9349
-20	13192	-25	9159
-15	10276	-20	8968
-10	8068	-15	8708
-5	6382	-10	8396
0	5085	-5	8031
5	4078	0	7614
10	3294	5	7150
15	2676	10	6649
20	2188	15	6121
25	1800	20	5580
30	1488	25	5039
35	1237	30	4513
40	1034	35	4012
45	869	40	3545
50	733	45	3117
55	622	50	2730
60	529	55	2386
65	453	60	2082
70	389	65	1816
75	335	70	1585
80	290	75	1385
85	252	80	1213
90	220	85	1064
95	192	90	937
100	169	95	828
105	149	100	734
110	131	105	654
115	116	110	585
120	103	115	525
125	92	120	474
		125	429