Configurator

RM169-1 – RTURADIO-169 – Z-AIR-1

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Radio modems have been designed to operate on civil frequency ranges as SRD (Short Range Device), the exact use of which differs from one region and/or country to another. The user of a radio modem must take care that the device is not operated without the permission of the local authorities on frequencies other than those specifically reserved and intended for use without a specific permit.

The radio modem can be used in the following countries with E.R.P. and duty cycle limitation, either on license free channels or on channels where the operation requires a license. More detailed information is available at the local frequency management authority.

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Country allowed [4]
ALB-AND-AUT-BEL-BIH-BLR-BUL-CVA-CYP-CZE-D-DNK-E-EST-F-FIN-G-GRC-HNG-HOL-HRV-I-IRL-ISL-LIE-LTU-LUX-LVA-MCO-MDA-MKD-MLT-MNE-NOR-POL-POR-ROU-RUS-S-SMR-SRB-SUI-SVK-SVN-TUR-UKR

Allowed use according to ERC Recommendation 70-03					
Model	**Frequency (MHz)**	**Annex [1]**	**E.R.P [2]**	**Duty Cycle [3]**	**Country[4] with restriction of use**
RM169-1 RTURADIO-169	169,400 – 169,475	1	≤ 500 mW	≤ 1 %	BLR-RUS-UKR
	169,400 – 169,475	2	≤ 500 mW	≤10 %	BLR-RUS-UKR
Z-AIR-1	863,000 – 870,000	1	≤ 25 mW	≤ 0.1 %	BLR-GRC-NOR-RUS-S
	868,000 – 868,600	1	≤ 25 mW	≤ 1 %	RUS
	868,700 – 869,200	1	≤ 25 mW	≤ 0.1 %	BLR-UKR
	869,400 – 869,650	1	≤ 500 mW	≤ 10 %	BLR-RUS-UKR
	869,700 – 870,000	1	≤ 5,0 mW	≤ 100 %	RUS-UKR

NOTE:
Before to install the device check always the latest version of ERC Recommendation 70-03 in order to verify any restriction and limitation in terms of E.R.P and Duty Cycle
[1] Annex 1.xxx refer to SRD (Short Range Device), Annex 2 refer to Tracking, Tracing and Data Acquisition.
[2] E.R.P. = Max Effective Radiated Power allowed from radiomodem and associated antenna takes into consideration transmitter power output, transmission line attenuation, RF connector insertion losses and antenna gain
[3] Duty Cycle is defined as the ratio, expressed as a percentage, of the maximum transmitter "on" time on one carrier frequency, relative to a one hour period
[4] The CEPT country codes can be seen under http://www.cept-org/cept/cept-country-codes

4. Warranty – Liability of the Product

Supplier represents and warrants that products are manufactured in accordance with the applicable specifications and are free from defects in materials and workmanship. The warranty, valid for a period of 12 months of use, maximum 18 months from the date of delivery, shall not cover defects caused by accident, Buyer's negligence, improper use or maintenance or by any other reason beyond Supplier's control.

Buyer shall have 10 (ten) working days following receipt of products to inspect the products and to notify to Supplier in writing any defects or non-compliance. In the event that any shipment of products is not accepted by Buyer due to any non-conformity with the specifications, or as a result of a cause occurred prior to placement thereof with the carrier, Buyer shall, if so indicated in writing by the Supplier, promptly return some samples or the full shipment that was rejected by Buyer at Buyer's costs.

Supplier, at its own discretion, shall, within a reasonable period, considering the entity of the complaint: (i) send a replacement shipment of products conforming, or (ii) credit Buyer a sum equal to the value of the defective or non-conforming products. This warranty overwrites all legal warranties for defects and compliance and exempts Supplier from any other responsibility for the supplied products; in particular, Buyer shall not be entitled to any requests for compensation or price reductions.

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If one of the products sold by the Supplier to the Buyer is defective, the Buyer will send it, at its own expense, at the headquarters of the Italian Supplier. The product will be repaired or replaced by the Supplier, at no costs to the Buyer.

The Buyer will pay all the shipping costs for the product repaired or replaced and sent back to the Buyer.

The Buyer will bear all costs related to disassembly, assembling and transportation of the product, and any damage caused by the "machinery inactivity".

Supplier shall indemnify Buyer against any liability of the products claims asserted by third parties relating to damages sustained as a result of a defective products. In such case Supplier shall reimburse Buyer exclusively within the limits, terms and conditions of the products liability insurance policy held by Supplier. Buyer shall not make any oral or written representations which vary from the specifications, operating instructions, labels or representations given or made by Supplier with respect to the products. If any liability is incurred because of such varying representations, Buyer holds Supplier harmless with respect to any such representations.

In no event shall Supplier be liable for any indirect, incidental, exemplary or consequential damages, including without limitation any claim for damages based on lost revenues or profits, however caused.

In no event shall the Supplier be liable for any costs or damages arising from any act or omission of Buyer, including, without limitation, relating to the modification, handling, storage and marketing of Products by Buyer or to Buyer’s failure to provide its employees, agents and customers or other third parties with adequate instruction as to the proper handling and use of Products.

In this respect we hereby confirm that our products are not designed for nuclear applications neither for aircraft/aerospace industries. For the above mentioned applications both warranty and insurance coverage do not apply.

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5. Program installation

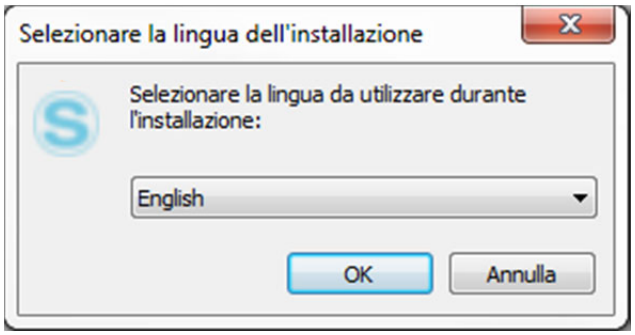
5.1 System requirements

Operating system : Windows 7, Windows 8, Windows 10.
Screen : minimum resolution 1024 x 768

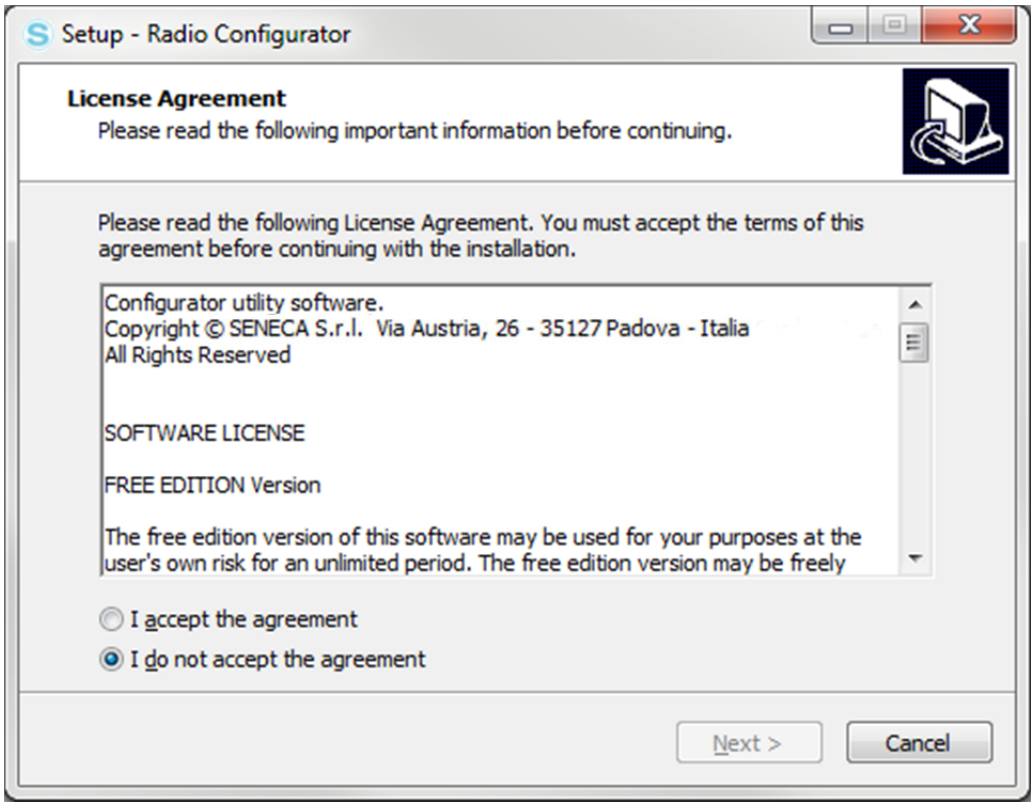
5.2 Software installation

1) Run the "setup.exe" file:

2) Select the desired language and press the OK button:

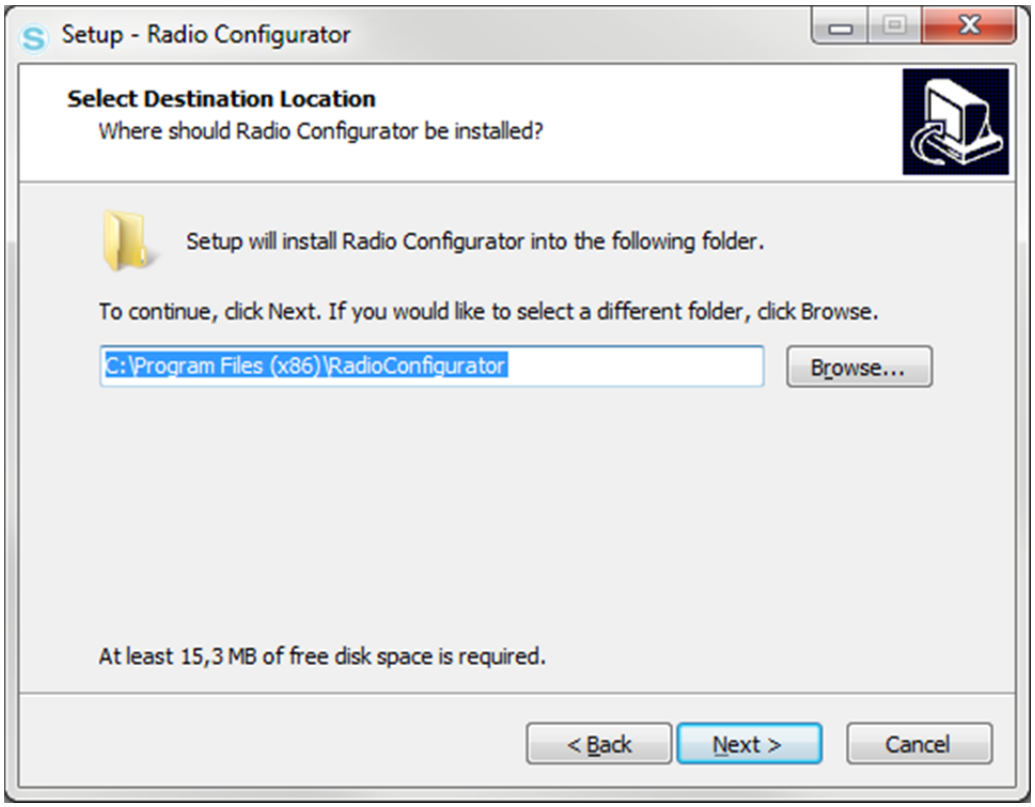


3) Read and accept the conditions to continue:

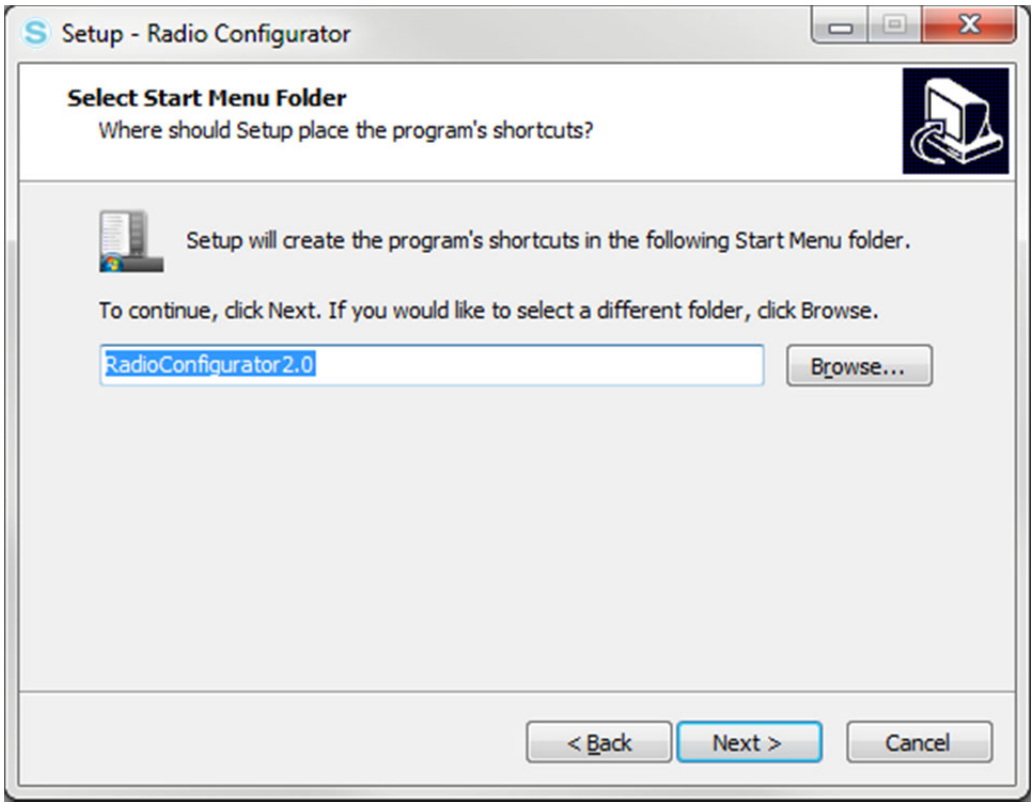


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4) Select the folder where you want to install the program:

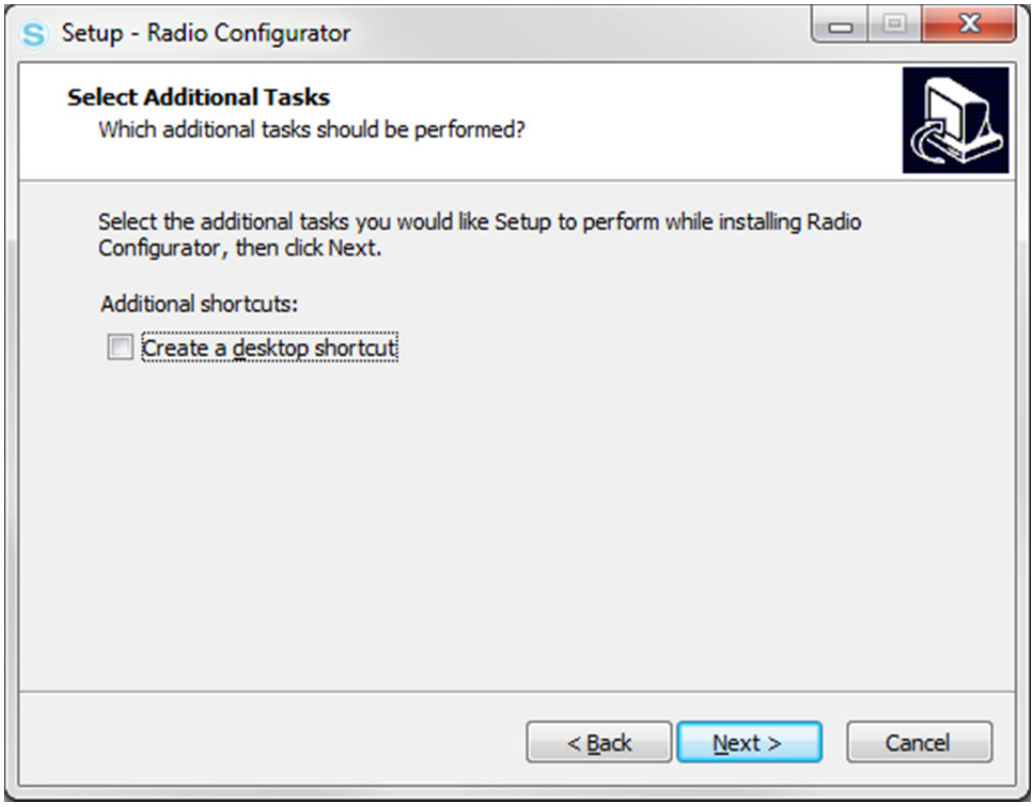


5) Select the start menu folder:

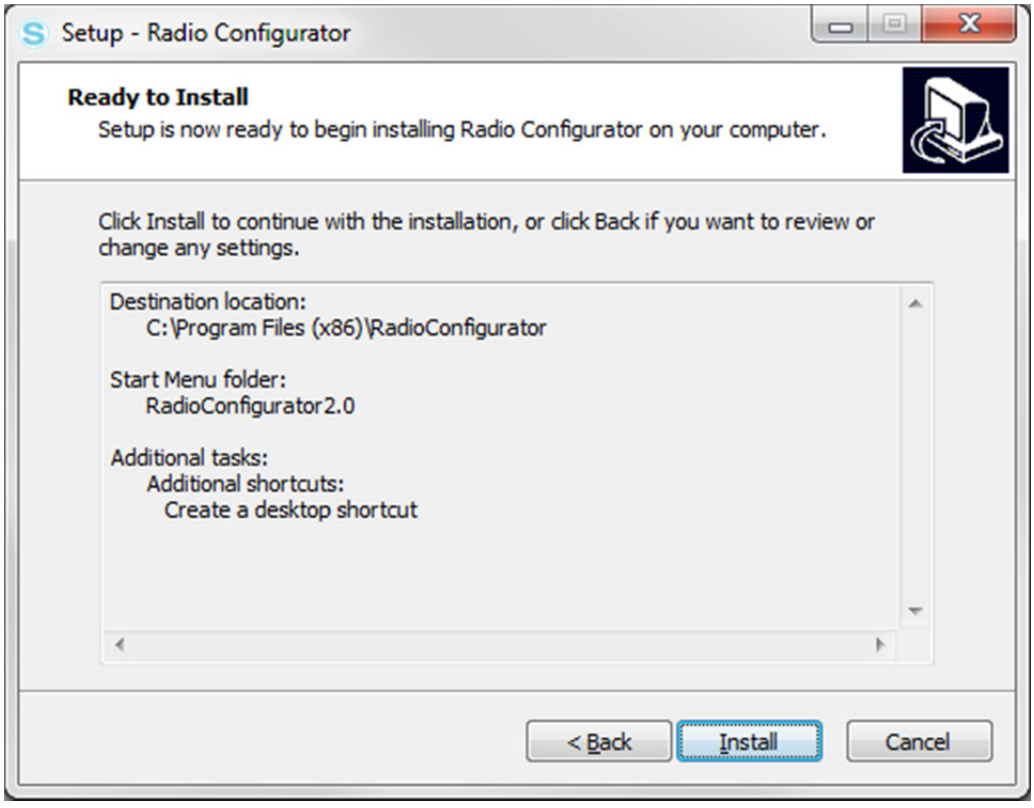


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6) Select whether or not you want to have the program icon on the desktop, press next to continue:

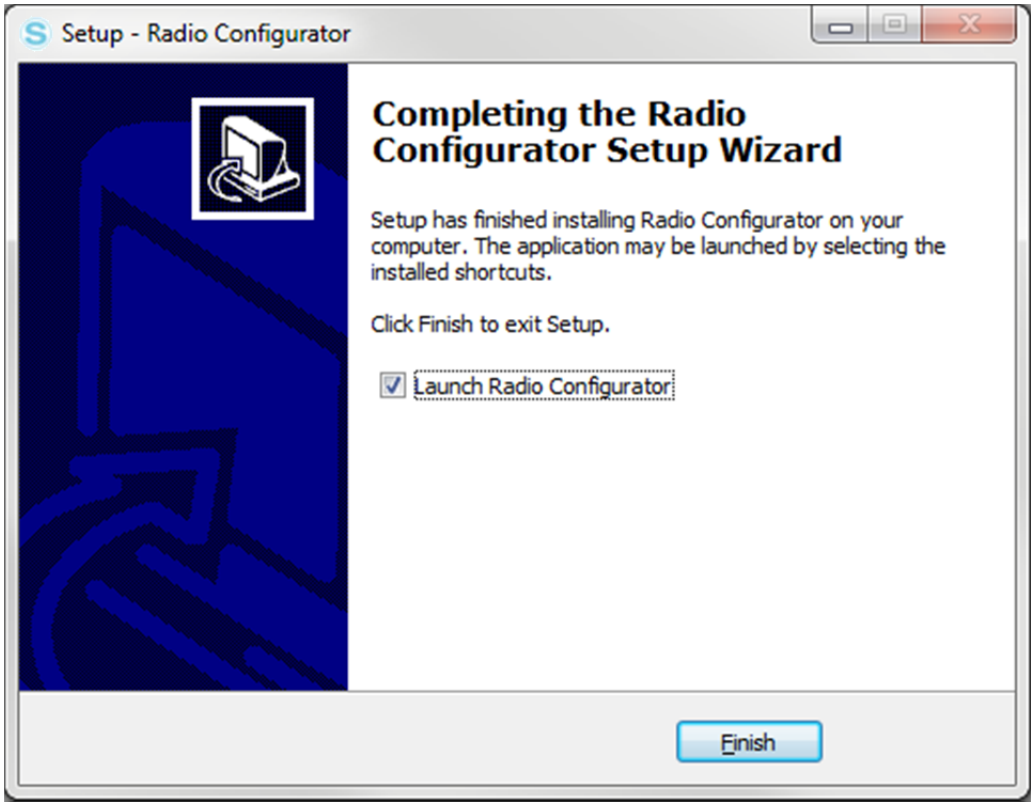


7) Press on the install button to proceed with the installation of the program:



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8) The installation program will proceed to the installation and when finished will display the following screen:



9) Press the Finish button to end the installation procedure.

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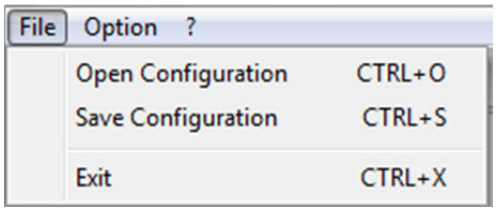
5.3 First program start

When the program starts, the following screen will be displayed:

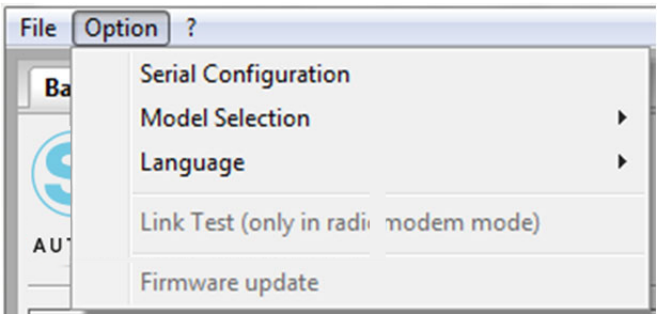


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5.3.1 Description File Menu

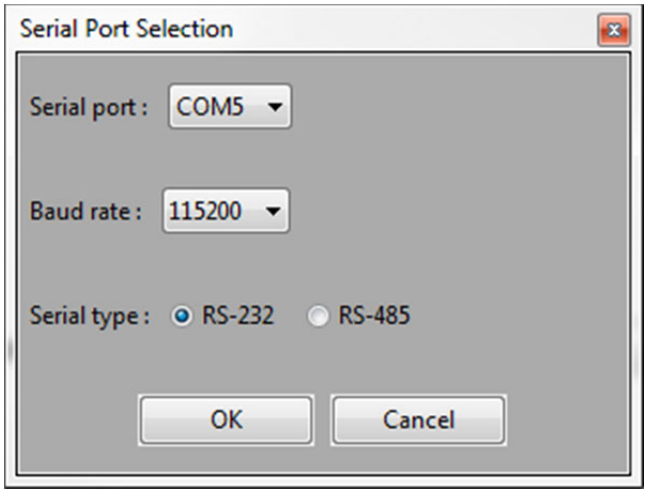


- *Open Configuration* : Load the saved configuration file
- *Save Configuration* : Save the current configuration to disk
- *Exit* : Close the program

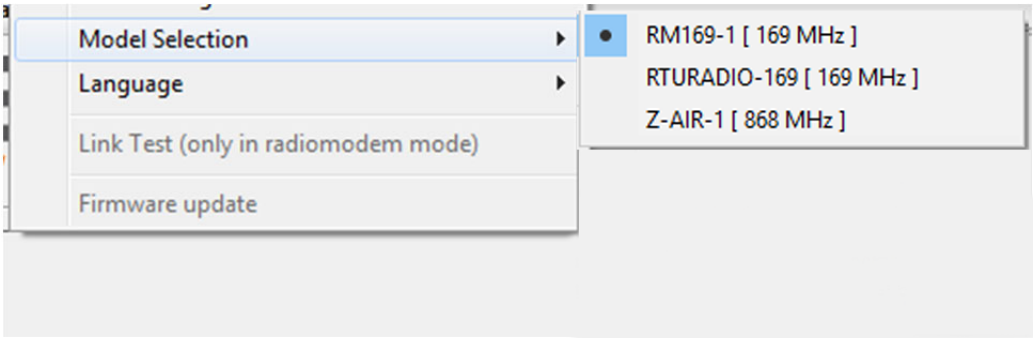


5.3.2 Description Option Menu

- *Serial Configuration* : It allows the selection of the serial port, the maximum speed, the type of serial port

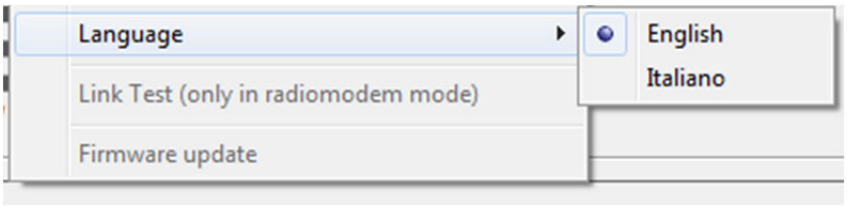


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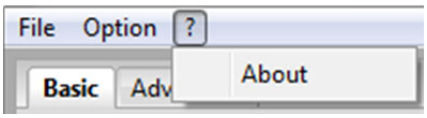


- *Model Selection* : Allows selection of the model to be configured:

- *Language* : Allows to change the language of the program:



- *Link Test* : Activate link test mode (this function is enabled only if in radiomodem mode)
- *Firmware update* : If the program detects that the new firmware is present on the radiomodem, it will enable the possibility to make updates.



5.3.3 Description ? Menu

- *About* : It will display an information window indicating the version of the program:

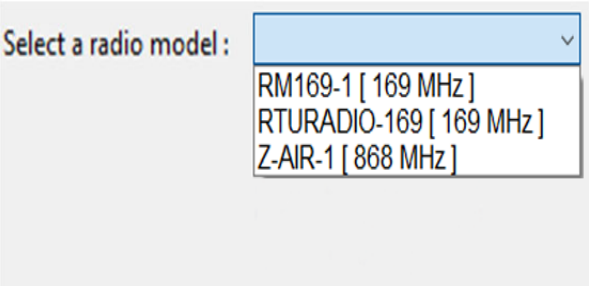


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6 First steps

6.1 Configuration via RS232 serial port

1) Connect the serial port of the radio modem to the computer communication port with a **NO Null Modem cable** and open the configuration utility. In the absence of a serial port, use a USB-Serial converter.
2) In Option menu select “Serial Configuration” and select the serial port. The selected serial port will be saved so that the next time the program is started, there will be no need to re-select the port.



3) Select the correct radiomodem model from the drop-down menu
4) Power the radiomodem.
5) Press the "Connect" button. In the radiomodem the entry into the configuration mode is confirmed by the color variation of the LED which turns orange. In the configurator, entry into the configuration state is signaled:



While connecting:

When connected [radio with new firmware]



When connected [radio with old firmware]



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In the case of connection problems between the radio and the PC, or the selected model is different from



the connected one, an error window will be displayed:

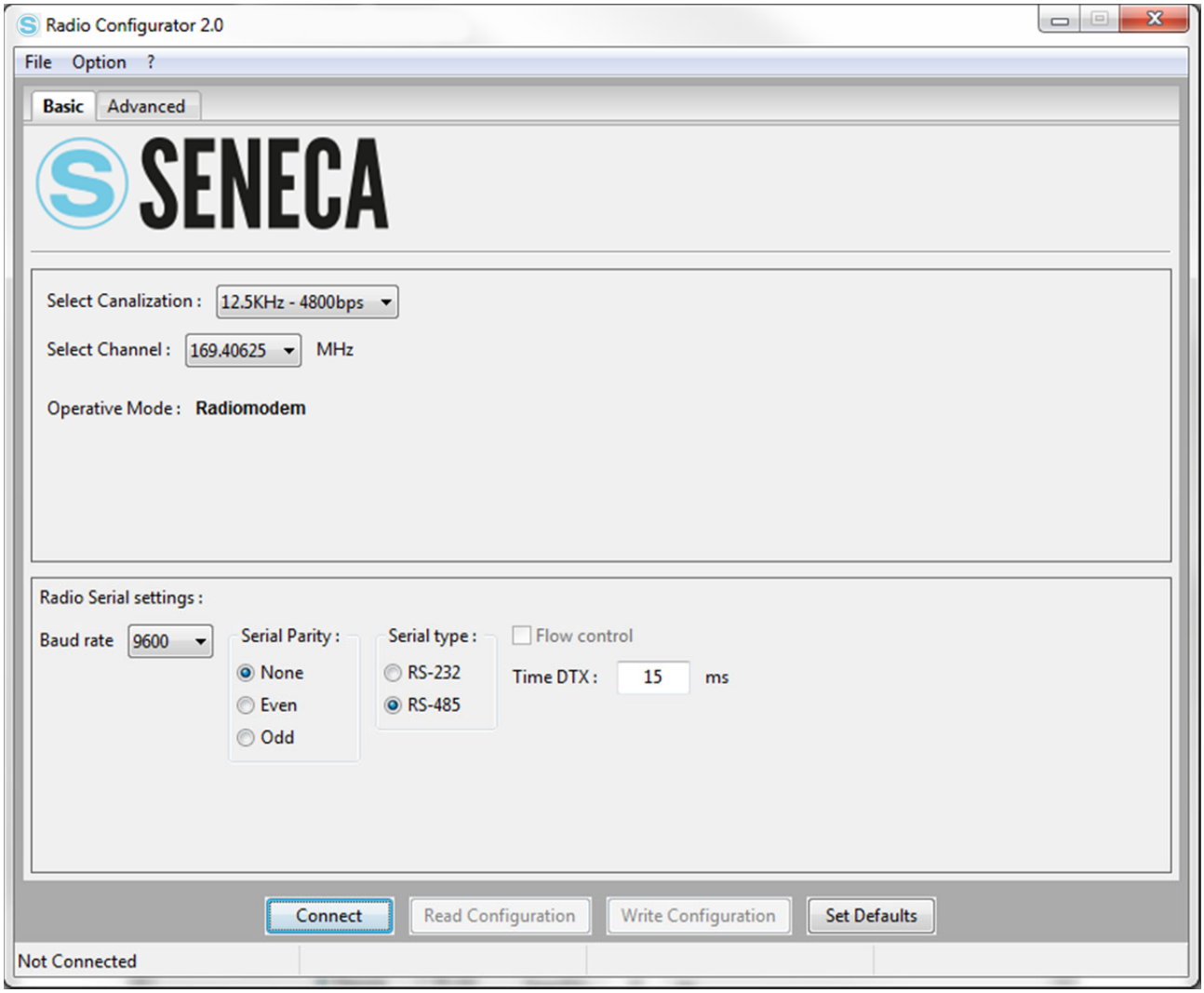
6) Button:
   - *Disconnect* : Disconnects the serial port
   - *Read Configuration* : Reads the configuration on the radiomodem and displays it
   - *Write Configuration* : Writes the configuration on the radiomodem
   - *Set default* : Reset the values to the default values

6.2 Configuration via USB

1) Install the appropriate driver as explained in the user manual of theinterface.
2) Connect the interface to a personal computer by a USB cable with type A connector (PC side) and microUSB connector (interface side).
3) In Option menu select “Serial Configuration” and select the serial port.
4) Using a cable with a DB9 connector on one side, connect the radio modem to the interface boardaccording to the diagram (see the figure below).
5) Power up the radio modem.
6) Press the "Connect" button. On the radiomodem, the entry in the configuration state is signaled by the change in color of the LED that changes from green (fast pulse) to orange. In case of using a different interface board with no DTR criterion, to enter in configuration mode you must follow this step: turn off the radio modem, click on the "Connect" button of the configurator and turn on the radio modem within 4 seconds from the push of the "Connect" button.

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6.3 Base Tab (models RM169-1)



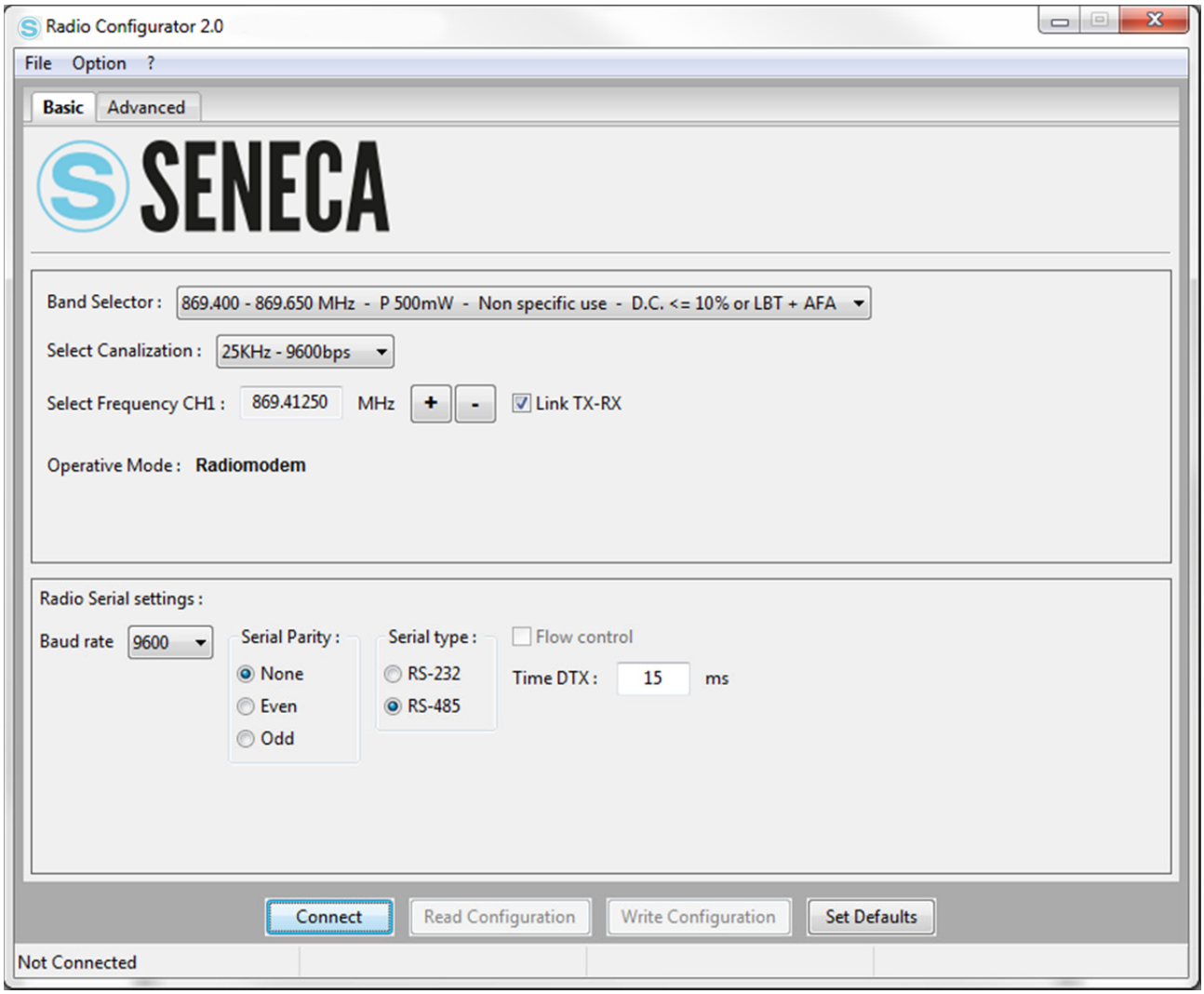
- *Select Canalization* : Allows to set the width of the radio channel
- *Select Channel* : Allows to select the radio channel to be used
- *Operative Mode* : Indicates the current operating mode of the radiomodem

The Radio serial configuration box, allows to modify the parameters of the serial on board:

- *Baud Rate* : set the serial speed (max. 57600bps)
- *Serial Parity* : Enable parity and type
- *Serial type* : selection of the serial type (the RS-232 is only available in the RM169-1 models)
- *Flow Control* : If the RS-232 is enabled, the RTS-CTS flow control can be activated
- *Time DTX* : Defines the time between the stop of the data received from the serial port and the sending of the packet via radio. In the "modus low energy" mode this parameter only affects the unit configured as a Slave. If you realize that the data transmitted from the slave unit are incomplete, try to increase this time.

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6.4 Base Tab (models RM169-1)



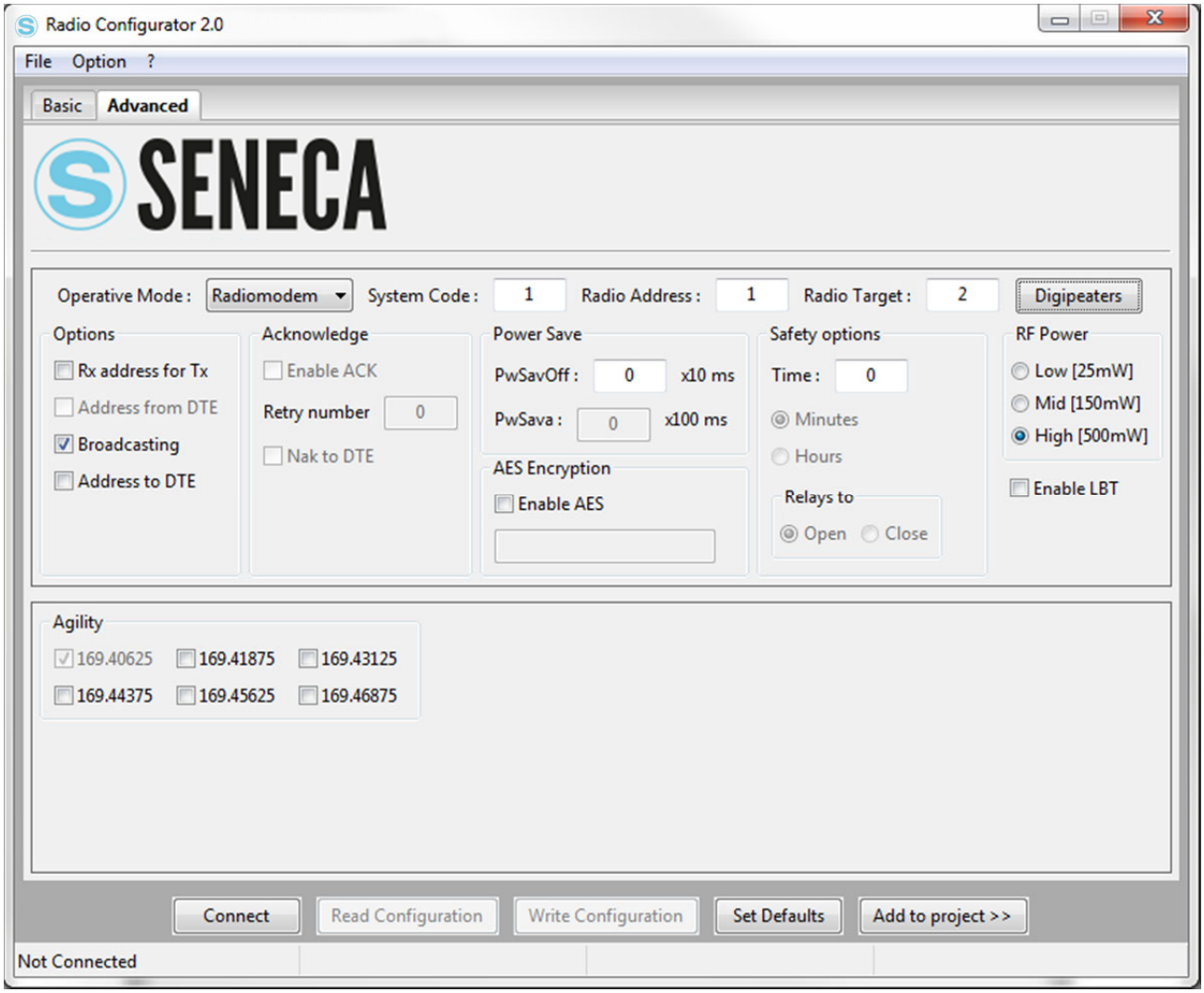
- *Band Selector* : Allows to select the operating band to be used
- *Select Canalization* : Allows to set the width of the radio channel
- *Select Frequency CH1* : Allows to select the radio channel to be used (with the + / - buttons you can change the channel frequency)
- *Operative Mode* : Indicates the current operating mode of the radiomodem

The Radio serial configuration box, allows to modify the parameters of the serial on board:

- *Baud Rate* : set the serial speed (max. 57600bps)
- *Serial Parity* : Enable parity and type
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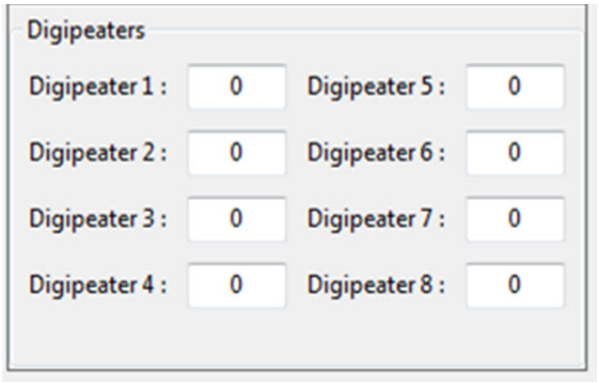
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6.5 Advanced Tab (common parameters)



- *Operative Mode* : Allows the selection of the operating mode of the radiomodem (see "**Errore. L'origine riferimento non è stata trovata.**" for further details)
- *System Code* : Sets the system code used to differentiate different radiomodem networks
- *Radio Address* : Unique id of the radiomodem
- *Radio Target* : Address of the destination radiomodem
- *Digipeaters* : Button that enables the box to enter the digipeaters to reach the "Radio Target"

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Options :

- *Rx address for Tx* : If enabled, the radiomodem stores the full address (digipeaters and target address) of the unit from which it received the last packet and uses these addresses to send the data received from the DTE connected to it. This function is available only if "Address from DTE" is inactive.
- *Address from DTE* : If active, the DTE must also provide the addressing for each transmitted packet. To do this, some bytes must be added before of the data bytes.
  The bytes to add are in this order:
  1 byte for the system code[1....255],
  1 byte-flag with the corresponding bits having the following scope:
  bit 0 (lsb) = Broadcasting;
  bit1 = ECHO;
  bit 2 = ACK request;
  bit3 = Diagnostic.
  1 Byte with the number of units [1..9] which includes the target and the digipeaters used.
  From 0 to 8 bytes of digipeater addresses disposed in the exact sequence of use.
  1 Byte indicating the target address
  Followed by the data bytes (from 1 to 1024).
  This function is available only if "Rx Address For Tx" is inactive.
- *Broadcasting* : If enabled, the radiomodem transmits a special packet that will be received by all the radiomodem that have the same System Code. This function is available only when the ACK is disabled.
- *Address to DTE* : If enabled, the data downloaded to the DTE will be preceded by the address of the sender. This feature allows the identification of the source of the message.

Acknowledge :

- *Enable ACK* : If enabled, the radiomodem that sent a packet waits for the acknowledge from the target radiomodem. If this response it is not received within a fixed time, the last packet is re-sent many times as set in the "Retry number" field. The function is available only if "Broadcasting" and "Address from DTE" are inactive.
- *Nak to DTE* : If enabled, the radio modem sends a NAK character (ASCII 21) to the DTE in the case where all repetition are sent without receiving any acknowledge. This function is available only when the ACK is enabled.

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Power Save :

- *PwSavOff* : Inserting in this field a number greater than 0, the power save feature is enabled. This is the value corresponding to the off period of the energy savings cycles. The step is in the tens of milliseconds. The Master unit is always active but uses this value to size the length of the preamble of the packets sent to a sleeping device (digipeater or slave). If you intend to use the power save feature all units in the network must have the same "PwSavOff" value.
  Note: If the Power Save feature is used, only the Master unit can always receive characters from the serial line; the Slave can only do it during the PwSava period.
- *PwSava* : When the Power Save is used, by this field you can set the time interval in which the radio modem remains operational (On) after it has been temporarily enabled by an event (i.e.: reception of a packet radio). This value is in steps of hundreds milliseconds. This field is also used to differentiate the device between Master and Slave: **a value of 255 identifies the unit as Master** and keeps it always On. The unit so configured is therefore not affected by the ON-OFF cycles, but the packets are sent with a suitable (longer) preamble time in order to be received by the slave devices that use the Power Save.

AES Encryption :

- *Enable AES* : Enable or disable the AES-128 data encryption. In the transmitted packet, the encoding and decoding is done on the payload only. When active the key fiels will be enabled, and the user must insert 16 ascii characters.
  Note: If the AES is used, all the radiomodems in the same network **must use the same AES key**. If the key setting is not the same, the data transiting on the serial line are not interpretable by the connected hardware.

Safety options :

- *Time* : sets the value of the safety timer whose time base is selectable between minutes and hours. If the radio doesn't receive a valid packet within the selected time interval, the digital output (relay) is forced to a condition chosen in the field "Relays to". To disable the functionality of the safety timer set the value of "Time" to zero.
- *Minutes*: the value of "Time" is expressed in minutes.
- *Hours* : the value of "Time" is expressed in Hours.
- *Relays to* : If set to Open when the timer expires, the relay will be forced open, if it is set to Closed when the timer expires the relay will be forced closed.

RF Power :

Allows the choice between three different levels of power.

Enable LBT :

It is possible to enable the LBT feature: the radio modem waits for the channel to become free before proceeding with the transmission of the packet.
When the LBT function is active the device counts the seconds of data ON-AIR transmission in order to operate according to EN300 220-1 standards that require to not exceed a transmission time of 100 seconds in a 1 hour period. After 100 seconds the device stop the transmission and wait the 1 hour period before to allow a new transmission.

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6.6 Advanced Tab (for RM169-1)



6.7 Advanced Tab (for Z-AIR-1)



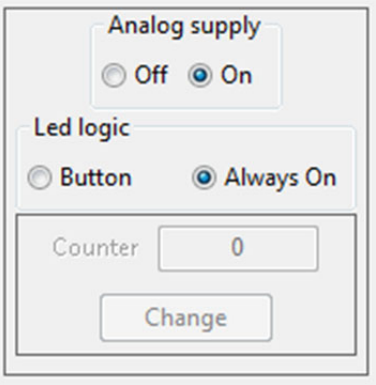
In this section you can choose to use multiple channels, enabling, in automatic, the function of agility.

The agility function will choose to transmit on the less disturbed radio channel among the active ones. The number of selectable channels depends on the chosen channel and for a maximum of 3 channels.

It is essential that exactly the same radio channels are configured in the units in the network.

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6.8 Advanced Tab (for RTURADIO-169)



- *Analog supply* : It allows to activate or not the analogue inputs and outputs.
  It also activates the 18 volt power supply output on the radiomodem connector.
  This voltage can be used to power the analog input sensors when an adequate external power source is not available.
  Note: In operating modes other than "radiomodem", this power supply is only activated during the device switch-on phases determined by the "cycle update" field and remains present for the time set in the "Sensor stabilization time" field.

- *Led logic* : Affects the functionality of the leds which indicate the states of the four digital inputs. In this modality it is not possible to use the two digital output (relay).
  Button : the digital in status is displayed only during the pressing of the "Led On" button on the radio modem (lower consumption).
  Always *On* : at every ON cycle the leds display the status of the four digital inputs (it implies a higher consumption).

- *Counter* : The radiomodem has an input pin dedicated to the count of the pulses (logic level transitions to a maximum frequency of 5 Hz). When the parameters of a Slave radiomodem are read, the value of the counted pulses up to that moment appears in this field.
  The counter value can be reset or changed by modifying the counter field and pressing the "Change" button. A window will open asking you to confirm.
  Note: it is possible to change the value only in modbus mode

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7. Operating Modes

7.1 Radiomodem Mode

This mode of operation is normally used for the exchange of data between different locations. In the same network the presence of a master unit as well as of one or more slave units is expected. If the power save feature is not used, each unit can receive data via the serial port RS485 (except during radio communications) up to a maximum of 1024 bytes.

When the reception of the data is completed (i.e. when 1024 bytes are received or when the "Time DTX" timer is expired), the radio modem send the packet to the target unit. It is possible to include in the radio path up to 8 digipeater to increase the coverage distance.

If the Power Save feature is used, the logic behavior is as follows: the Master unit can always receive characters from the serial line (except during radio communications). The slave units can receive characters from the serial line only during the time interval referred to as "PwSava" i.e. the period in which a slave unit remains active after the reception of a radio packet.

In the configurator, when the radiomodem mode is selected, an additional tab called "Link Test" is available, which can be activated from the "Options" menu. Refer to the relevant page of this manual for details. (see “**Errore. L'origine riferimento non è stata trovata.**” for more details)

7.2 Mirror Mode

In Mirror mode, the status of digital inputs of an unit is replicated on digital outputs of a remote unit and vice versa. In this operating mode, data communication on the serial line is not allowed. The mirror mode can only work between two radiomodem units (point to point) and can use digipeater (up to 8) to extend the route of the radio link. The initiative of the transmission is always taken from the master device and it is triggered by two different events:

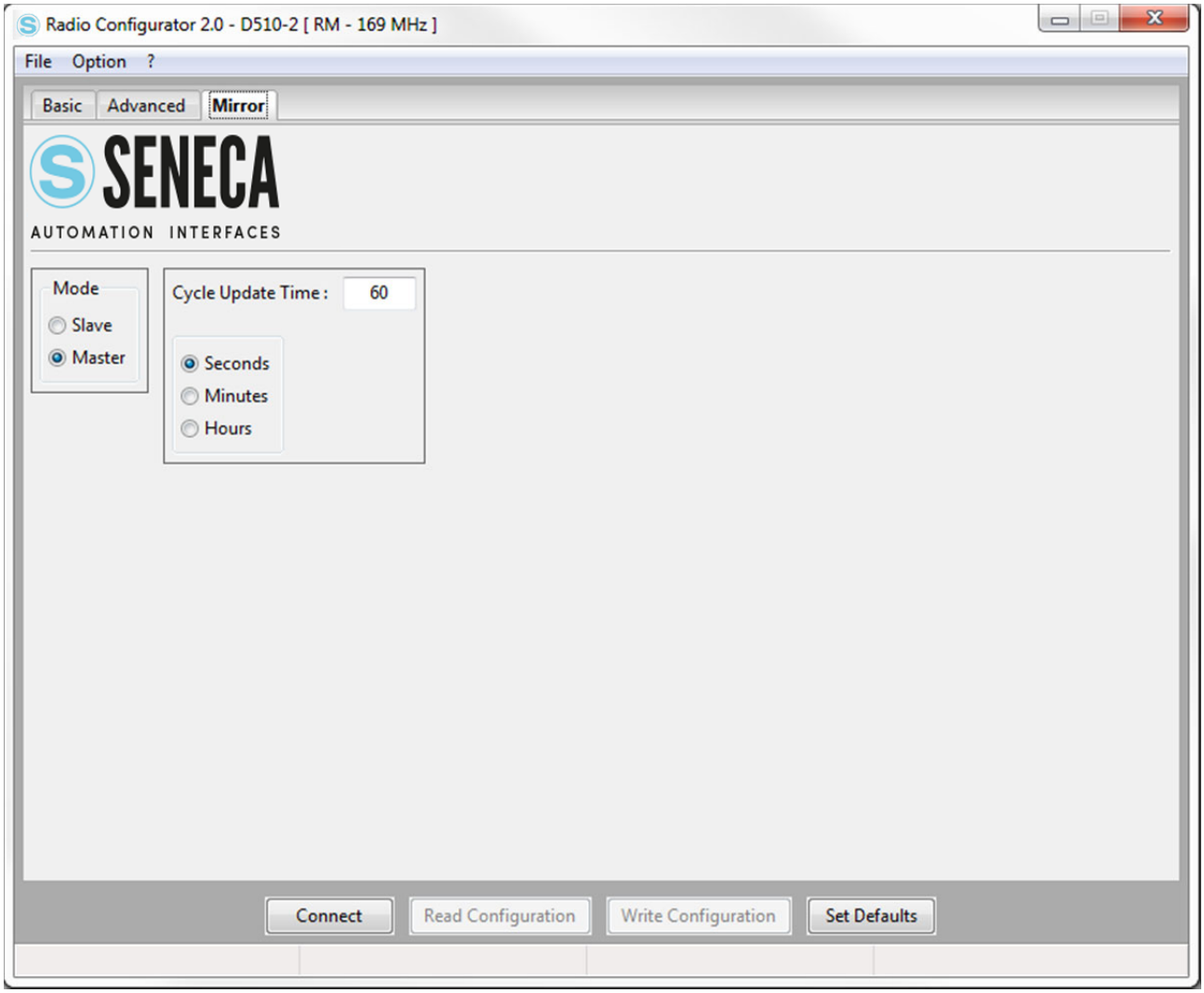
1) The change of the state of the Master’s digital inputs (every input of the four available modes may trigger this event).
2) The expiration of the timer dedicated to the periodic sending of the data (cycle update).

On the Slave unit, every time a packet is received, the diagnostic parameters are sent over the serial line. The sent parameters are:

1) Status of four digital inputs and two digital outputs of the Master unit.
2) Value (in milliampere) of two analog inputs and two analog outputs of the master unit.
3) Value of the battery voltage of the Master unit.
4) RSSI value related to the last packet received by the Master unit.

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7.2.1 Mirror tab



- *Mode* : Allows you to select the functionality of the radiomodem between Master and Slave. The unit configured as Master uses the energy saving and transmits as a result of events. The unit configured as a Slave is always active and never takes the initiative of the transmission.
  When a device is used as digipeater the device must be settled as Slave.
- *Cycle Update Time* : In this field the time of the periodical transmission is set. The time base is selectable between seconds, minutes or hours. The time range can vary from one second (minimum) to 255 hours (maximum).

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7.3 Low Energy Mode

In this modality the network is composed of one Slave unit and one or more (up to 16) Master units. The Slave unit is connected to a PC (or PLC) on which there is a running SCADA software. The slave device is always in reception, never takes the initiative of the transmission and transmits only in response to a packet received from a Master units. The Master units send a packet to the Slave unit using the modbus RTU Protocol. The function "Write multiple registers (function code 0x10) is used. The transmission of the Master units is triggered by two events:

1) The expiration of the timer dedicated to the periodical sending;
2) A change of digital inputs on the Master radiomodem.

On each Master device, it is possible to connect, by the RS485 interface, an external Modbus node (Modbus device that can read digital or analog inputs) in order to extend the number of monitored signals.

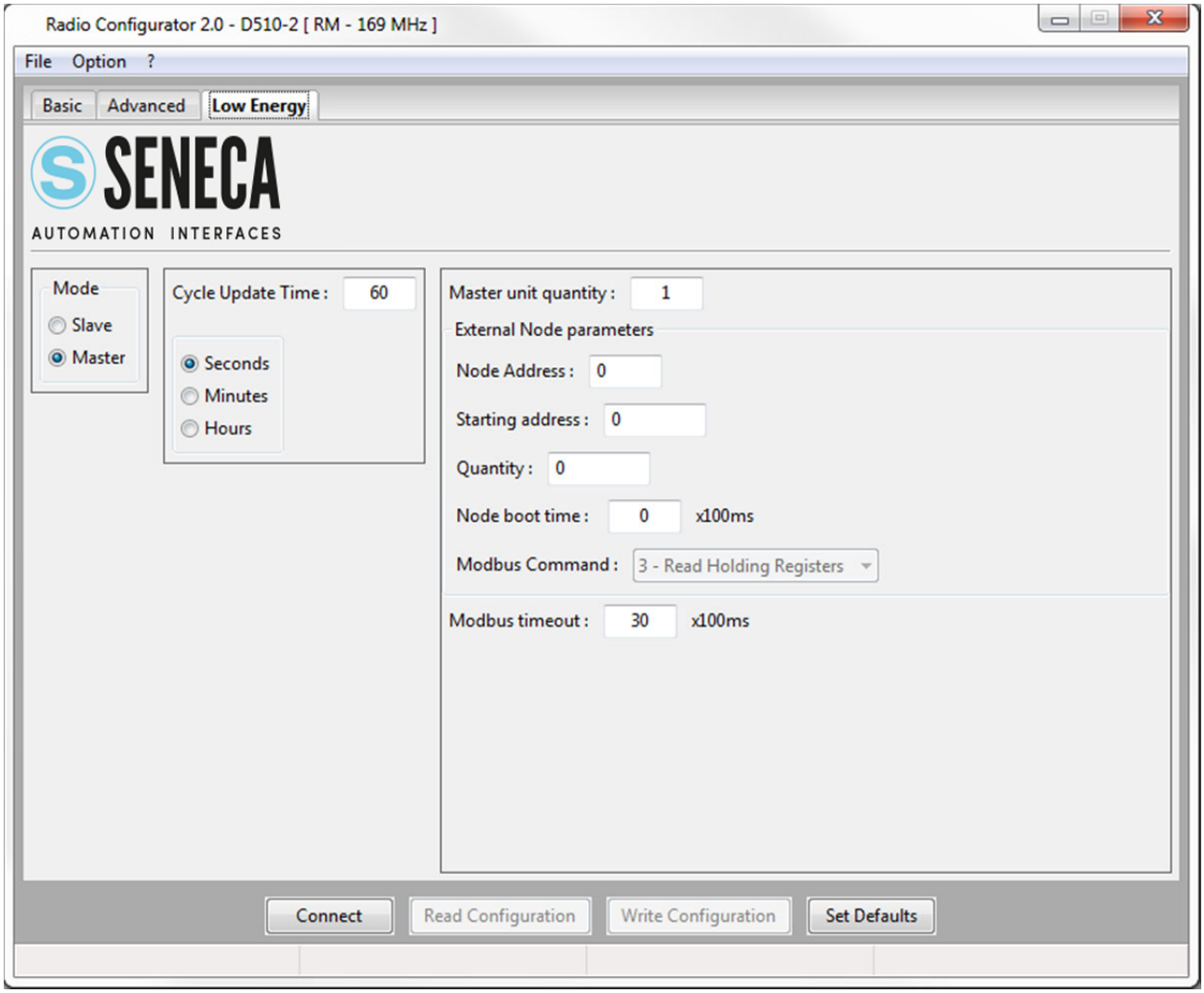
Note: You cannot use the digital inputs of an external Modbus node to trigger the transmission on the radiomodem.

In the Master unit, when a transmission is triggered, the value of the digital input is first acquired, the external node (if present) is read, then the radio modem sends the packet consisting of the collected data.

The slave device receives the packet, controls it, and if there are no errors, it sends the data (payload) to the SCADA application via the RS485 interface. At this point the SCADA software, connected to the Slave radiomodem, sends the response packet, which is transmitted back to the Master unit. At the end of the communication, the Master unit returns in sleep mode, waiting for a new transmission event.

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7.3.1 Low Energy tab



- *Mode* : Allows you to select the functionality of the radiomodem between Master and Slave. The unit configured as a Master uses the energy saving and transmits due to events. The unit configured as a slave is always active and never takes the initiative of the transmission.
- *Cycle Update Time* : In this field the time of the periodical transmission is set. The time base is selectable between seconds, minutes or hours. The time range can vary from one second (minimum) to 255 hours (maximum). In this field you cannot insert a value less than the time interval assigned to the field "External node boot time".
- *Master units quantity* : Defines the number of the Master radiomodems present in the network. The allowed values range from 1 to 16.

External Node parameters :

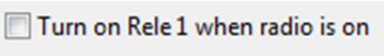
- *Node Address* : In this field the address of the external modbus node is set, which it must be identical to the address assigned to the modbus node device.

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- *Starting address* : In this field the address of the first register to be read from the external node is set.
- *Quantity* : In this field the quantity of registers to be read from the external node (max 96 registers) is set.
- *Node boot time* : This is the interval of time required to the external modbus node to become ready after the switch on. **Only for models *RTURADIO-169*** : The radiomodem supplies the power to the external modbus node (18 Volt) only following the generation of a transmission event. See the specifications of the modbus device in use to size this variable.
- *Modbus Command* : With the new firmware it is possible to choose the type of command to send to the external modbus node (read coils, read discrete input, read holding registers, read input registers).
- *Modbus Timeout* : Represents the time interval (in hundreds of milliseconds) within which the modbus answer on the packet sent by the Master unit must be received.

New firmware option:

With the introduction of the new firmware a new feature has been added that allows you to activate relay 1 when the unit wakes up and becomes operational, the option is only visible when the program detects the new firmware.



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7.4 ModBus Mode

This mode of operation provides one Master unit (star center) and one or more slave units. The Master unit must be connected via the serial interface to a PC (or PLC) on which a SCADA application is running, which uses the communication protocol Modbus RTU. The SCADA application is the heart of the system and has the task to read and/or write the parameters of the different nodes of the network using the Modbus protocol. The Master radiomodem, connected to the SCADA, uses the radio link to transmit the packets received from the serial line. The required addressing is realized by the use of an internal routing table. To do this the Master radiomodem evaluates the first byte of the received modbus packet, which, in the Modbus protocol, corresponds to the address of the node which you want to communicate with. Each node address (1 to 254) may be associated with an independent radio path.

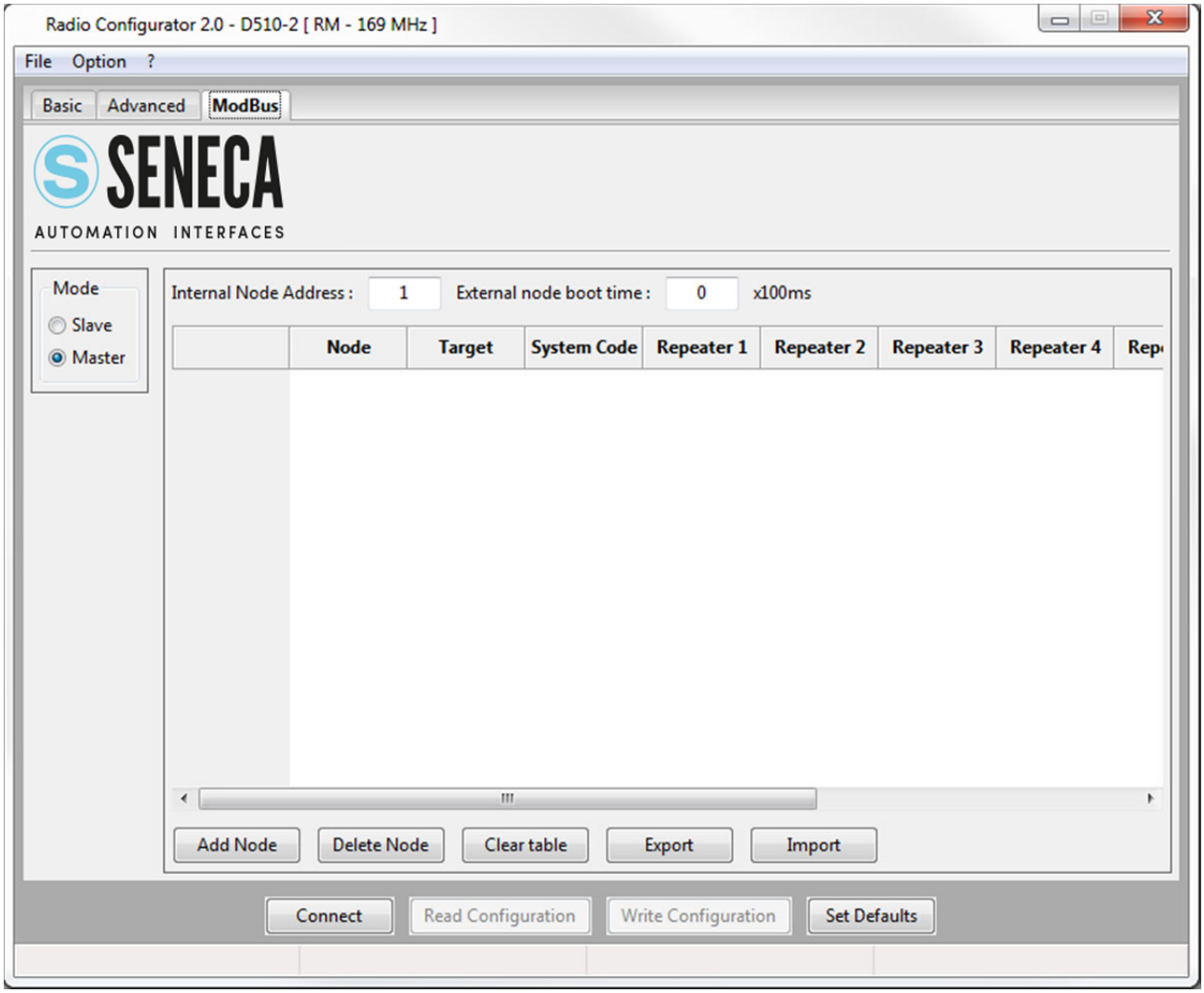
All radio modems in the network (both Masters and Slaves) must be configured with **a unique address** (the "Its address" field). The routing table is used to indicate the path of the packet radio, in this way, the packet arrives to the target radiomodem directly or via all the interested digipeaters. In the routing table, the node address number 255 is reserved for the broadcasting modbus packet. In this case, the Master radiomodem, when it receives a packet with address zero (packet broadcasting type) from the SCADA application, uses the node number 255 of the routing table to route properly the radio packet. The broadcasting mode cannot be implemented if there is a radio modem unit that cannot communicate with all the other units of the network, because in this case one or more units would not receive the broadcasting packet. This is the case of a network geographically widespread in mountainous areas or where there are many obstacles.

The node addresses must be unique, in the same network can exist up to 254 nodes distributed according to need among the slave units in the network. If, in a radiomodem unit, the internal peripherals are used, this radiomodem is seen as a modbus node in the network. It has its own modbus address, through which it is possible to read and / or write the internal peripherals of the radiomodem (digital inputs / outputs, pulse counter and analog inputs / outputs).On each radiomdem up to 32 external Modbus nodes can be connected via the RS485 serial interface. Each of these external nodes has its own modbus address, to be able to interrogate each node is necessary that all the nodes belonging to the same slave units use the same routing, that is, the same sequence of radiomodem addresses, which, in this case will be common to more node addresses (simply copy the addresses of the radio path in every node address connected to the same radiomodem) given that the modbus packet must pass through the same radiomodem.

At every slave radiomodem an external Modbus devices (I / O analog, digital or mixed) unit can be connected via the RS485 interface. The maximum number external nodes is of 32 units. The maximum number of slave radiomodems that may be present in a network is dependent on the number of modbus nodes connected to each slave unit and also by the number of Slaves that use its internal peripherals: in this case each Slave radiomodem has one modbus node address that is subtracted to the total of 254 modbus addresses available. Since the limit is of 254 addresses, the sum between the radiomodem units (of which are used the internal peripherals) and the external nodes connected cannot exceed this value. For example, if a network contains 25 slave radiomodems used as modbus nodes (ie, if its internal peripherals are used), the maximum number of available addresses of the external nodes are: 254-25 = 229; distributed on each slave radiomodem according to the requirements and respecting the maximum limit of 32 nodes for each slave unit.

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7.4.1 ModBus tab



- *Mode* : Allows you to select the functionality of the radiomodem between Master and Slave. The units configured as a slave never takes the initiative of the transmission.
- *Internal Node Address* : It is the address of the modbus node related to the internal peripherals of the radiomodem. Set a non-zero value if you want to use its internal peripherals.
- *External node boot time* : This field specifies the amount of time required for the external modbus nodes and/or for the external analog sensors (connected to the analog inputs of the radiomodem) to be operational. This field has a value in steps of 100 milliseconds. Set this parameter considering the node that takes longer to start-up.

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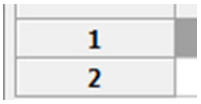
Routing table :

	Node	Target	System Code	Repeater 1	Repeater 2	Repeater 3	Repeater 4	Rep
1	1	2	1	0	0	0	0	

- *Add Node* : Adds a node to the routing table.

Double clicking on the desired cell you can edit the field.

- *Delete Node* : Remove the selected node, to select the node to be removed, press on the cell with



the gray background.

- *Clear table* : Completely empty the routing table.
- *Export* : Exports the current table in CSV format.
- *Import* : Imports data from the file in CSV format.

CSV File Format:

The file must be made up as follows:

Header row:

```
Nodo;Destinazione;CodiceSistema;Repeater1;Repeater2;Repeater3;Repeater4;Repeate
r5;Repeater6;Repeater7;Repeater8;
```

Data rows:

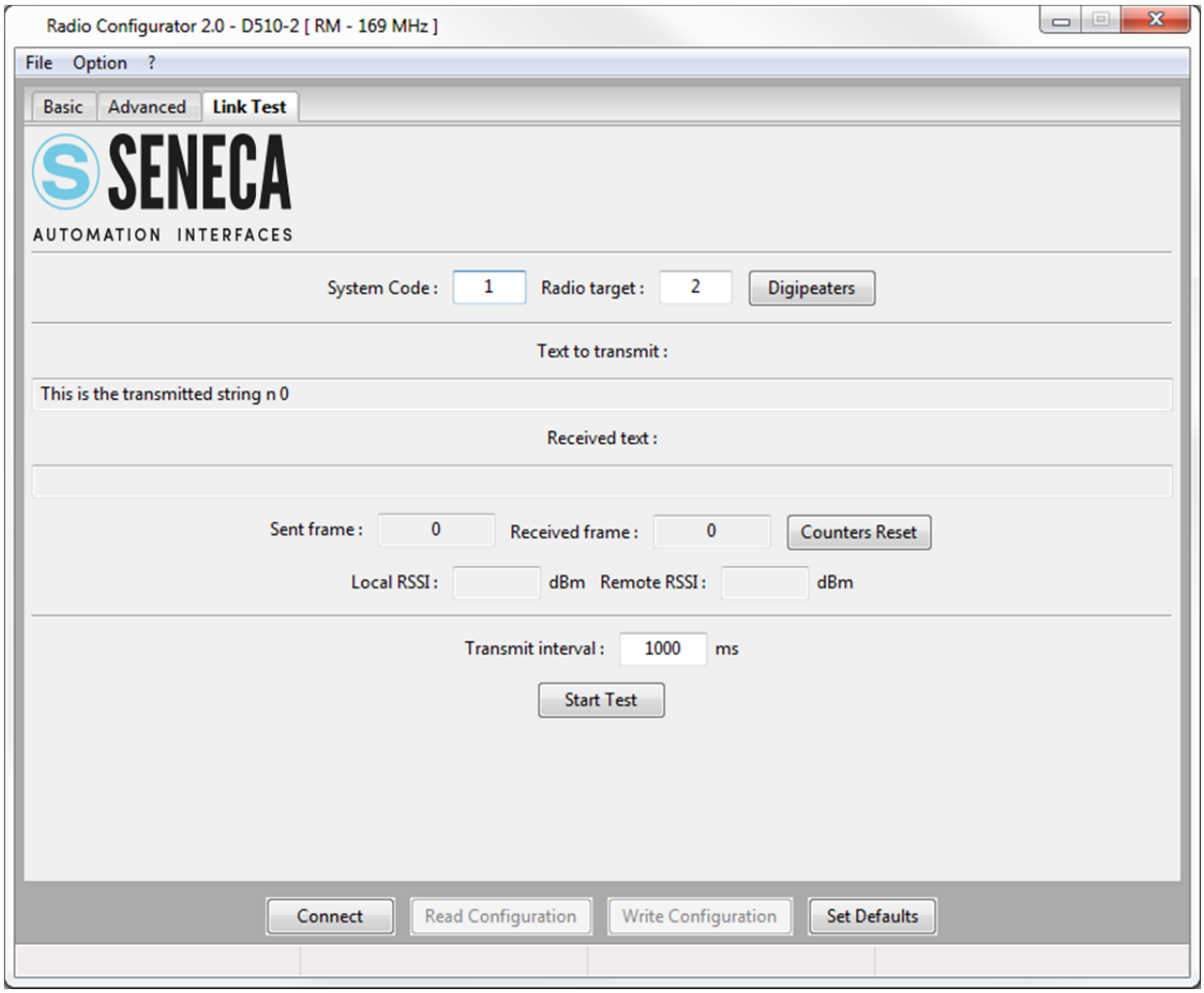
```
1;2;1;0;0;0;0;0;0;0;0;
```


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8. Link test

The access to this page is only allowed if, on the first page of the configurator, the "radiomodem" modality is chosen. On this page you can test the communication with the remote radiomodem, valuate the quality of the radio signal and the level of the battery voltage on the selected units. This feature is only allowed in radiomodem mode therefore the remote units reply to the link test packets only if they are configured in the same mode. This functionality is available only in Configuration mode, enable the configuration mode as describe at configuration paragraph of this manual.

When the use of the Link Test is finished it is necessary to switch off the radiomodem, then switch it on again. This must be done in order to restore the normal operational functionality.



- *System Code* : Code of the system you want to test.
- *Radio Target* : Target radiomodem.
- *Digipeaters* : Enable the digipeaters window.
- *Text to transmit* : Dynamic string that is sent to the target radiomodem.
- *Received text* : String equal to "text to be transmitted", transmitted by the target radio.

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- *Sent frame* : Number of frames sent (each time it is sent is increased).
- *Received frame* : Number of frames received (is increased in the case of reception without errors).
- *Counters Reset* : Reset the value of "Sent frame" and "Recevied frame".
- *Local RSSI* : RSSI value of the data received from the local radio.
- *Remote RSSI* : RSSI value of the data received from the target radio.
- *Transmit interval* : Is possible to set the frame transmission interval (min 500ms).
- *Start test* : Button to start the test, once started the text of the button changes to "Stop Test".

During the communication test, diagnostic parameters are also sent whose values appear in the Local RSSI, Remote RSSI fields. These values make it possible to evaluate the intensity of the radio signal received from the remote unit and that received from the local unit; the value is expressed in dBm.

The RSSI provides a correct measurement in the range from **-100** to **-50 dBm**. Values less than **-100 dBm** (for example -105, -110 dBm) may create communication problems. The saturation of the measured RSSI restricts the maximum value indicated approximately to -47 dBm ± 3dBm, signals of greater intensity return the same indication.

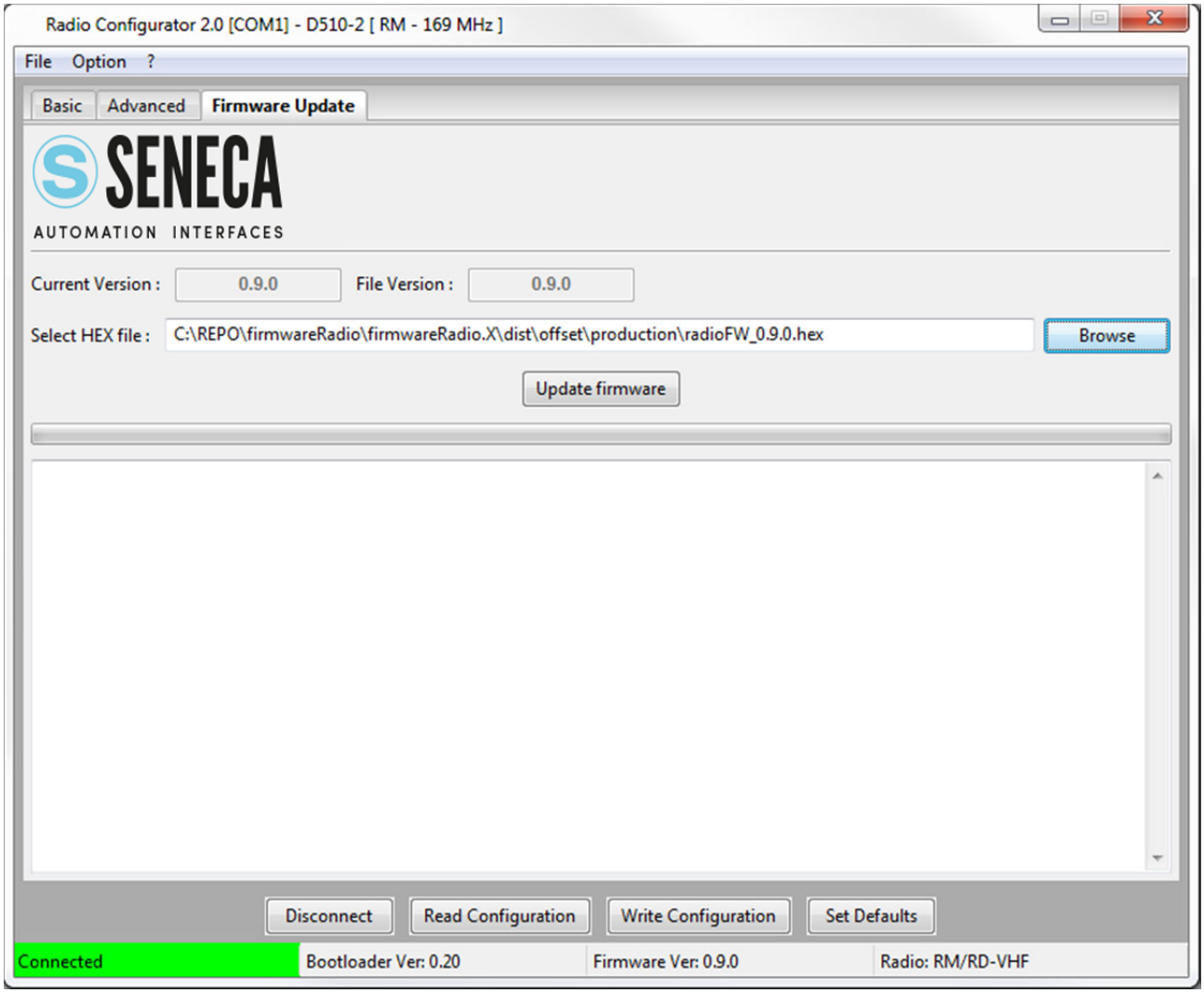
Note: If, in the radio link, one or more digipeater units are used, the level of the RSSI is always referred to the last received signal of the radio stations chain.

Example: with four units present in the network (Master "A", first digipeater "B" , second digipeater "C", slave "D") the RSSI read from the slave "D" is referred to the reception of the digipeater "C", while the RSSI read from the master A is referred to the reception of the digipeater "B".

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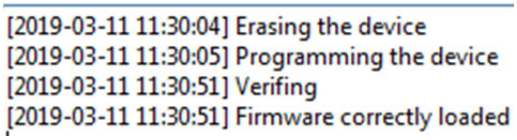
9. Firmware Update

This tab is only accessible for devices produced starting from July 2019, for previously produced devices contact SENECA.



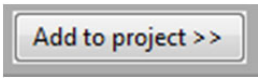
- *Current Version* : Indicates the current version of the firmware loaded on the radiomodem.
- *File Version* : Indicates the firmware version of the file
- *Select HEX file* : Pressing the "Browse" button to open the window for selecting the file to be loaded.
- *Update firmware* : Pressing the Update Firmware button starts the firmware update procedure. In the white box, the executed steps will be displayed and if the operation was successful.

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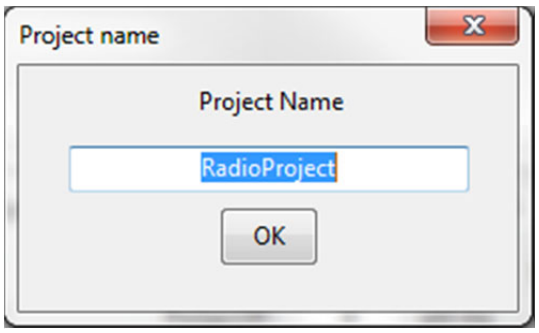


10. Project management

The configurator allows the management of a project that contains multiple radiomodems. To start, select the radiomodem that you want to add to the project and in the "Advanced" tab press the button:



Once pressed, a window will appear where you can enter the project name:

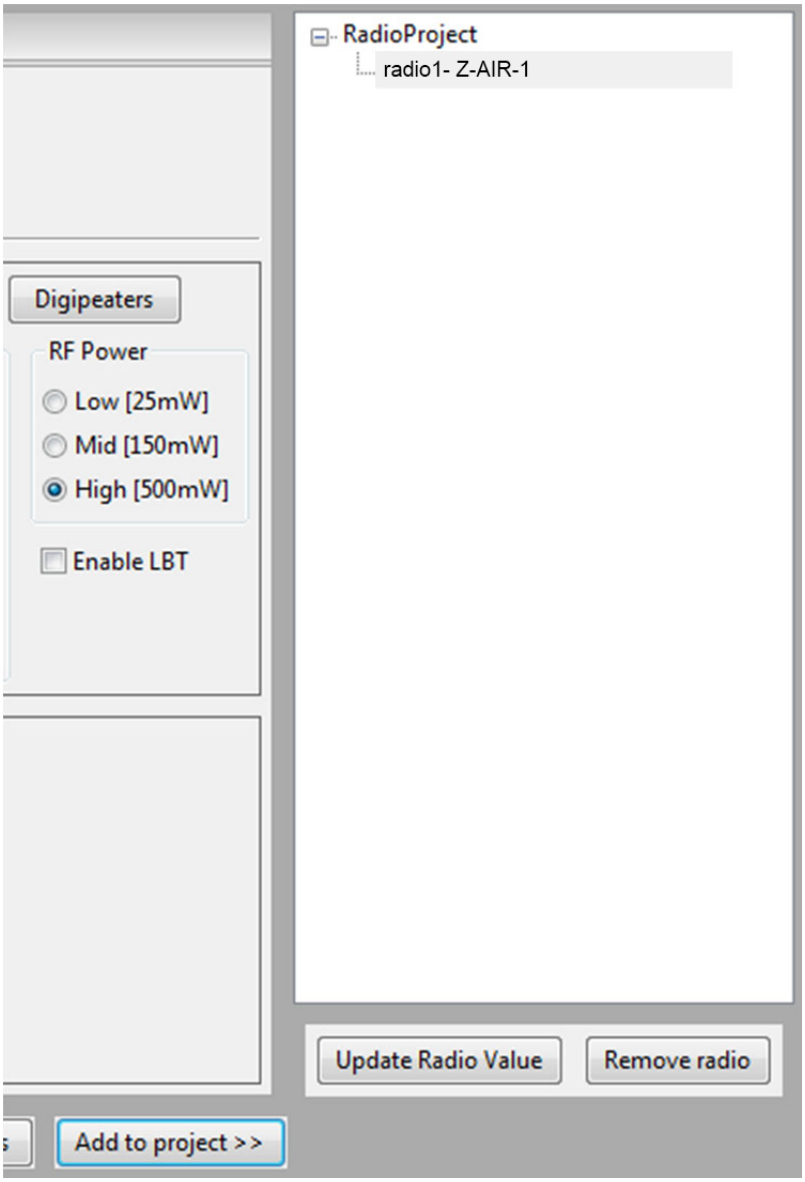


Pressing ok, you will be asked to give a name to the radiomodem that you want to add to the project:

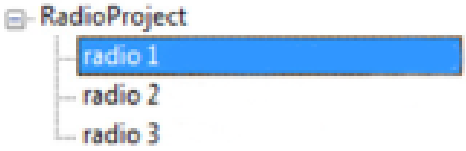


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Once you have pressed ok, on the right side of the program, the structure of the project will be displayed with the various radios inserted:

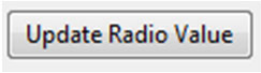


You can add the various radiomodems that make up the project. (The project can be composed of different types of radiomodems)



By selecting the radiomodem in this window, the configuration will be loaded automatically.

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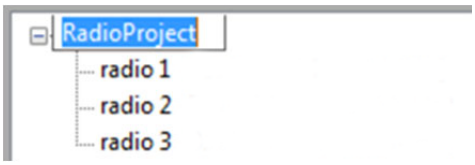


To change the parameters, select the radiomodem, change the values you want, and press the button:

While to remove a radiomodem press the button:



The name of the project and of the radio can also be modified later by clicking on the value to be changed after selecting it.



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11. Appendix

11.1 Access to internal registers in ModBus mode

Read of digital inputs

Use Modbus command “Read discrete inputs” (0x02). The address are:

For RM169-1 models:

Digitale Input 1 = Address 0

For Rturadio-169 models:

Digitale Input 1 = Address 0

Digitale Input 2 = Address 1

Digitale Input 3 = Address 2

Digitale Input 4 = Address 3

Read of digital ouptus

Use Modbus command “Read coils” (0x01). The address are:

For RM169-1 models:

Digital output 1 = address 0

For RTURADIO-169 models:

Digital output 1 = address 0

Digital output 2 = address 1

Read of radiomodem registers

Thanks to Modbus command “Read Input Registers” (0x04 it’s possible to read different Radiomodem parameters as following:

Address 0: Digital input status (bit 0 = digital input 1)
Address 1: Analog input value CH1 (µA) (only DRTURADIO-169 in other cases fixed value 0)
Address 2: Analog input value CH2 (µA) (only RTURADIO-169, in other cases fixed value 0)
Address 3: Battery voltage (mV) (only RTURADIO-169, in other cases fixed value 0)
Address 4: RSSI value of local unit (dbm, signed int16 format
Address 5: RSSI value of remote unit (dbm, signed int16 format).
Address 6: Counter most significant bit (only RTURADIO-169, in other cases fixed value 0)
Address 7: Counter least significant bit (only RTURADIO-169, in other cases fixed value 0)

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The counter register is in uint32 format and the counter value is combined by address 6 and 7 value: multiply the most significant bit per 65536 and sum it to least significant bit.
The max value allowed is 232- 1.

In order to read the register select the address node, set the starting address and the number of register to read (max 8).

Write digital output
Use Modbus command “Write sigle coil” (0x05) or “Write multiple coils” (0x15). The address are:

For RM169-1 models:

Digital output 1 = address 0

For RTURADIO-169 models:

Digital output 1 = address 0

Digital output 2 = address 1

Only for RTURADIO-169 models:

Write analog output
Use Modbus command “Write single register” (0x06). The address are:
Analog output 1 = address 0
Analog output 2 = address 1.

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11.2 Low Energy register

The Slave unit connected to the management system when it receives data from the master units present in the network will write (Modbus master) starting from the register:

- Old firmware : value set in the "Start address" parameter
- New firmware : 100 * parameter value "Radio address"

The data received will be according to the following structure:

Master setup:

- External Node not connected
- Digital inputo on
- Analog input off (Output analog supply OFF)

Byte	Description	Note
0	Slave Address	Address setted as Slave unit
1	Function Code	Preset Multiple Register 16
2	Data Address	Address of first register, always 0064
3		
4	Register quantity	In this setup always 05
5		
6	Number of bytes to follow	CRC not included, in this setup always 0A
7	Register 1- Digital input	Bit 0 = input 1 Bit 1 = input 2 Bit 2 = input 3 Bit 4 = input 4 Value 1 refer to contact closed (active low)
8		
9	Register 2 – Voltage battery	Voltage value refert to PIN 3-4 of Master unit, (millivolt)
10		
11	Register 3 – RSSI Master unit	RSSI Value of Master unit related to previous data transmission (dBm, signed int16)
12		
13	Register 4 – RSSI Slave unit	RSSI Value of Slave unit related to previous data transmission (dBm, signed int16)
14		
15	Register 5 – Master Address	Address of setted as Master unit (data sender)
16		
17	CRC	Cyclic Redundancy Check
18		

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Master setup:

- External Node not connected
- Digital inputo on
- Analog input off (Output analog supply OFF)

Byte	Description	Note
0	Slave Address	Address setted as Slave unit
1	Function Code	Preset Multiple Register (16)
2	Data Address	Address of first register, always 0064
3		
4	Register quantity	In this setup always 07
5		
6	Number of bytes to follow	CRC not included, in this setup always 0E
7	Register 1- Digital input	Bit 0 = input 1 Bit 1 = input 2 Bit 2 = input 3 Bit 4 = input 4 Value 1 refer to contact closed (active low)
8		
9	Register 2 – Analog input A.I.1	Analog input A.I.1 value refer to PIN 14
10		
11	Register 3 – Analog input A.I.2	Analog input A.I.2 value refer to PIN 17
12		
13	Register 4 – Battery voltage	Voltage value refert to PIN 3-4 of Master unit, (millivolt)
14		
15	Register 5 – RSSI Master unit	RSSI Value of Master unit related to previous data transmission (dBm, signed int16)
16		
17	Register 6 – RSSI Slave unit	RSSI Value of Slave unit related to previous data transmission (dBm, signed int16)
18		
19	Register 7 – Master Address	Address of setted as Master unit (data sender)
20		
21	CRC	Cyclic Redundancy Check
22		

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Master setup:

- External node connected (register “n”)
- Digital input on
- Analog input off (Output analog supply OFF)

Byte	Description	Note
0	Slave Address	Address setted as Slave unit
1	Function Code	Preset Multiple Register 16
2	Data Address	Address of first register, always 0064
3		
4	Register quantity	Value in function of external node register quantity
5		
6	Number of bytes to follow	CRC not included, value in function of external node register quantity
7	Register “n”	External node register quantity “n” connected to PIN 14 and 16. This value must to setted also in “Ext Node Address Quantity” tab.
8		
	After register’s node:	
8+(n*2)	Register 1 – Digital input	Bit 0 = input 1 Bit 1 = input 2 Bit 2 = input 3 Bit 4 = input 4 Value 1 refer to contact closed (active low)
8+(n*2)+1		
8+(n*2)+2	Register 2 – Battery voltage	Voltage value refert to PIN 3-4 of Master unit, (millivolt)
8+(n*2)+3		
8+(n*2)+4	Register 3 – RSSI Master unit	RSSI Value of Master unit related to previous data transmission (dBm, signed int16)
8+(n*2)+5		
8+(n*2)+6	Register 4 – RSSI Slave unit	RSSI Value of Slave unit related to previous data transmission (dBm, signed int16)
8+(n*2)+7		
8+(n*2)+8	Register 5 – Master address	Address of setted as Master unit (data sender)
8+(n*2)+9		
8+(n*2)+10	CRC	Cyclic Redundancy Check
8+(n*2)+11		

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Master setup:

- External node connected (register “n”)
- Digital input on
- Analog input on (Output analog supply ON)

Byte	Description	Note
0	Slave Address	Address setted as Slave unit
1	Function Code	Preset Multiple Register (16)
2	Data Address	Address of first register, always 0064
3		
4	Register quantity	Value in function of external node register quantity
5		
6	Number of bytes to follow	CRC not included, value in function of external node register quantity
7	Register “n”	External node register quantity “n” connected to PIN 14 and 16. This value must to setted also in “Ext Node Address Quantity” tab.
8		
	After register’s node:	
8+(n*2)	Register 1- Digital input	Bit 0 = input 1 Bit 1 = input 2 Bit 2 = input 3 Bit 4 = input 4 Value 1 refer to contact closed (active low)
8+(n*2)+1		
8+(n*2)+2	Register 2 – Analog input A.I.1	Analog input A.I.1 value refer to PIN 14
8+(n*2)+3		
8+(n*2)+4	Register 3 – Analogic input A.I. 2	Analog input A.I.2 value refer to PIN 17
8+(n*2)+5		
8+(n*2)+6	Register 4 – Battery voltage	Voltage value refert to PIN 3-4 of Master unit, (millivolt)
8+(n*2)+7		
8+(n*2)+8	Register 5 – RSSI Master unit	RSSI Value of Master unit related to previous data transmission (dBm, signed int16)
8+(n*2)+9		
8+(n*2)+10	Register 6 – RSSI Slave unit	RSSI Value of Slave unit related to previous data transmission (dBm, signed int16)
8+(n*2)+11		
8+(n*2)+12	Register 7 – Master Address	Address of setted as Master unit (data sender)
8+(n*2)+13		
8+(n*2)+14	CRC	Cyclic Redundancy Check
8+(n*2)+15		

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12. Revision

Rev.	*Note*	*Data*
00	First issue	11/03/2019

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