

# **ARF51 & 51-PRO**

## **RF I/O Module - Digital/analog**

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Firmware version V2.0.0  
User guide V1.0

### **ADEUNIS RF**

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## Table of contents

Information	5
Disclaimer	5
Technical Support	5
Declaration of conformity	6
Glossary	7
1. Introduction	7
1.1. General description	7
1.2. Mechanical characteristics	8
1.3. Description of terminal blocks (user interface)	8
1.4. Description of the leds	9
2. Connecting the ARF51	10
2.1. Introduction	10
2.2. Electrical power supply for the product	10
2.3. Connecting the products comprising the system	10
2.3.1 System configuration	10
2.3.2 System configuration	10
2.3.3 Chaining I/O modules to expand the number of I/Os	11
2.3.4 Connecting an I/O module to the configuration IHM	11
2.3.5 Connecting an I/O module to the supervision IHM	11
3. Radio characteristics	11
3.1. Table of available frequencies	11
3.2. Table of delays	12
3.3. Table of radio ranges	13
3.4. Positionning of the antenna	13
3.5. Protection of remote aerial modems against overloads	13
4. Configuring the ARF51 – Configuration of the communication mode	14
4.1. General	14
4.2. Installation – Removal	14
4.3. Configuration procedure	15
4.3.1 Open the configuration software	15
4.3.2 Define the operating mode of the system	15
4.3.2.01 Definition of the properties of the system (« system properties »)	15
4.3.2.02 Define the properties of the modem ("modem properties" field)	16
4.3.3 Connect the product to be configured	17
4.3.4 Configure the products in the system	17
4.3.4.01 Select the product to be configured	17
4.3.4.02 Enter the product serial number	17
4.3.5 Configure the product	18
4.3.6 Backing up the parameters	21
4.3.7 Duplication of product configuration parameters	22
4.3.8 Replacing a product in a system	23
4.4. Backing up the system	24
4.5. Load an existing system	24
4.6. Pairing without a PC	25

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5.	Modbus Communication	26
6.	Exemples of architectures	29
6.1.	Mirror Mode	29
6.1.1	Operation	29
6.1.2	I/O allocation	29
6.2.	« Peer to Peer » mode	29
6.2.1	Operation	29
6.2.2	I/O allocation	29
6.3.	« Trigger » mode	30
6.3.1	Operation	30
6.3.2	I/O allocation	30
6.4.	«Modbus» mode	31
6.4.1	Operation	31
6.4.2	I/O assignment	31
7.	Versions history	31
Annexe 1		32

# ENGLISH

## Information

Document information	
<b>Title</b>	ARF51 - User Guide
<b>Subtitle</b>	User guide version V1.0
<b>Document type</b>	product implementation and use
<b>Document status</b>	Release for ARF51 software version V1.0.0

This document applies to the following products

Name	Reference		Firmware version
<b>ARF51</b>	ARF8029AA	4 digital I/O module	V2.0.0
<b>ARF51-PRO</b>	ARF8029BA	4 digital I/O + 2 analog I/O module	V2.0.0

## Disclaimer

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## Technical Support

### Website

Our website contains many useful information : modules and stand alone products information, user guides, configuration software and technical documents which can be accessed 24 hours a day.

### Email

If you have technical problems or cannot find the required information in the provided documents, contact our Technical Support by email. Use our dedicated email address ([arf@adeunis-rf.com](mailto:arf@adeunis-rf.com)) rather than any personal email address of our staff. This makes sure that your request is processed as soon as possible.

### Helpful Information when Contacting Technical Support

When contacting Technical Support please have the following information ready:

- Complete product type & reference (e.g. ARF51, reference ARF8029AA),
- Firmware version (e.g. V2.0.0)
- Clear description of your question or the problem
- A short description of the application
- Your complete contact details

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**Declaration of conformity**

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**DECLARATION OF CONFORMITY  
EUROPEAN UNION**

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**We** ADEUNIS RF  
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38920 CROLLES  
FRANCE

**Declare under our sole responsibility that the product(s)**

Designation :	<b>I/O Module</b>
Product Name(s) :	<b>ARF51</b>
References :	<b>ARF8029AA</b> <b>ARF8029BA</b>

**Fulfill the directives**

- RTTE 99/5/EC
- RoHS 2011/65/UE

**The following standards and/or other normative documents have been used to demonstrate the conformity to the above directives:**

- EN300220-1&2 V2.4.1
- EN60950-1 (2006) + A11 (2009) +A1 (2010) +A12 (2011)
- EN301489-1 V1.9.2
- EN301489-3 V1.4.1
- EN62311 (2008)
- EN50581 (2012)

**Notes**

Receiver class (if applicable): 2

Demonstration of conformity has been realized with ARF7763BA mounted on NB868 extension pack ARF7891AA

**Usage restrictions**

Pursuant to the recommendation 1999/519/EC on RF signals, and depending on the module integration a minimum distance between the antenna and the body could be required.

It is the user responsibility to be sure that the configuration and use of the NB868 module fulfill all the requirements of the Rec 70-03 (describing in annex 1, frequency bands, g, g1, g2, g3 or g4). In certain cases, you may need to notify the final equipment to European administrations. Adeunis RF can assist you on regulatory aspects.

**Date**

January 6th, 2014

**Mr Hervé VINCENT****CEO**

## Glossary

I/O	Input / Output
Master	Master ARF51
I/O expansion	Expansion I/O: expansion module for number of master I/Os
RF slave	Slave radio module
TOR	Digital
SCADA	Supervisory control & data acquisition (remote monitoring and acquisition of data)
IHM	Man-machine interface (sensor, counter, automated system, etc.)
Vih	input high voltage
Vil	input low voltage

## 1. Introduction

The ARF51 is an I/O module that can acquire the states of sensors, contacts or counters in order to control remote equipment by means of digital or analog information.

It embeds an ADEUNIS RF radio transceiver to establish a wireless link between 2 remote units where a wired connection is not practical.

Configuration is by means of the dedicated software (ADEUNIS RF configuration manager) and so no programming knowledge is required.

### 1.1. General description

Product name	ARF51/ ARF51-PRO
Type of equipment	Digital & analog Input / output module
Local Inputs / Outputs	4 x 0~40 V NPN digital inputs 4 x 0~40 V PNP protected digital outputs 2 x 12 bit analog inputs (0~20 mA current and 0~10 V voltage) 2 x 12 bit analog outputs (0~20 mA current and 0~10 V voltage)
Number and type of ports	2 x RS485 2 wire for connection to the supervisor 1 x proprietary port for chaining I/O modules 1 x USB format port system for programming configuration
Baud rate	RS485#2 configurable up to 1Mb/s
Programing and Set up	PC through USB connector
Operating temperature	-10 to +70°C
Supply voltage	10 to 36Vdc
Typical consumption	1W
Protocol	Modbus RTU
Versions	Standard : 4 digital I/Os PRO : 4 digital I/Os + 2 analog I/Os

## 1.2. Mechanical characteristics

Rail-DIN enclosure

Dimensions with SMA connector : 105 x 100 x 70 mm (6 x U - 6 modules of a standard electrical panel).

Dimensions with standard antenna (delivered with the product) : 105 x 240 x 105mm

## 1.3. Description of terminal blocks (user interface)

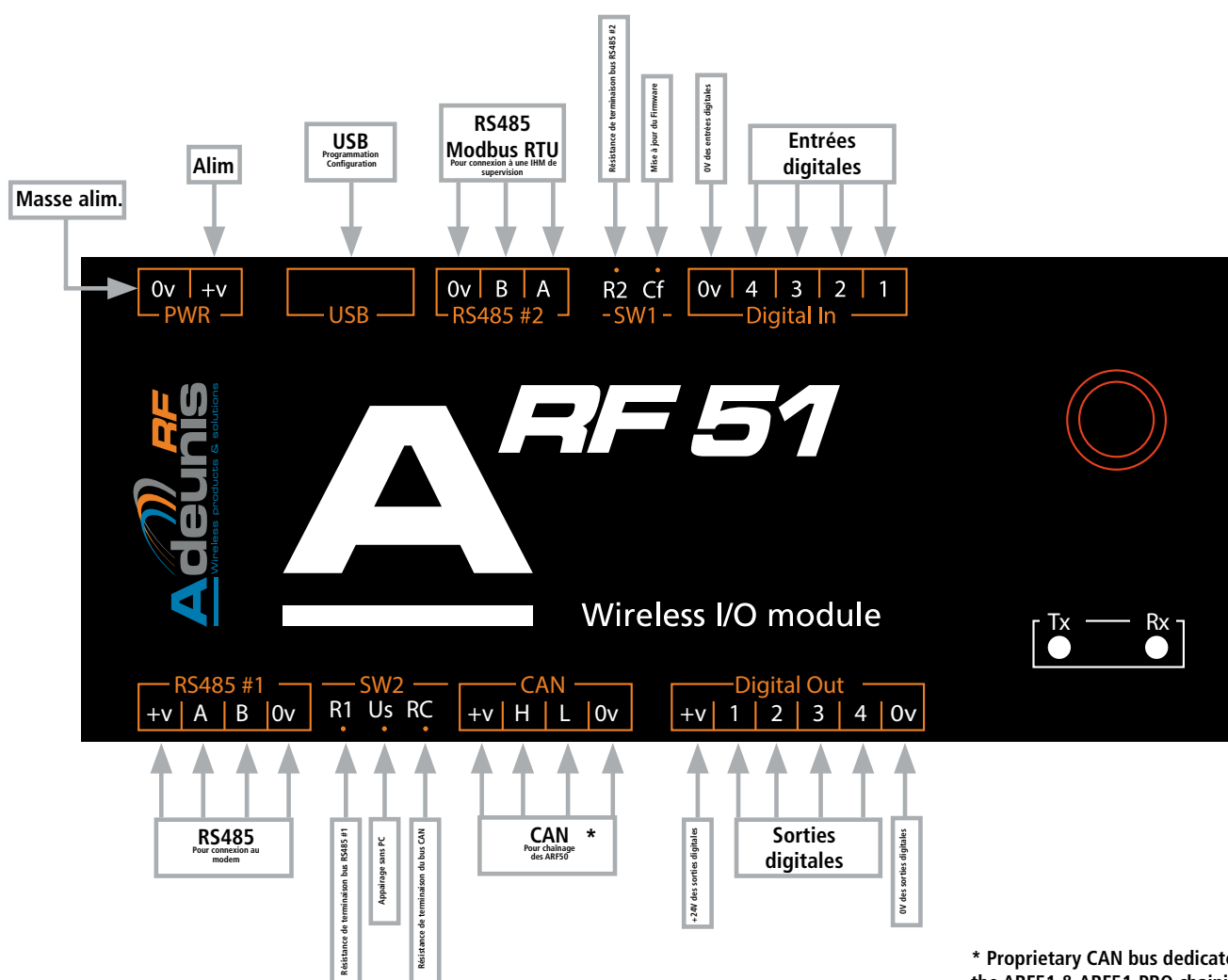


Switch R1 and R2 : always ON

Switch Cf : Always OFF

Switch RC : ON for end of line products, OFF for others.

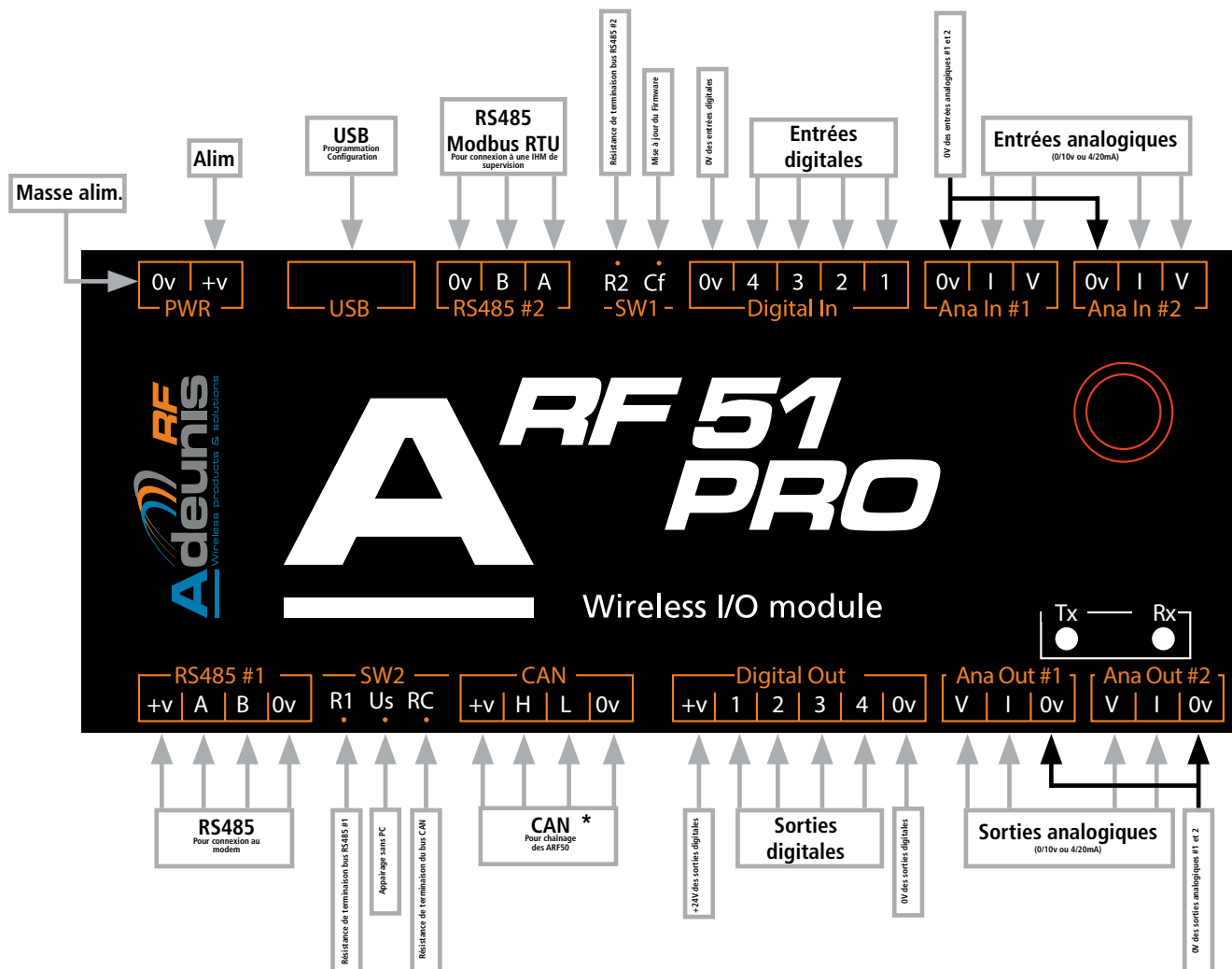
### ARF51



\* Proprietary CAN bus dedicated only for the ARF51 & ARF51-PRO chaining.



## ARF51-PRO



\* Proprietary CAN bus dedicated only for the ARF51 & ARF51-PRO chaining.

## 1.4. Description of the leds



Color of the leds	ARF51 Status	Signification
Green	Power	lights up when the product is power supplied
Blue	Activity	fast flashing = modem configuration slow flashing = normal mode
Red	Default	flashes when a modem initialization error is detected
Orange		ARF51 data transmission
Yellow		ARF51 data reception

## 2. Connecting the ARF51

### 2.1. Introduction

A system consists of the following items:

- Master: master module
- RF slave: slave radio module
- I/O expansion: I/O expansion of the master

The system may consist of 1 to 16 « RF slave » and 1 to 15 « I/O expansions » in addition to the « master ».

### 2.2. Electrical power supply for the product

The power supply voltage must be between 10 and 36 Vdc

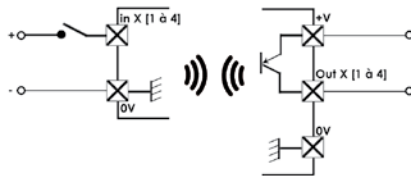
### 2.3. Connecting the products comprising the system

- The ARF51 is fitted with WAGO detachable terminal blocks enabling the system to be fully prewired. The terminal blocks must be connected with the connector unplugged and only using the WAGO accessory supplied with the product.
- Cables to be used for connection to the RS485 and proprieta ports (for distances  $\geq 5$  m): 2 pairs of 0.5 mm<sup>2</sup> twisted shielded cables.
- A complete representation of the wiring of all the products is given in Appendix 1 of this document.

#### 2.3.1 System configuration

- AFR50 side: set switch SW.R1 to «ON»

#### 2.3.2 System configuration



Vih	5V
Vil	2V
Outputs protection	100mA
Type of outputs	Open collector PNP Transistor
+V	5 to 36V
Digital Input	5 to 36V

### 2.3.3 Chaining I/O modules to expand the number of I/Os

Via the proprietary port (named CAN)

Depending on the power supply used and the number d'I/O expansion in the system, the distances given in the table below can be covered. This distances are RS485 cable lengths.

Number of I/O expansion	Alimentation under 12Vdc	Alimentation under 24Vdc
16	2m	40m
8	4m	80m
4	8m	120m
2	16m	160m

### 2.3.4 Connecting an I/O module to the configuration IHM

Via the USB interface

### 2.3.5 Connecting an I/O module to the supervision IHM

RS485 Modbus RTU protocol. Via the RS485#2 interface.

## 3. Radio characteristics

the ARF51 embeds a radio module which transmits on the 863-870MHz frequency band.

Find below the main radio characteristics :

Max power	500mW
Max radiated power	27dBm
Available RF power	27, 25, 23, 20, 17, 14, 10dBm
RF data rates	2.4 / 9.6 / 38.4 / 57.6kbps
Frequencies	from 863MHz to 870MHz

The ARF51 proposes 3 radio modes :

- **NB High Power** : maximum power (27dBm) and low RF data rate (2.4kbps). This mode allows the best radio ranges.
- **WB High Power** : maximum power (27dBm) and any RF data rate. This mode allows long range at any RF data rates.
- **WB Low Power** : low power (14dBm) nd any RF data rate. This mode allows maximum of available radio channels.

For each of the modes above, the product offers a range of more or less significant frequency taking into account the European regulatory radio perimeter. You will find below the list of available frequencies depending on the mode, power and speed selected.

#### 3.1. Table of available frequencies

Mode	Available RF power	RF data rates	Channel #	Frequency
NB High Power	27dBm	2.4kbps	11	869.525MHz
	25dBm		526	869.425MHz
	23dBm		528	869.450MHz
	20dBm		530	869.475MHz
	17dBm		532	869.500MHz
	14dBm		536	869.550MHz
	10dBm		538	869.575MHz
			540	869.600MHz
			542	869.625MHz

Mode	Available RF power	RF data rates	Channel #	Frequency
WB High Power	27dBm 25dBm 23dBm 20dBm 17dBm 14dBm 10dBm	2.4kbps 9.6kbps 38.4kbps 57.6kbps	11	869.525MHz
	23dBm 20dBm 17dBm 14dBm 10dBm	2.4kbps 9.6kbps 38.4kbps 57.6kbps	530 538	869.475MHz 869.575MHz
WB Low Power	14dBm 10dBm	2.4kbps 9.6kbps 38.4kbps 57.6kbps	11 24 48 72 96 120 144 168 192 216 240 264 288 312 336 360 384 408 432 456 480 504 530 538 552	868.525MHz 863.150MHz 863.450MHz 863.750MHz 864.050MHz 864.350MHz 864.650MHz 864.950MHz 865.250MHz 865.550MHz 865.850MHz 866.150MHz 866.450MHz 866.750MHz 867.050MHz 867.350MHz 867.650MHz 867.950MHz 868.250MHz 868.550MHz 868.850MHz 869.150MHz 869.475MHz 869.575MHz 869.750MHz

### 3.2. Table of delays

Depending on the selected RF data rate, the period of interrogation of slave by the master varies as indicated below. This period of interrogation must be multiplied by the number of slaves in the system.

Mode	Available RF power	RF data rates	Delay in ms
NB High Power	27dBm 25dBm 23dBm 20dBm 17dBm 14dBm 10dBm	2.4kbps	2026.7
WB High Power	27dBm 25dBm 23dBm 20dBm 17dBm 14dBm	2.4kbps	2026.7
		9.6kbps	614.7
		38.4kbps	162.9
		57.6kbps	108.6

Mode	Available RF power	RF data rates	Delay in ms
WB Low Power	14dBm 10dBm	2.4kbps	2026.7
		9.6kbps	614.7
		38.4kbps	162.9
		57.6kbps	108.6

### 3.3. Table of radio ranges

Depending on the choice of the RF power and speed, you will find below the RF ranges that can be achieved. These theoretical ranges are dependent on the quality of the installation, the positioning of the product and its antenna and interference present on the site. Values below must be taken to indication.

RF Power	RF data rate	Outdoor range (line of sight)	Indoor range
27dBm	2.4kbps	up to 20 km	up to 2.5 km
	9.6kbps	up to 14 km	up to 1.5 km
	38.4kbps	up to 10 km	up to 1 km
	57.6kbps	up to 10 km	up to 1 km
14dBm	2.4kbps	up to 4 km	up to 500m
	9.6kbps	up to 2.5 km	up to 300m
	38.4kbps	up to 1 km	up to 100m
	57.6kbps	up to 1 km	up to 100m

### 3.4. Positionning of the antenna

- In the event of use of a modem fitted with a TNC base for a remote aerial, we recommend using our range of aerials (Cf catalogue of Stand-alone products available on our web site,).
- The aerial should be installed in a free field, at least 10 cm away from any conducting material. There should be no metal obstacle within a range of less than one metre.
- Install the 2 aerials in view of each other.
- If the modem is installed in an electrical cabinet, the aerial should be installed outside. The same applies if the modem is placed inside a building and it needs to communicate with a modem positioned outside.
- The co-axial cable should be as short as possible (memo: cable of 25m => 6db of attenuation => range divided by 2)

### 3.5. Protection of remote aerial modems against overloads

It is sometimes necessary to protect the product against lightning. When the product is positioned high up it can potentially be struck by lightning which results in irreversible damage to the product. All lightning arrester systems can be installed between the aerial and the ARF51 module. It is important to follow the manufacturer's recommendations.

## 4. Configuring the ARF51 – Configuration of the communication mode

### 4.1. General

Configuring the ARF51 requires the prior installation of the ADEUNIS RF «ARF51\_configuration\_manager». This software can be found on the Adeunis RF web site.

The configurator is software that:

- Configures the ARF51 (choice of mode, parameters of the RS485 and proprietary port communication interfaces, selection of the direction of working of the I/O)
- Displays the current configuration of an ARF51
- Enables backup of a complete system
- Recalls an existing system configuration for the downloader in new products in the case of a new system or for maintenance purposes (replacing a faulty product)

### 4.2. Installation – Removal

The configuration software operates under Windows XP SP3 and more recent versions.

Before installing the configuration software, make sure you have the following installed on your computer:

- .NET Framework 4.0



- Windows Installer 3.1

- CP210x USB to UART UCP DRIVERS

If you don't have it, download it (available on the Adeunis RF website).

Installation: start «ARF51\_configuration\_manager.msi»

Uninstall the programme using Windows control panel: Add / Remove programmes.

Note: System configuration files created by the user are not deleted during uninstallation. They will still be accessible in the installation directory.

By default: c:\Program files\Adeunis-RF\ARF51 Configuration manager\ARF51 system saved.

They will be added automatically when the software is next installed.

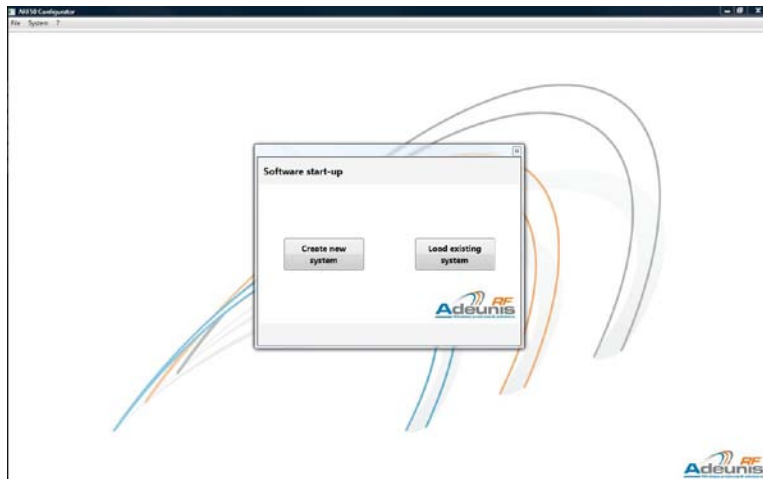


### 4.3. Configuration procedure

Once the software has been installed, follow the steps described below.

#### 4.3.1 Open the configuration software

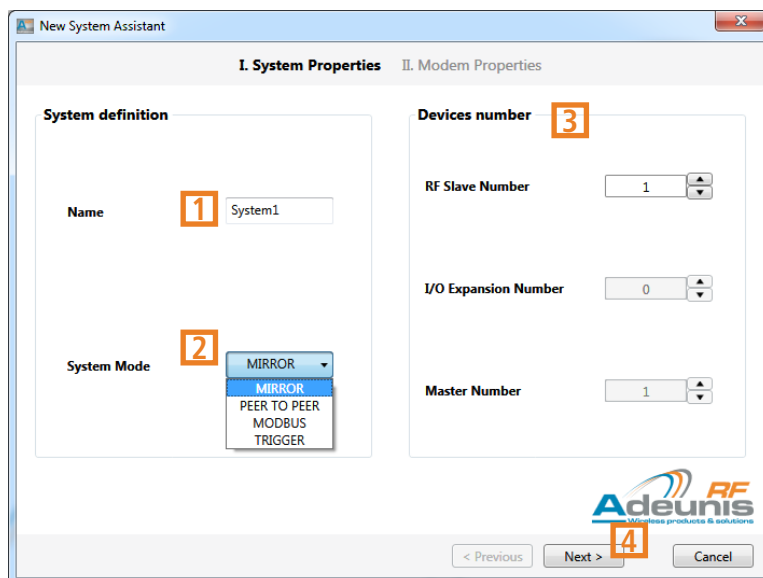
Click on the « Create new system » button (or go to the « File » tab then « create new system »)



#### 4.3.2 Define the operating mode of the system

##### 4.3.2.01 Definition of the properties of the system (« system properties »)

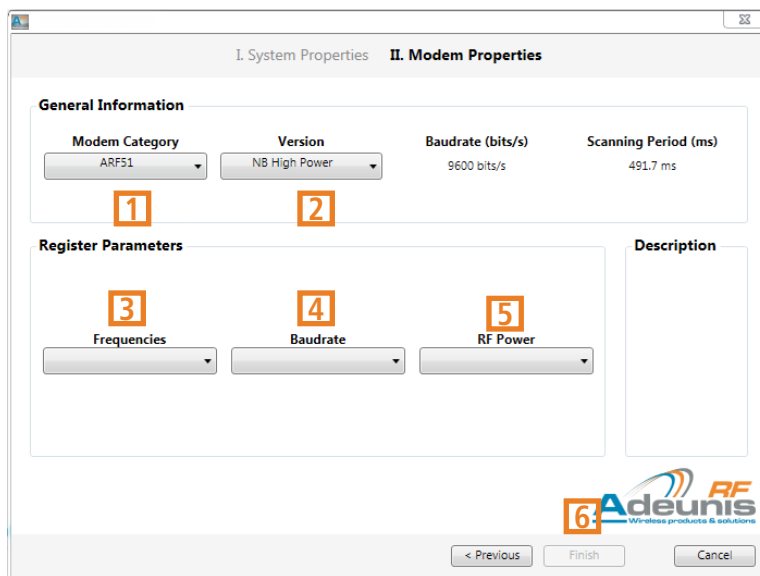
- Name the system **(1)**
- Choose the desired mode of operation: Mirror – Peer-to-peer – Trigger – Modbus **(2)**
- Define the number of « masters » and/or « RF slaves » and/or « I/O expansions » **(3)**  
 Note: Only the products necessary for the mode of operation previously chosen will be accessible.
- When all the parameters have been entered, click on « next » to confirm the configuration **(4)**



#### 4.3.2.02 Define the properties of the modem ("modem properties" field)

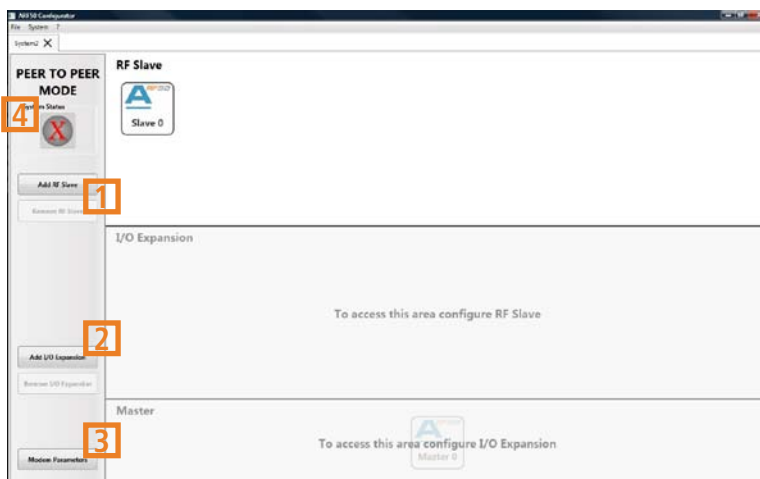
- General information: Select the category **(1)** (in case of ARF51-PRO, please choose ARF51) and version **(2)** of the modem from the drop-down lists. The configuration corresponds to the 3 radio communication modes.
- Register parameters: Enter the transmission frequency **(3)** and the power **(4)** from the drop-down lists.  
*Note: the choice of these parameters will determine the Baud rate of the radio transmission (Baudrate) and the time interval between each product interrogation (scanning period)*
- All fields must be completed. When all the parameters have been entered, the « finish » button becomes active. Click to confirm the configuration **(5)**

When these 2 stages are complete, a window can be accessed that represents a complete system with the number of products as previously determined.



At this stage it is possible to:

- Add or remove modules in the system by clicking on « Add ... » **(1)** & « Remove ... » **(2)**
- Modify the modem parameters by clicking on the « modem parameters » button **(3)**
- The red cross **(4)** indicates that the system configuration has not been finalised.





### 4.3.3 Connect the product to be configured

- Switch on the product (terminal block PWR) – see § 3.3.Description of terminal blocks
- Connect the I/O module to the USB port of the configuration computer.



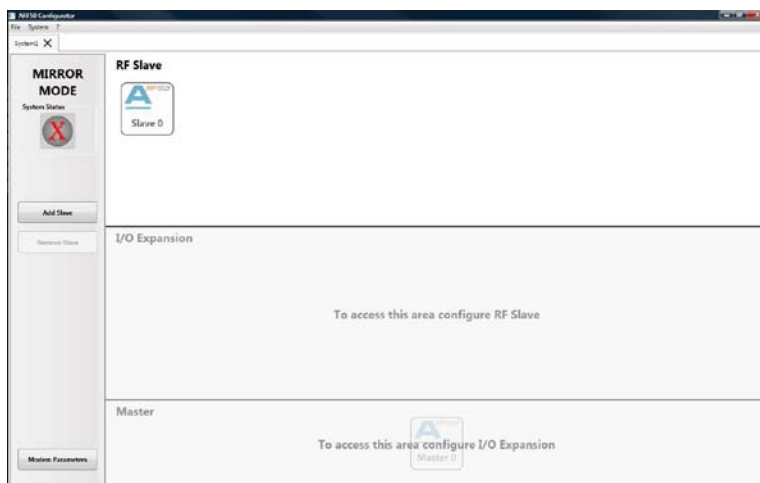
**In the mirror and Peer to peer modes :** first configure all the slaves (RF & expansion). The master can then automatically recover all the serial numbers previously entered in the software.

**In Trigger mode :** connect first the "RF slave » then the various « Masters ». The serial number of the "RF slave" will then be automatically recovered by the software and retransmitted to the « masters ».

### 4.3.4 Configure the products in the system

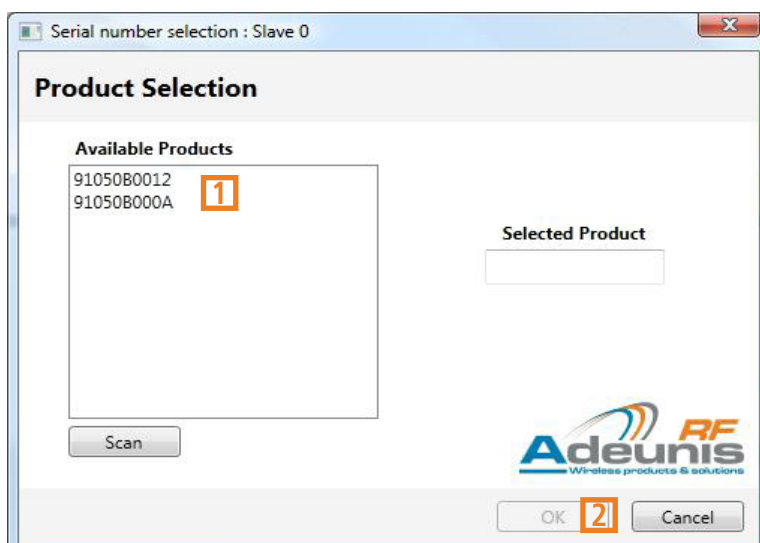
#### 4.3.4.01 Select the product to be configured

Double click on the flashing module to initialise product configuration.



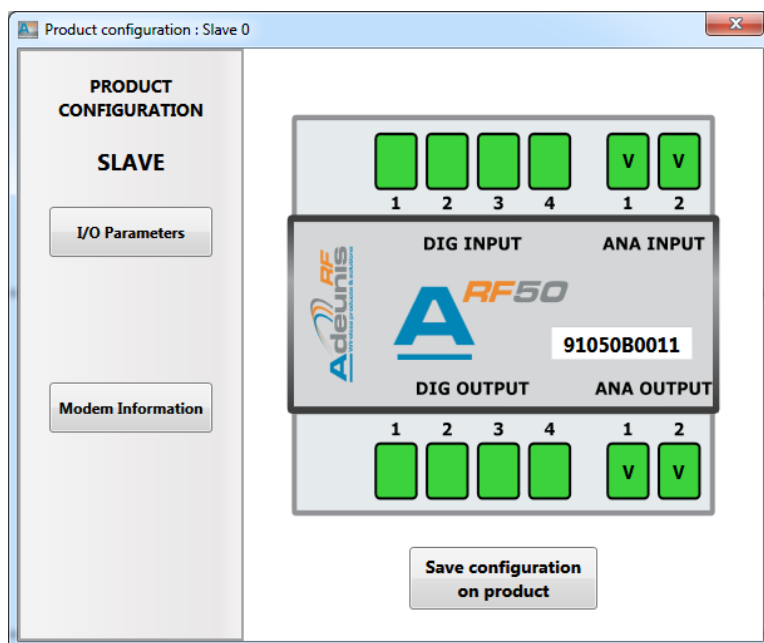
#### 4.3.4.02 Enter the product serial number

- A search window appears with a list of serial numbers of the remaining available equipment.
- The software automatically recovers the serial numbers of all the products that can be connected to the various USB ports of the computer. **(1)**
- Select the serial number of the product to be configured (the serial number of the product can be found on the label on the side of the enclosure) and confirm by clicking on OK. **(2)**



### 4.3.5 Configure the product

- Open the product configuration window.

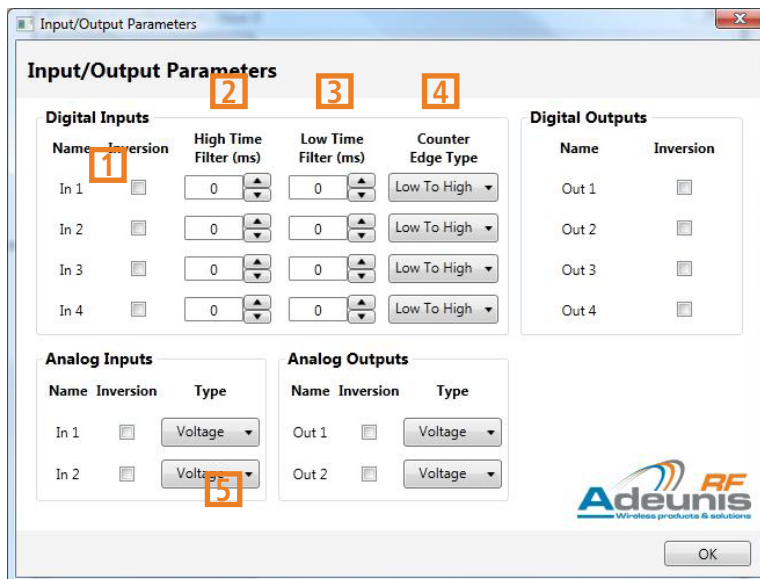


Depending on the chosen mode, various buttons are accessible and personalisable (see table below).

	RF Slave	I/O Expansion	Master Trigger mode	Master Mirror mode	Master Peer-to-peer mode	Master Modbus mode
I/O parameters	Yes	Yes	Yes	Yes	Yes	Yes
Modbus parameters	No	No	Yes	Yes	Yes	Yes
Modem information	Yes	No	Yes	Yes	Yes	Yes
Trigger parameters	No	No	Yes	No	No	No
Peer to peer summary	No	No	No	No	Yes	No
Mirror summary	No	No	No	Yes	No	No
Modbus Summary	No	No	No	No	No	Yes

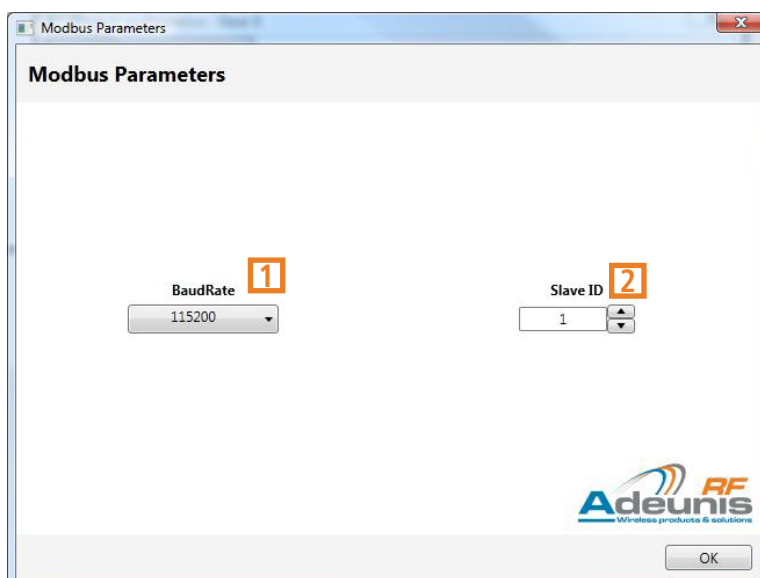
« I/O parameters » button

- (1) Reversal of the digital and analog inputs or outputs
- Filters the high (2) and low (3) level of the input signal  
Signal not taken into account since it does not remain stable for the programmed time (in ms)
- (4) Defines what is counted  
Low to high: counts rising edges  
High to low: counts falling edge  
Both: counts rising and falling edges  
The counter is recovered and displayed by Modbus
- (5) Type of analog input or output (voltage or current)



« Modbus parameters » button (only for the master)

- (1) To choose the Baud rate for the RS485#2.
- (2) Slave ID (up to 255): product identifier for the bus



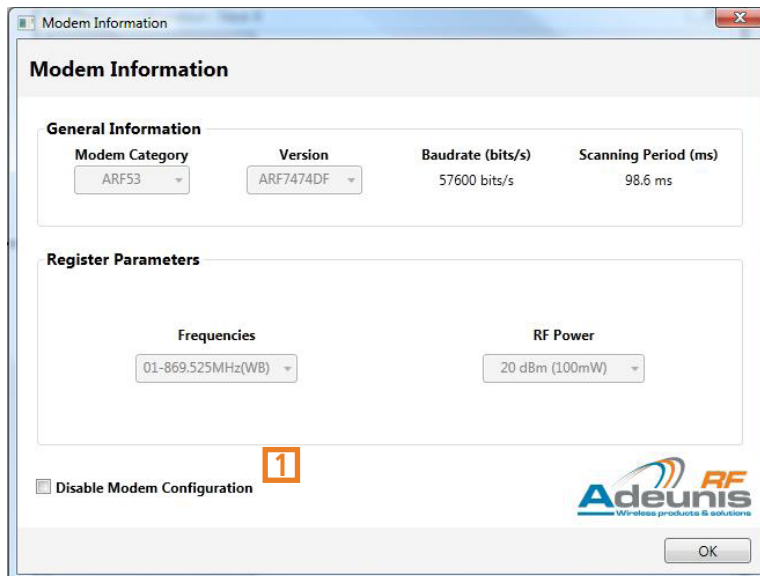
### « Modem Information » button

- By default, the items entered are those defined during stage 2 « modem properties ». These parameters are included in the ARF51.



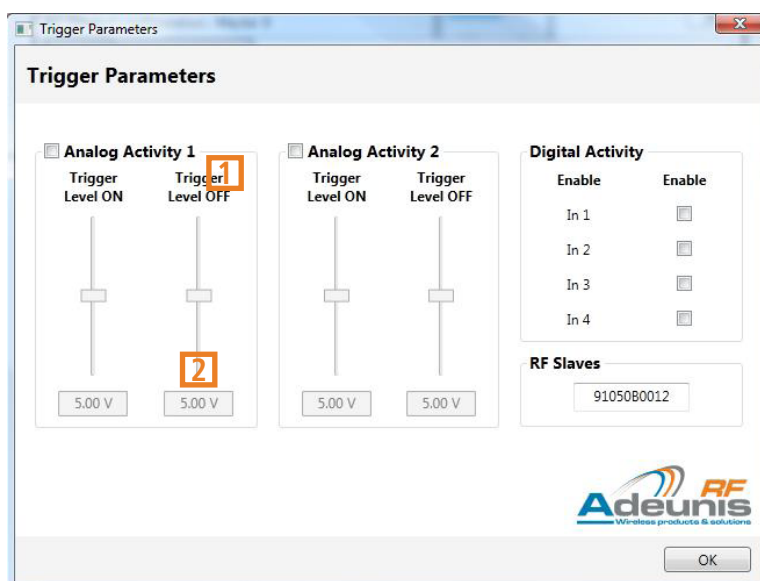
*Note: In certain configurations, it may not be necessary to initialise the modem. In that case, tick the « disable modem configuration » box (1).*

*An ARF51 configured in this way will have no associated modem.*



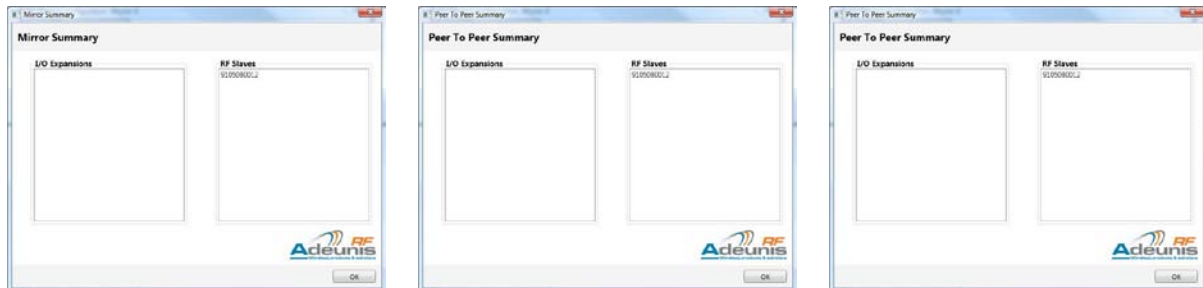
### « Trigger parameters » button (only for the «Trigger» mode)

- (1) Activate the trigger mode as required for each analog and digital input by clicking in the boxes to tick the corresponding ones.
- (2) In the case of analog inputs, select the activation and deactivation levels via the or by entering the value the value desired directly.



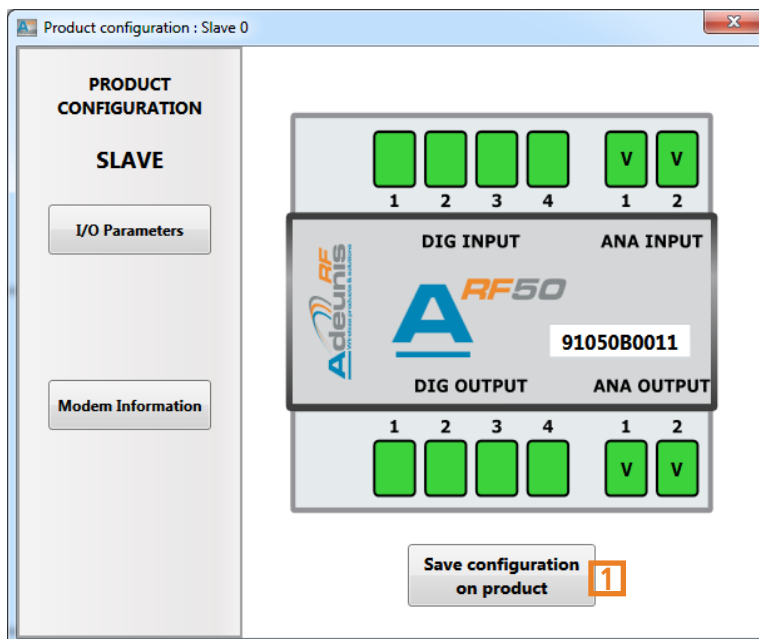
### “Mirror summary”, “peer to peer summary” and “Modbus summary” buttons

- These 2 buttons only open the display windows and changes are not possible. They give an overall dynamic view of the system (summary)
- Representation of 2 display fields containing the serial numbers of the I/O expansion and RF slaves.

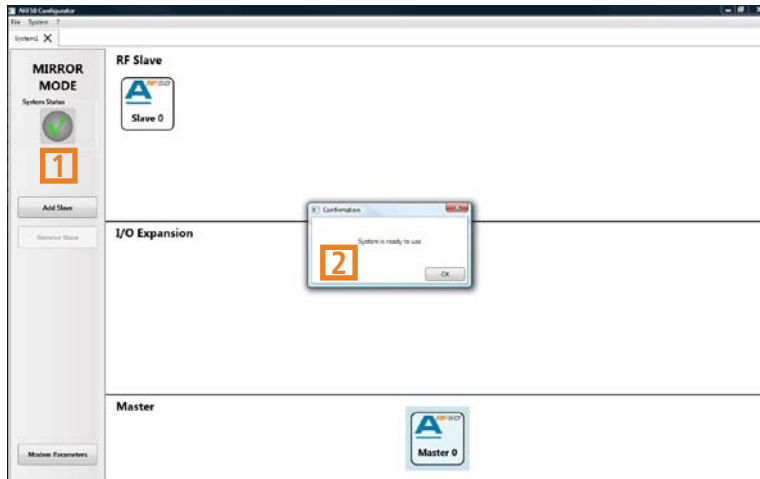


#### 4.3.6 Backing up the parameters

- When all the fields have been completed, click « Save configuration on product » **(1)** to confirm the parameters previously entered

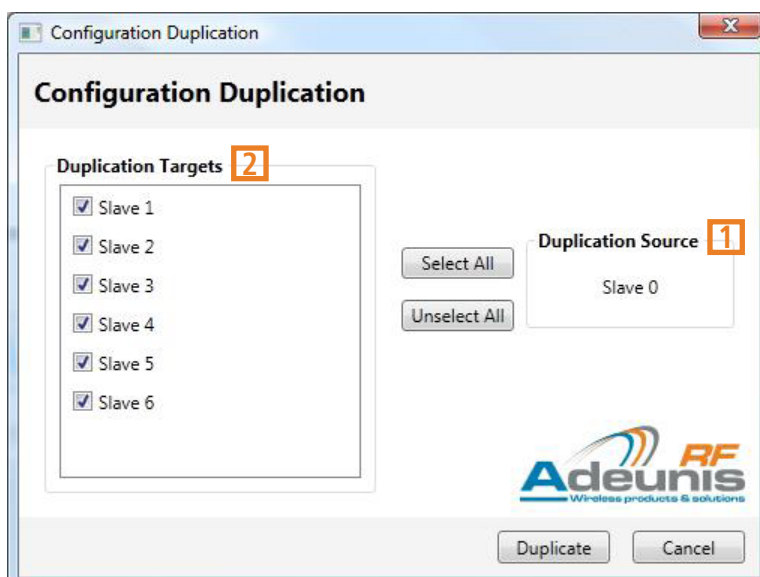


- Disconnect the configured product.
- Reproduce steps 3 and 4 for all the products comprising the system.
- When all the modules have been configured => a green icon is displayed **(1)** (≠ red: NOK – system error) under the name of the mode and a dialogue box opens with the message « system is ready to use » **(2)**



#### 4.3.7 Duplication of product configuration parameters

- In the case of a multi-product system, it is possible to reproduce the product configuration of a previously configured product **(1)**. This option is automatically proposed at the end of configuration. Tick those whose configuration you wish to reproduce **(2)**.
- This option is active for each product with a new configuration provided that all the products have been configured.
- Disconnect the configured product.
- Then proceed normally to step 3 then 4 but only entering the serial number.



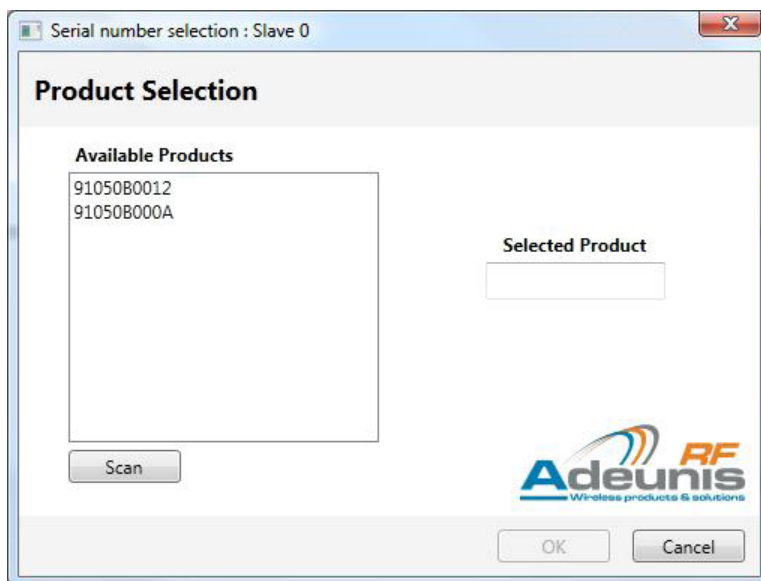
#### 4.3.8 Replacing a product in a system

It is possible to replace a product in an existing system:

- Connect the product to be replaced to the USB port of the PC and switch it on
- "Right click" on the icon for the product to be replaced => a drop-down menu opens
- Select « replace product »



- The « Product selection » windows opens
- Select the serial number and confirm by clicking on "OK"



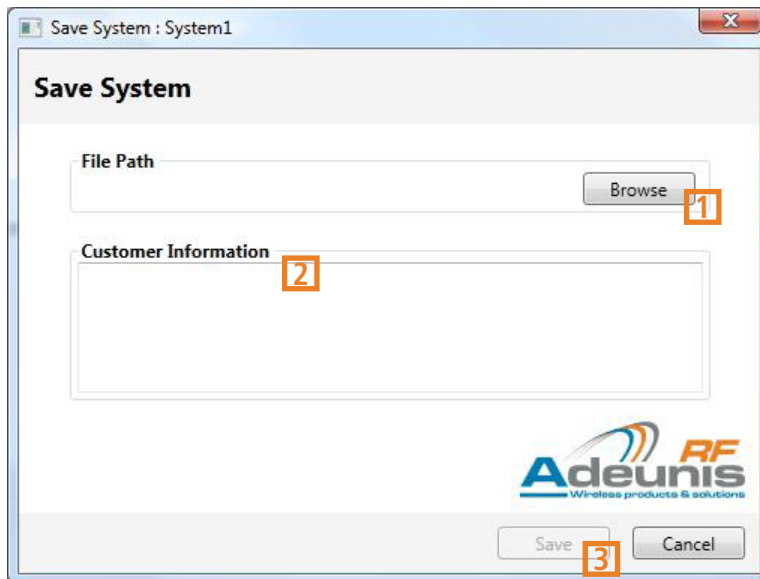
When the parameters are changed, all the products requiring updating display an icon  
Don't forget to update the list of serial numbers in the «master(s)».

#### 4.4. Backing up the system

Click on the « System » tab and select "save system"

- (1) Select the location for backing up the file
- (2) If necessary, complete a free text field
- (3) Click save

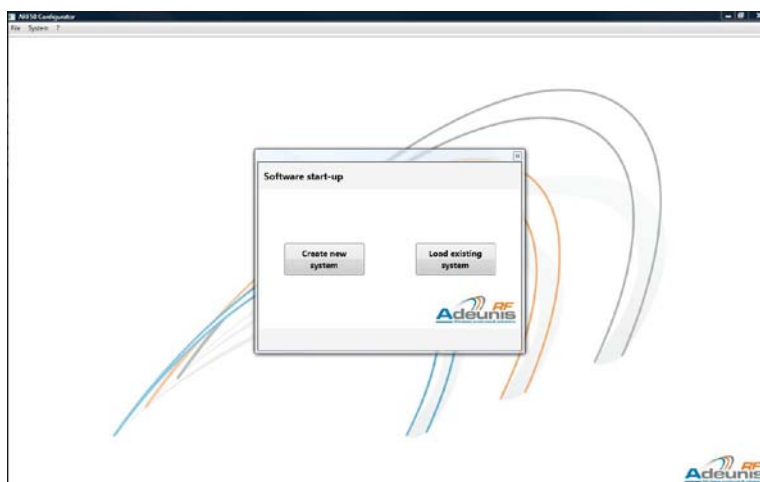
*Note : The file generated is in .xml format*



#### 4.5. Load an existing system

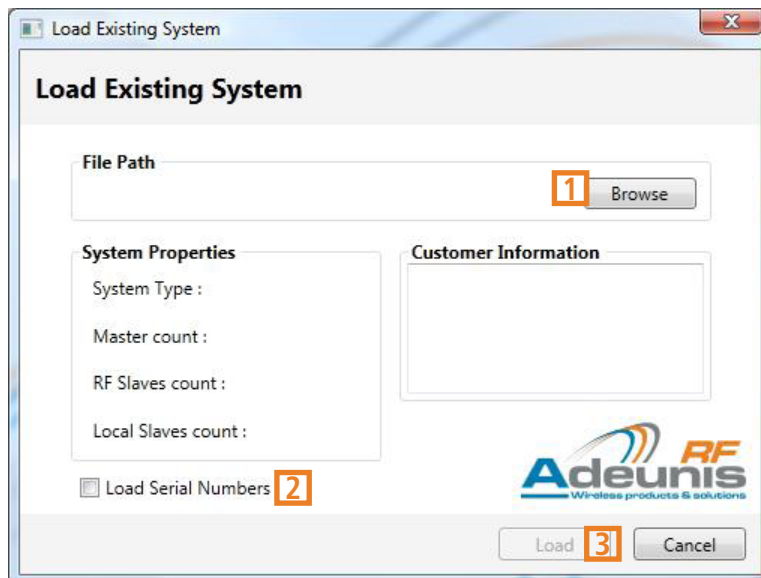
Open the configuration software

Click on the « Load existing system » button (or go to the « System » tab then « Load existing system »)





- (1) Search for the file via Browse
- If you wish to recover the product serial numbers, tick the box « Load serial number» (2).
- If this box is not ticked, the load will contain all the parameters of the system apart from the serial numbers.
- Click on the « load » button to load the file (3)



#### 4.6. Pairing without a PC

In the case of "Mirror architecture", 2 ARF51 modules can be paired together using the ADEUNIS RF configurer. Pairing may either be by radio (where the ARF51s are connected by radio modems), or by cable via the RS485.

The procedure is as follows:

A representation of the location of the miniDIP is given in § 3.3. "Description of terminal blocks".

- Step 1: « Master»: Set the pairing miniDIP "Us" of switch 2 (Us/SW2) to ON
- Step 2: Switch on the products
- Step 3: « RF slave » : Set the Us/SW2 miniDIP to On then OFF
- During this step the « RF slave » sends its serial number to the "Master"
- Step 4 « Master »: Set the Us/ W2 miniDIP to OFF.



Pairing ARF51s without a PC only affects the memorisation of the product serial number. It does not permit changes to the configuration of the ARF51 I/Os, nor the modem. The configuration software must be used to change these parameters.

## 5. Modbus Communication

The Modbus protocol is used to connect a compatible GUI and to display the I/O values for the purposes of supervision.

Function code implemented:

- 0x03: read multiple output registers (maximum number of registers read by the command = 125).
- 0x04: read multiple input registers.

In «Modbus» mode, outputs can be controlled via the following function code:

- 0x10: write multiple registers.

Comment: the «Broadcast» address is not managed by the product.

In both cases, a Modbus table is used (set of 16 bit words) formed as follows:

For an ARF51, there is a 16 word information block of 16 bits:

Word indice	word label	Signification of 16 bits of	Commentary
0	DI	Bits : [0-0-0-0-0-0-0-0—0-0-0-0-DI4-DI3-DI2-DI1]	Representation of the 4 digital inputs
1	AI1	Value on 12 bits (0 .. 4095) of analog input 1	Read analog input 1
2	AI2	Value on 12 bits (0 .. 4095) of analog input 2	Read analog input 2
3	CPT1	Value on 16 bits (0 .. 65535) of the counter for DI1	Read counter for digital input 1
4	CPT2	Value on 16 bits (0 .. 65535) of the counter for DI2	Read counter for digital input 2
5	CPT3	Value on 16 bits (0 .. 65535) of the counter for DI3	Read counter for digital input 3
6	CPT4	Value on 16 bits (0 .. 65535) of the counter for DI4	Read counter for digital input 4
7	DO	Bits : [0-0-0-0-0-0-0-0—0-0-0-0-DO4-DO3-DO2-DO1]	Representation of the 4 digital outputs
8	AO1	Value on 12 bits (0 .. 4095) of analog output 1	Read analog output 1
9	AO2	Value on 12 bits (0 .. 4095) of analog output 2	Read analog output 2
A	enable	0 : Disable , 1 : enable	Indicates whether the ARF51 is active
B	ComErrorImage	value on 8 bits (0 à 255)	Increments at each error, decrements at each success
C	ComErrorCpt	value on 16 bits (0 à 65535)	Increments at each error since switch-on
D	NS1	[L] [AA]	[ L letter or digit in ASCII] [AA] number (year of manufacture) on 8 bits (from 0 to 255)]
E	NS2	[SS] [N]	[N letter or digit in ASCII] [SS] number (week of manufacture) on 8 bits (from 0 to 255)]
F	NS3	[XXXX]	[XXXX number on 16 bits (from 0 to 65535)]

Each ARF51 has this block:

- 16 in local.
- 16 in remote.

Addresses	ARF51 emplacement	ARF51 number	Product name
0x0000		0	Master 0
0x0010		1	I/O expansion 0
0x0020		2	I/O expansion 1
0x0030		3	I/O expansion 2
0x0040		4	I/O expansion 3
0x0050		5	I/O expansion 4
0x0060		6	I/O expansion 5
0x0070		7	I/O expansion 6
0x0080	LOCAL	8	I/O expansion 7
0x0090		9	I/O expansion 8
0x00A0		10	I/O expansion 9
0x00B0		11	I/O expansion 10
0x00C0		12	I/O expansion 11
0x00D0		13	I/O expansion 12
0x00E0		14	I/O expansion 13
0x00F0		15	I/O expansion 14
0x0100		0	RF Slave 0
0x0110		1	RF Slave 1
0x0120		2	RF Slave 2
0x0130		3	RF Slave 3
0x0140		4	RF Slave 4
0x0150		5	RF Slave 5
0x0160		6	RF Slave 6
0x0170		7	RF Slave 7
0x0180	REMOTE	8	RF Slave 8
0x0190		9	RF Slave 9
0x01A0		10	RF Slave 10
0x01B0		11	RF Slave 11
0x01C0		12	RF Slave 12
0x01D0		13	RF Slave 13
0x01E0		14	RF Slave 14
0x01F0		15	RF slave 15

Modbus global addressing table in read / write mode.  
A Modbus word = 16 bits.

Adresse	READ Function code: 03 et 04			WRITE Function code: 10		
0x1000 0x1003	INPUTS	LOCAL	4 Words (16x4 DIGITAL)	-		
0x1004 0x1023			32 Words (16x2 ANALOG)	-		
0x1024 0x1027		REMOTE	4 Words (16x4 DIGITAL)	-		
0x1028 0x1047			32 Words (16x2 ANALOG)	-		
.....	-			-		
0x2000 0x2003	-			OUTPUTS	LOCAL	4 Words (16x4 DIGITAL)
0x2004 0x2024	-					32 Words (16x2 ANALOG)
0x2024 0x2027	-				REMOTE	4 Words (16x4 DIGITAL)
0x2028 0x2047	-					32 Words (16x2 ANALOG)
.....	-			-		

Adresse	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0x1000	DIG Extension 3				DIG Extension 2				DIG Extension 1				DIG Master			
0x1001	DIG Extension 7				DIG Extension 6				DIG Extension 5				DIG Extension 4			
0x1002	DIG Extension 11				DIG Extension 10				DIG Extension 9				DIG Extension 8			
0x1003	DIG Extension 15				DIG Extension 14				DIG Extension 13				DIG Extension 12			
0x1004	-				ANA 1 Master											
0x1005	-				ANA 2 Master											
0x1006	-				ANA 1 Extension 1											
0x1007	-				ANA 2 Extension 1											
...	-				...											
0x1022	-				ANA 1 Extension 15											
0x1023	-				ANA 2 Extension 15											

0x1024	DIG Remote 4	DIG Remote 3	DIG Remote 2	DIG Remote 1
0x1025	DIG Remote 8	DIG Remote 7	DIG Remote 6	DIG Remote 5
0x1026	DIG Remote 12	DIG Remote 11	DIG Remote 10	DIG Remote 9
0x1027	DIG Remote 16	DIG Remote 15	DIG Remote 14	DIG Remote 13
0x1028	-			
0x1029	-			
0x1030	-			
0x1031	-			
...	-			
0x1046	-			
0x1047	-			

## 6. Examples of architectures

### 6.1. Mirror Mode

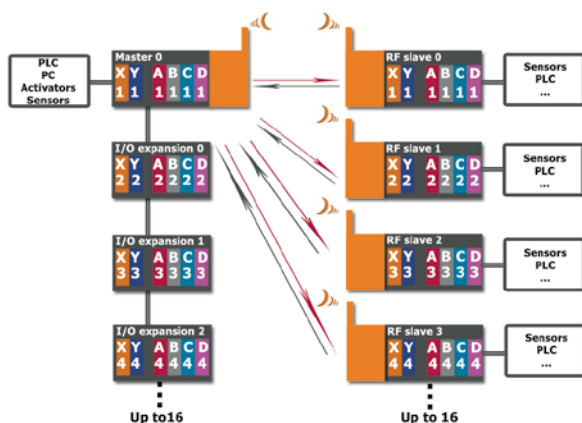
#### 6.1.1 Operation

The Mirror mode consists in concentrating N ARF51 RF slaves on one ARF51 master  
In order to expand the number of I/Os of the master ARF51, it is possible to chain ARF51 I/O expansions to it.  
The number of RF slaves is between 1 and 16, the number d'I/O expansions is between 1 and 15.  
The inputs are repeated to form a mirror through the radio link.

#### 6.1.2 I/O allocation

Definition: a channel is a combination of one input and one output (for example, digital input 1 and digital output 1 forming digital channel 1).

▲ : digitale channel 1      ■ : digitale channel 2      ● : digitale channel 3      ■ : digitale channel 4  
X : Analog channel 1      Y : Analog channel 2



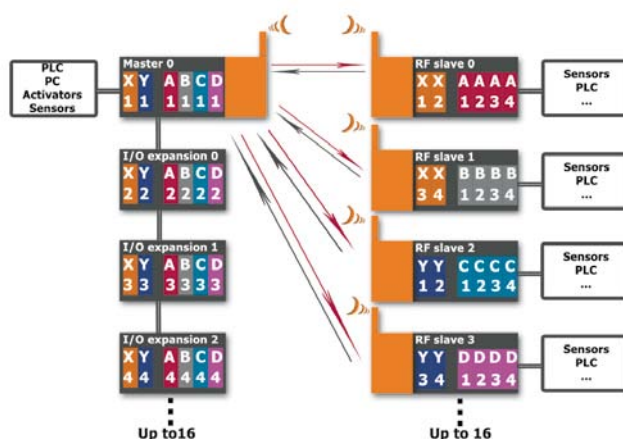
### 6.2. « Peer to Peer » mode

#### 6.2.1 Operation

Cyclic interrogation. The network master interrogates the RF slaves cyclically, inviting them to use the word to relay the change of state information. Report on one master from 1 to 16 RF slaves.  
In order to expand the number of I/Os of the master, it is possible to chain 1 to 15 ARF51 I/O expansions with it.  
The "channels" are crossed in groups of 4 pairs of ARF51s, (matrix inversion).

#### 6.2.2 I/O allocation

See above, § 6.1. "Mirror mode"



### 6.3. « Trigger » mode

#### 6.3.1 Operation

Relaying alarms from “n” ARF51s. Exchanges are limited to changes in state of the inputs of the master modules. When not relaying alarms, the products are in standby to optimise power consumption.

- The Trigger mode consists of 1 to 16 masters and one RF slave.
- The masters are configured to exchange with the RF slave when its inputs change.
- Each input of each master is configured independently (digital input: level/analog input): threshold).
- At exchange an exchange is made with the RF slave
- During the exchange, the active inputs transmit their values and the other inputs a “0”.
- The RF slave memorises all the values sent to it.

#### 6.3.2 I/O allocation

- Slave

The digital outputs of the slave are a logical OR of the N digital inputs of the masters:

$$SA = OU(E[M\_1]A \dots E[M\_N]A)$$

$$SB = OU(E[M\_1]B \dots E[M\_N]B)$$

$$SC = OU(E[M\_1]C \dots E[M\_N]C)$$

$$SD = OU(E[M\_1]D \dots E[M\_N]D)$$

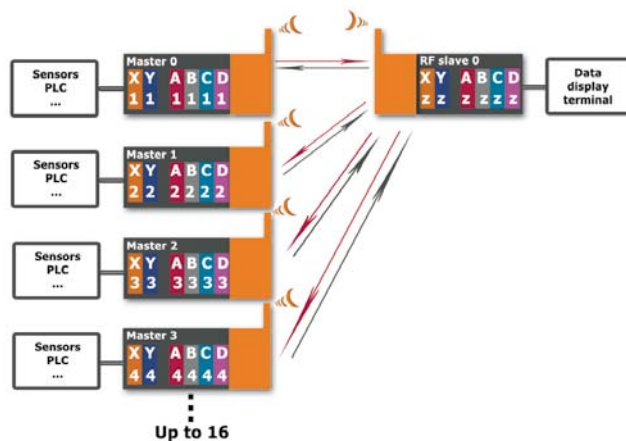
The analog outputs of the slave are the MAX of N analog inputs of the masters:

$$SX = MAX(E[M\_1]X \dots E[M\_N]X)$$

$$SY = MAX(E[M\_1]Y \dots E[M\_N]Y)$$

- Master

For each exchange between the master and the slave, there is a repeat of inputs of the slave on the outputs of the master.



6.4. «Modbus» mode

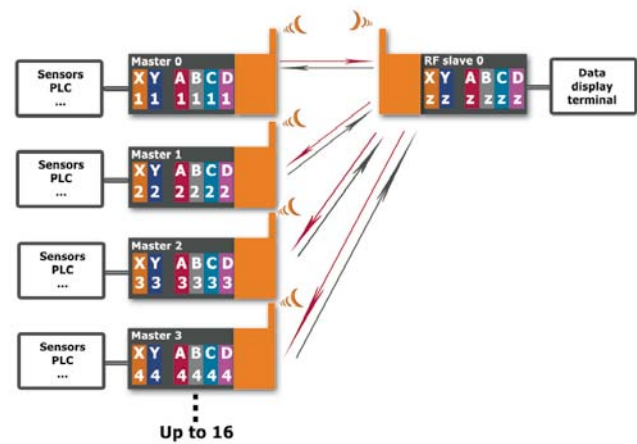
6.4.1 Operation

- «Modbus» mode lets you:
- return a global view of the system to a supervisor.
  - control / command the system's I/O.

6.4.2 I/O assignment

- There is no assignment of I/Os.
- Each I/O is autonomous and independent.
- All the I/Os are read by the «RS485 Modbus RTU».
- All the outputs are controlled by this same «RS485 Modbus RTU».

The number of «Slave RFs» is between 1 and 16. The number of «I/O expansions» is between 0 and 15 (see &6: Modbus communication).

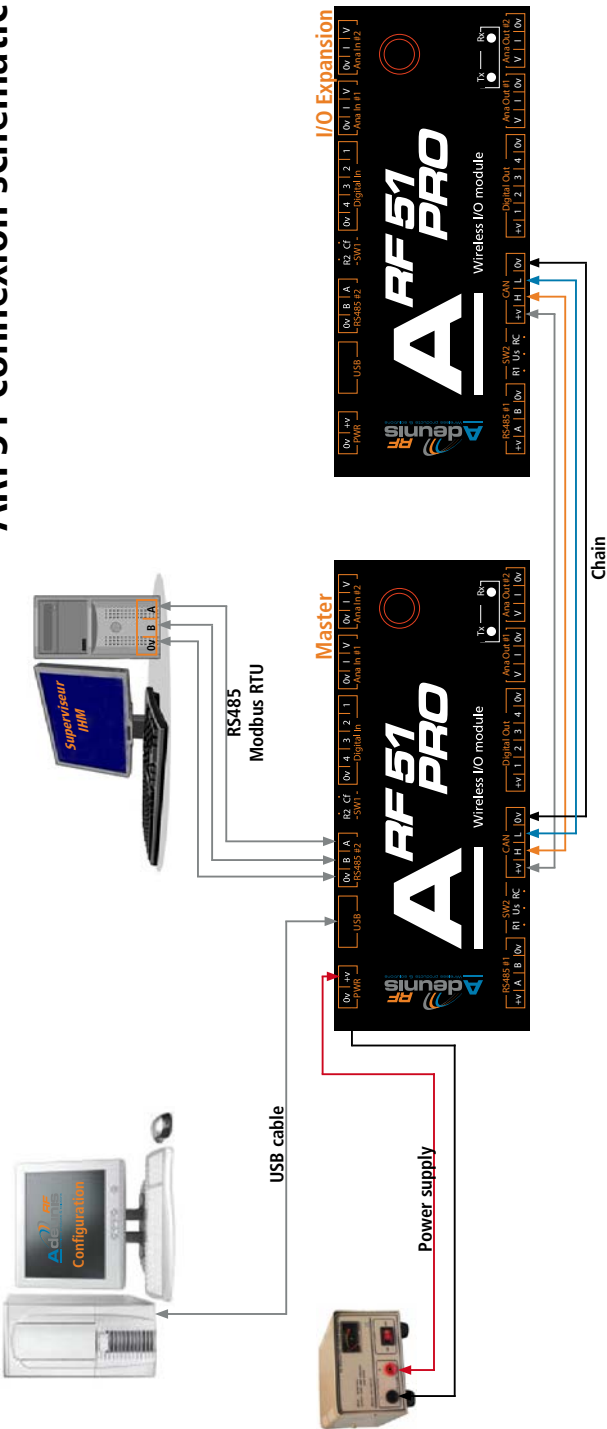


7. Versions history

VERSION	SUBJECT	WRITTEN BY	DATE
1.0	Creation	FFR	9/01/2013

Appendix 1

ARF51 connexion schematic



**Legend**

- Cables to use for RS485 interfaces: 2 pairs of twisted shielded cable 0.5mm²
- Use the WAGO accessory supplied with the product to cable the socket terminal block
- Radio modem connection: The RS485 bus wiring needs only two wires on the socket terminal block (TX+ is connected to RX+ and TX- is connected to RX- on the PCB)