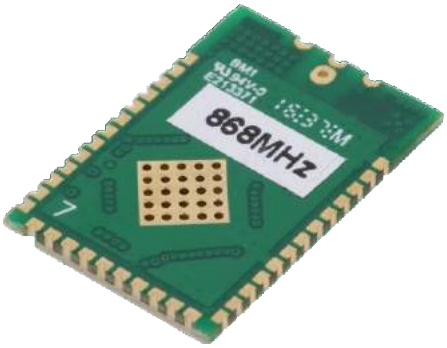
RCQ3-868

based on RadioControlli RC-CC1310-868 component.



The functionality of the device RCQ3-868 are the following :

- ***Multichannels Radio Modem***
  The modem operates in the ISM 868 MHz band.
  The RF modem is very simple to use and provides a wireless RS232 link with a RF data rate of up to 100 kbps. The transceivers have the functions of a complete radio modem and simply require CMOS/TTL data at the transmit input and the corresponding transceiver(s) output the same data. Preamble and CRC are automatically generated and added to the RF transmission.
  The RCQ3-868 can use any channel in 100 (200) KHz step.
  Possible applications include one-to-one and multi-node wireless links in applications including security, EPOS, wireless sensor network, industrial process monitoring and computer networking.

- ***Wireless Switch***
  It's an 8 channels wireless switch module with pairing function, it provides maximum 8 channel signal input and maximum 8 channel control output (4 bistable channels and 4 monostable channels).

- ***Wireless Controller***
  It's an 4 channels wireless controller module with pairing function, it's possible to control and verify the logic state (open or close) of the Remote Module.

- ***Wireless Actuator***
  Wireless actuator for home automation, it's possible use 1 unit as Transmitter (controllable via RS232 serial interface) and by one or more RX units with the possibility to switch 4 bistable channels and 4 monostable channels for every RX units.

Applications :

- *Wireless security systems*
- *Home and building automation*
- *Automatic Measure Reading*
- *Industrial Control and Monitoring*
- *Wireless Sensor Network*
- *EPOS Terminal*

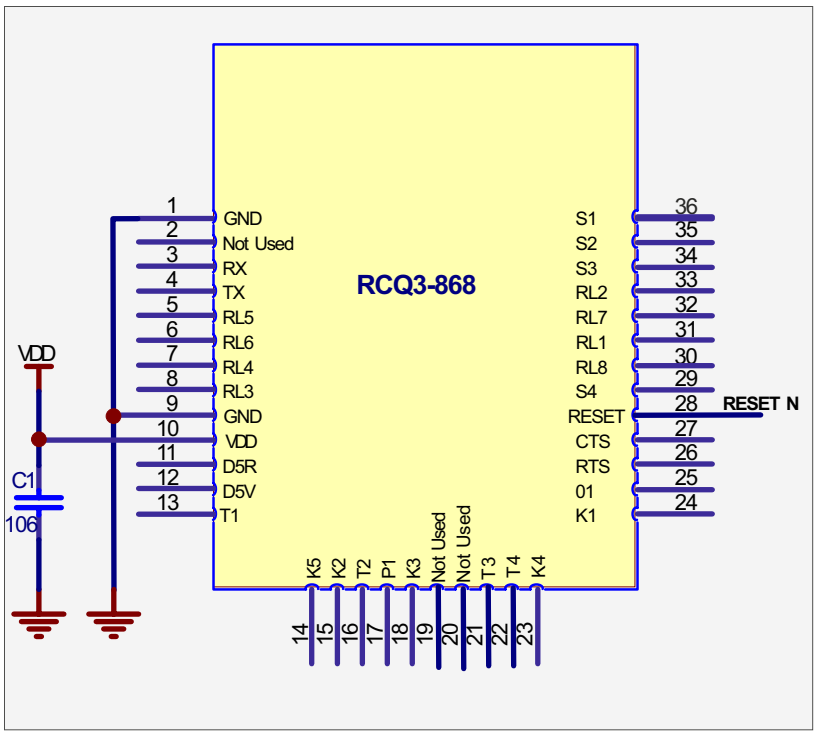
Operating Mode :

- *One to One*
- *One to Many*
- *Broadcast*
- *Many to One*

Feature :

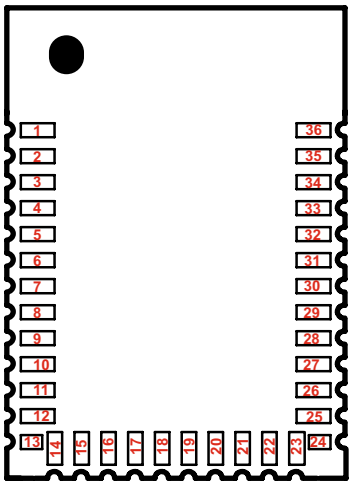
- *Radio Modems Application Inside*
- *Low consumption technology*
- *RF Data Rate to 100Kbps*
- *RF Channel Selectable*
- *Serial Data Interface with Handshake*
- *Host Data Rate up to 115200 Baud*
- *Very Stable Operating Frequency*

Reference Schematics

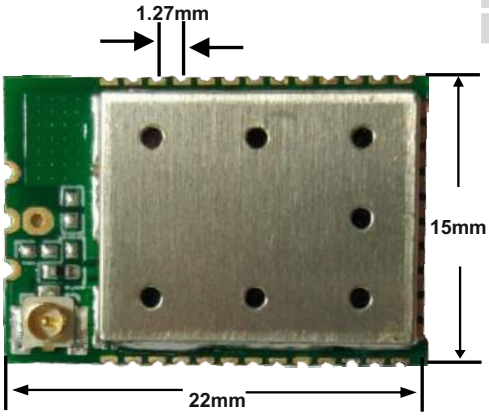


Pads	Name	Description
1	GND	Ground
2	NU	Not Used
3	RX	UART RX
4	TX	UART TX
5	RL5	Bistable Output RL5
6	RL6	Bistable Output RL6
7	RL4	Monostable Output RL4
8	RL3	Monostable Output RL3
9	GND	Ground
10	VDD	Power 3Volt
11	D5R	Digital Output Led Info RED
12	D5V	Digital Output Led Info GREEN
13	T1	Remote Request State S1
14	K5	Shift Switch for channels 5-8
15	K2	Switch for channels 2
16	T2	Remote Request State S2
17	P1	Switch Test Mode
18	K3	Switch for channels 3
19	NU	Not Used
20	NU	Not Used
21	T3	Remote Request State S3
22	T4	Remote Request State S4
23	K4	Switch for channels 4
24	K1	Switch for channels 1
25	01	Led Test Mode
26	RTS	UART RTS
27	CTS	UART CTS
28	RESET	RESET (Active low,No internal pull up)
29	S4	Input S4
30	RL8	Bistable Output RL8
31	RL1	Monostable Output RL1
32	RL7	Bistable Output RL7
33	RL2	Monostable Output RL2
34	S3	Input S3
35	S2	Input S2
36	S1	Input S1

Pin out device

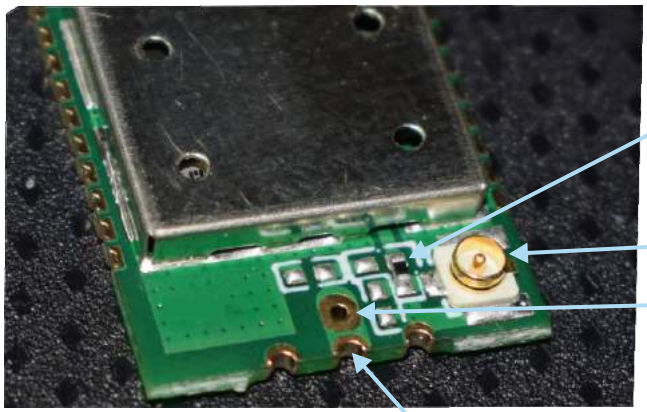


Mechanical dimensions

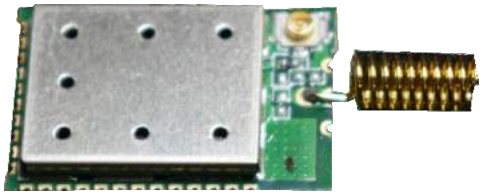


Thickness = 2,5mm

Antenna Connection

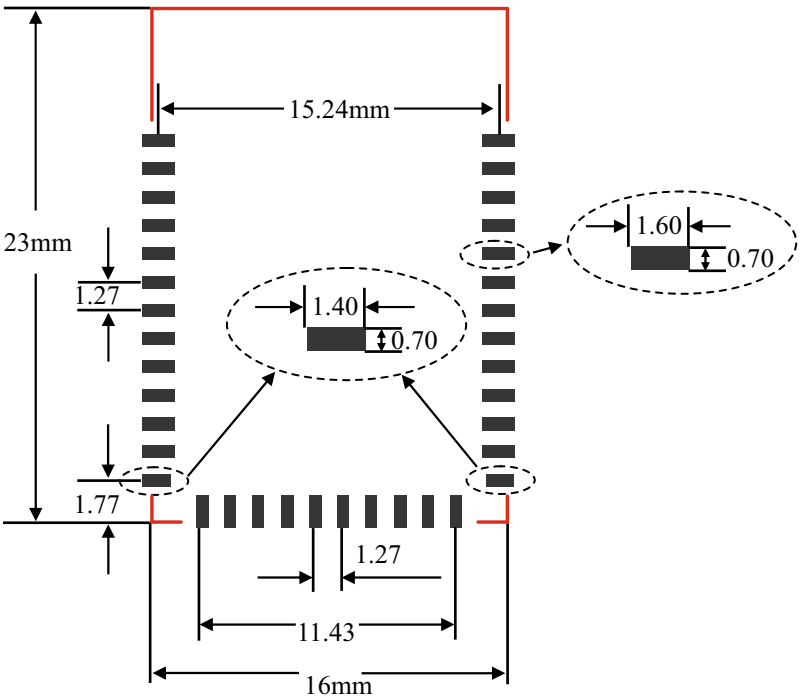


Antenna pad connector if you want connect this device to a pcb antenna.



Connection using hole (868MHz Elicoidal Antenna)

Recommended PCB Layout



1.0 Technical Specifications

Technical Characteristics

Characteristics	MIN	TYP	MAX	UNIT
Supply Voltage	1.8	3	3.8	VDC
Supply Current RX mode		5.5		mA
Supply Current TX mode ---> +10dBm		13.4		mA
Supply Current TX mode ---> +14dBm		23.5		mA
Supply Current Standby Mode		0.7		µA
Supply Current Shut Down Mode		185		nA
Operative Frequency		434/868/915		MHz
Frequency error		± 10		ppm
RF Power Output 50ohm (*)	-10		+14	dBm
RF Sensitivity 50kbps		- 110		dBm
Data Rate	0,01		4	Mbit/s
Operative Temperature	-30		+75	°C

(*) Programmable parameter.

2.0 Multichannels Radio Modem Functionality

The RCQ3-868 Radio Modem has applications in many areas where reliable half duplex communications are required over ranges up to 200 meters (with the maximum RF Power is possible to reach up to 400-500meters).
The crystal controlled narrow band design, in the embedded RCQ3-868 device, gives reliable performance within the 868 MHz band.
The addressing protocol employed enables many different configurations such including:

one-to-one operation: for point to point data communication;

broadcast operation: where a single master address many RCQ3-868 modules concurrently (using many RCQ3-868 modules set to the same address);

one-to-many: a network consisting a master and many slaves (the receivers all have the same address)

many-to-one: where the transmitters all send to a single receiver address

Since each RCQ3-868 can contain a unique address, multiple RCQ3-868 network can co-exist in the same area.

2.1 Configuration Mode

Byte	Name	Description	Text	HEX
0		MSB	~	7E
1	Remote Address		~	7E
2			~	7E
3		LSB	~	7E
4		MSB	~	7E
5	Local Address		~	7E
6			~	7E
7		LSB	~	7E
		868.0 MHz	P	50
		868.2 MHz	R	52
		868.4 MHz	T	54
		868.6 MHz	V	56
		868.8 MHz	X	58
8	RF Channels	869.0 MHz	Z	5A
		869.2 MHz	\	5C
		869.4 MHz	^	5E
		869.6 MHz	<	60
		869.8 MHz	b	62
		870.0 MHz	d	64
		0 dBm	0	30
		2 dBm	2	32
		4 dBm	4	34
9	RF TX Power	6 dBm	6	36
		8 dBm	8	38
		10 dBm	:	3A
		12 dBm	<	3C
		14 dBm	>	3E
10	TX DATA PACKET SIZE			1E 30byte
11	TX DATA PACKET SIZE			1E 30byte

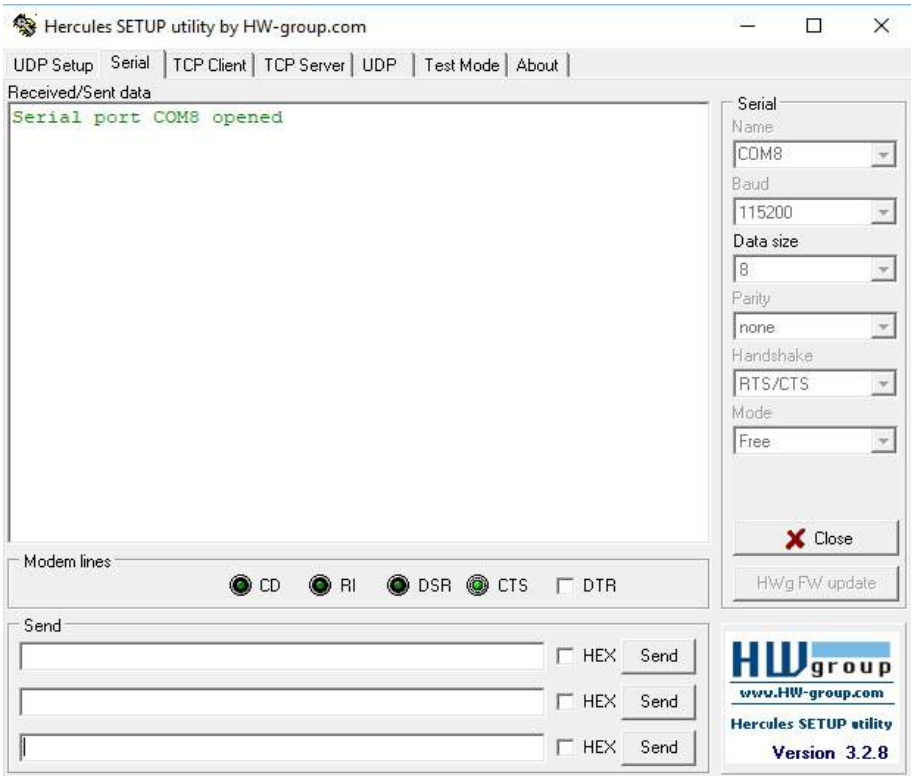
The **RF Channel is calculated** in the following mode:

FREQUENCY = 860 + (ASCII code / 10) + (Rest division / 10)
for example to character «R» (HEX 52) corresponds to the frequency 868.2 Mhz because :
achieve the frequency = 868.9MHz the procedure is the following :
«R» Ascii Code = 82 ---> Frequency = 860 + int(82/10) + rest division (82/10) = 860+8+0.2 = 868.2

The **Power value is calculated** in the following mode :

Power = Ascii code - 48
For example to the character «7» (HEX 37) correspond the value 7dBm because :
«7» Ascii code = 55 -----> Power = 55 - 48 = 7

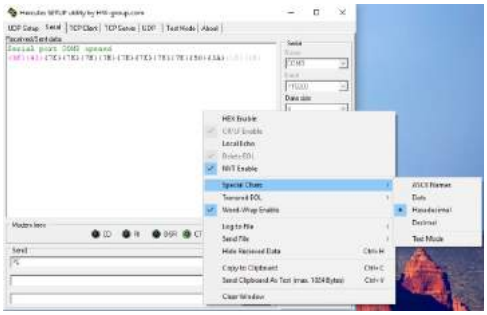
2.2 Example of Configuration

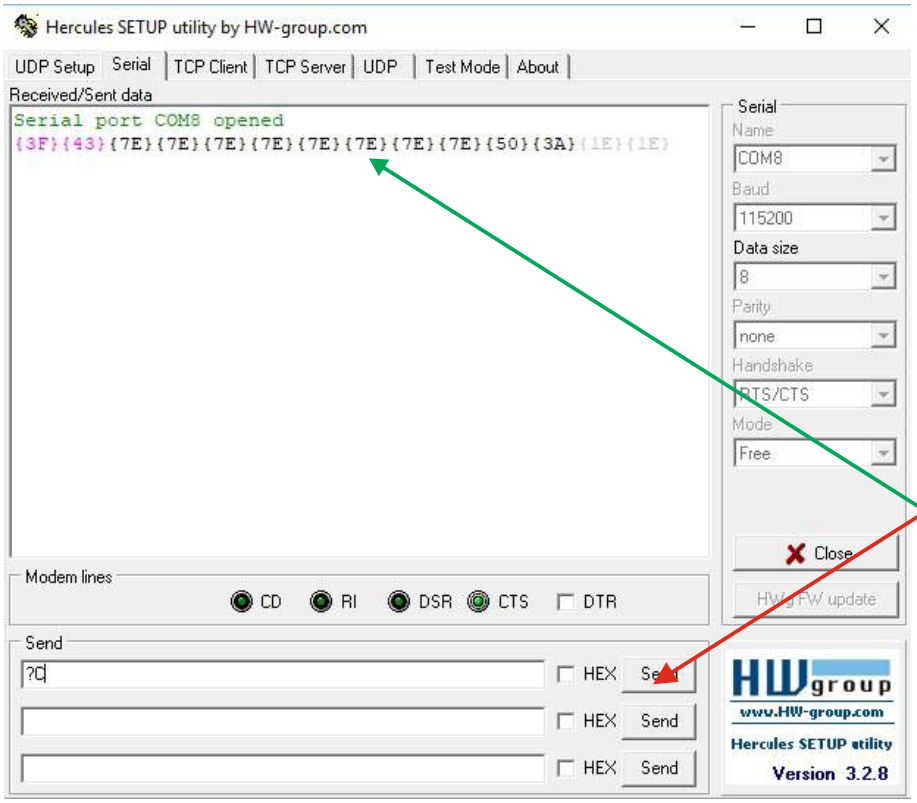


Software used : Hercules SETUP utility (free use)

Open the serial port with this parameters

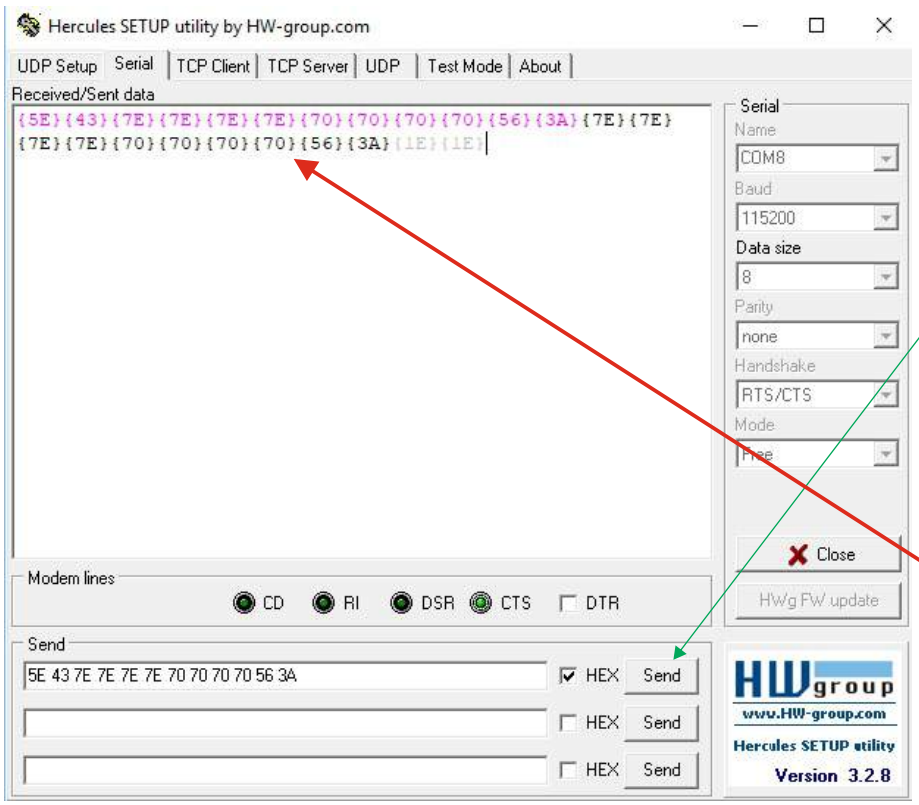
Set the Hercules software to receive hexadecimal character (press the right mouse button and :
- In the Special Chars menù choise HEX
- Choice HEX Enable





Push this button, in this mode the string “?C” is transmitted (request of configuration)

The module responds by sending the default configuration parameters
7E 7E 7E 7E 7E 7E 7E 7E 50 3A 1E 1E



Push this button, in this mode we sent the new Configuration String 7E 7E 7E 7E **70 70 70 70 56** 3A (hexadecimal string)
We have changed the parameters in red :

70 70 70 70 Destination address

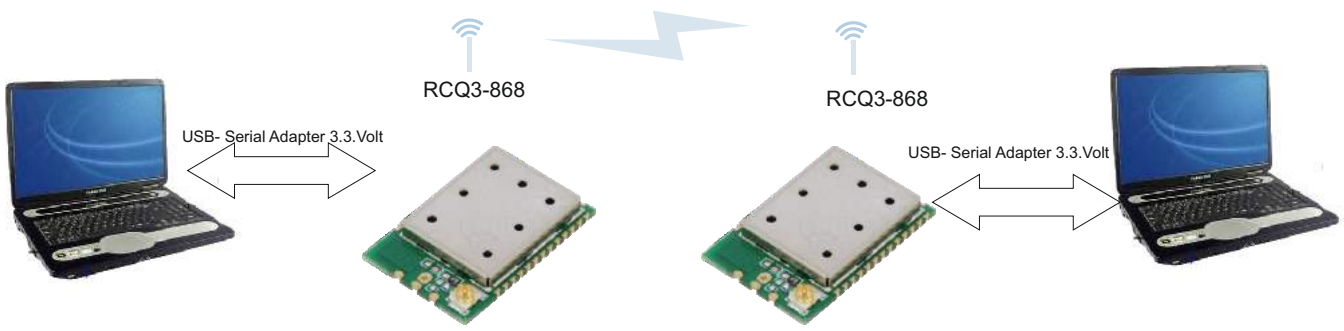
56 Frequency = 868.6MHz

The module answer confirming the new configurazion :
7E 7E 7E 7E **70 70 70 70 56** 3A

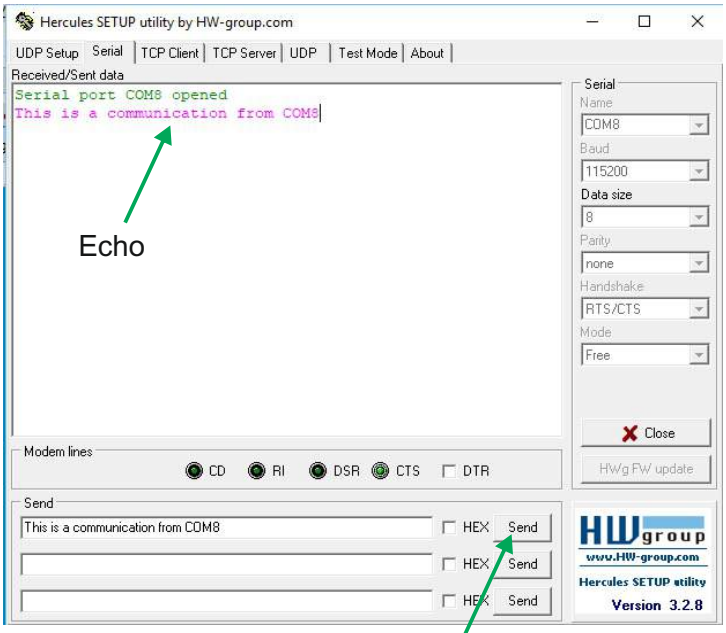
These operation can be done also in Text Mode instead that in Hex Mode, in this case the default string is :
«**~~~~~~~~P:**» (7E 7E 7E 7E 7E 7E 7E 7E 50 3A
To modify is necessary send the following text string «**3C~~~~ppppV:**» (53 43 7E 7E 7E 7E 70 70 70 70 56 3A

2.3 Example of Operation Mode (One to One)

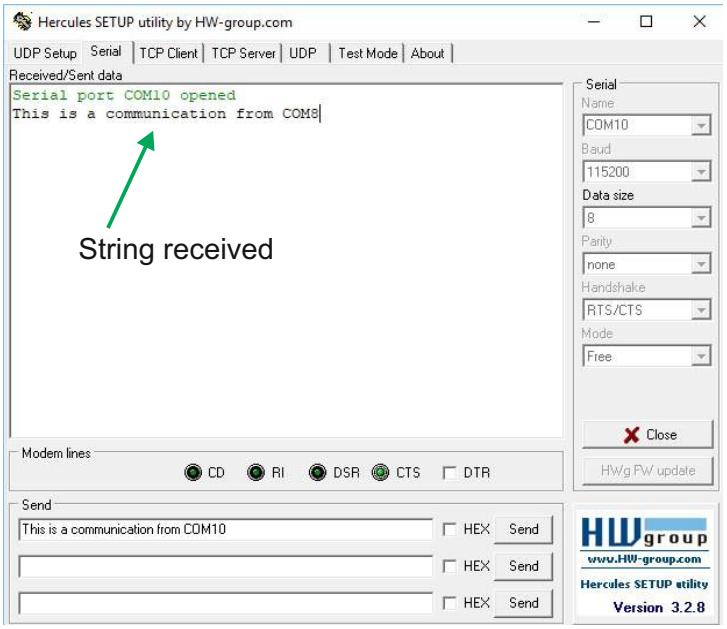
This example is performed according to the following schematics and using the software Hercules SETUP utility (free use).



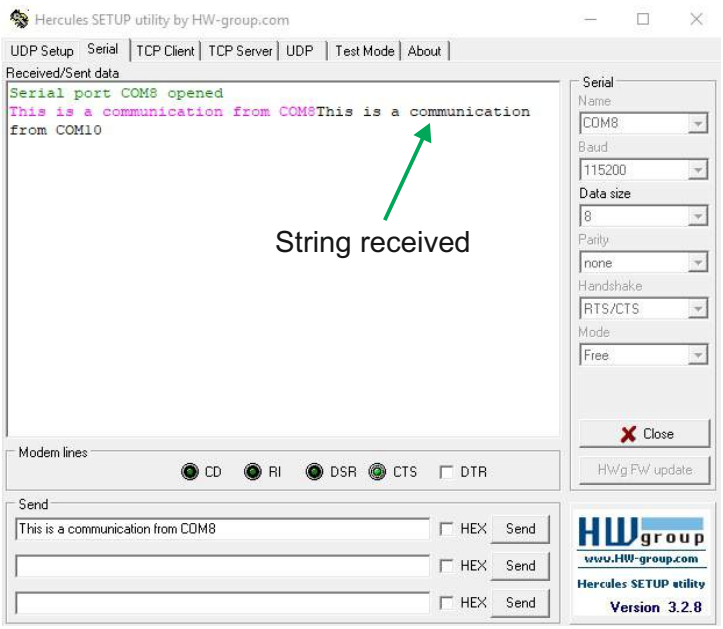
Serial Port COM8

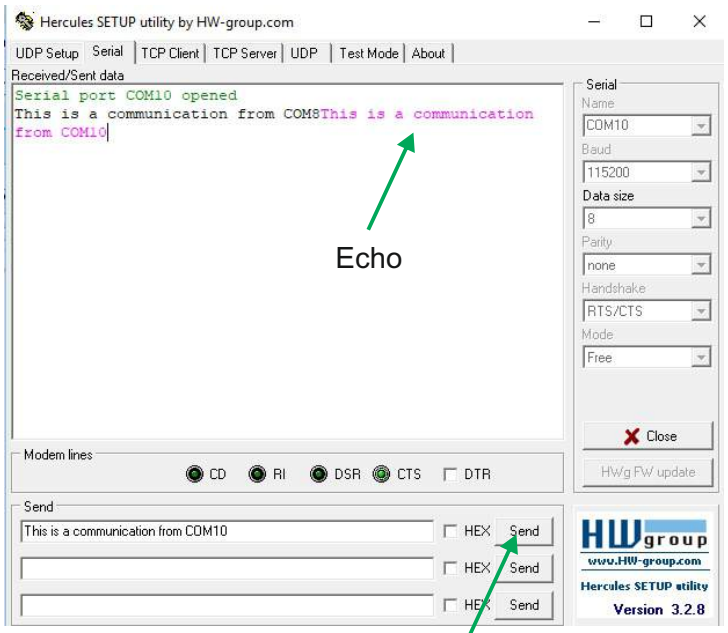


Serial Port COM10



Push this button, in this mode we sent the following string "This is a communication from COM8"

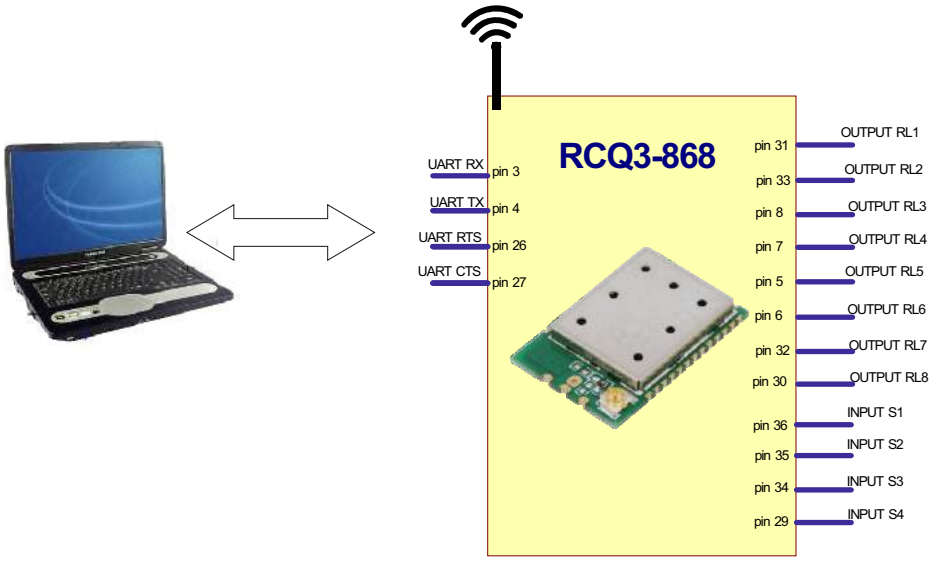




Push this button, in this mode
we sent the following string
"This is a communication from COM10"

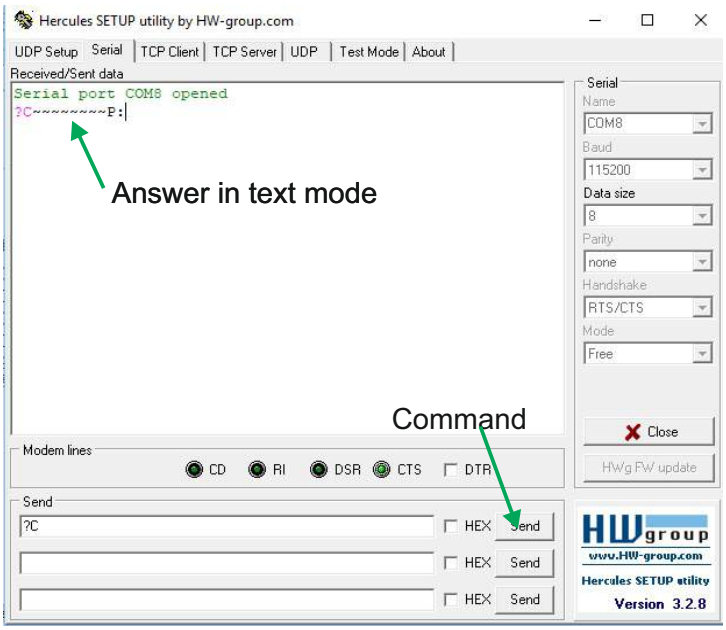
2.4 Local List Command

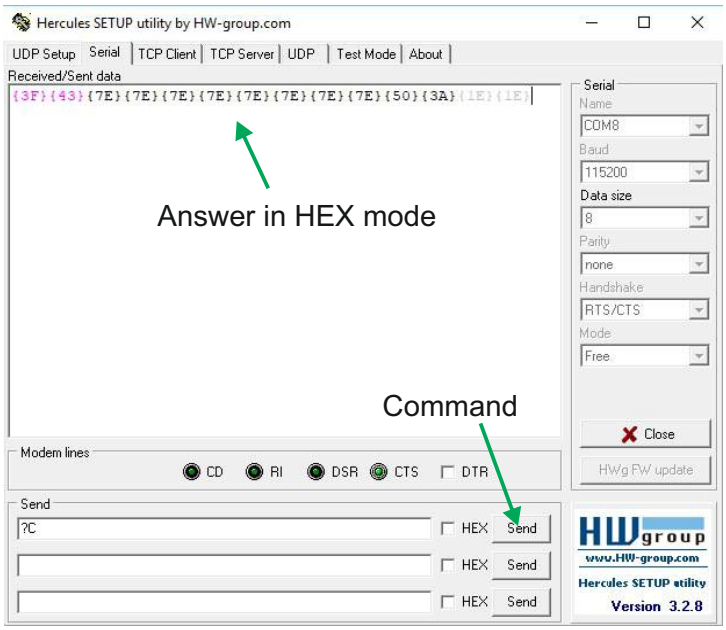
	Local Command	Description	Example
1	?C	Return the configuration parameters :SB	See par. 2.4.1
		1) Remote Address, 2) Local Address, 3) Frequency, 4) Power Value	
2	?T	Returns the temperature value (°C)	See par. 2.4.2
3	?B	Returns the value of Battery (Volt)	See par. 2.4.2
4	?O	Returns the state of the Outputs : RL1,RL2,RL3,RL4,RL5,RL6,RL7,RL8	See par. 2.4.3
5	?I	Returns the state of the Inputs : K1,K2,K3,K4,K5,S1,S2,S3,S4,Test Mode	See par. 2.4.3
6	?V	Returns the firmware version	See par. 2.4.4
7	?BR	Returns the baud rate setted	See par. 2.4.4
8	?S	Returns the initial informations	See par. 2.4.5
9	?H	Returns the command list	See par. 2.4.5
10	^C+CONF	Allow to modify the configuration of the module example:	See par. 2.4.6
		^C~~~~~~~~T2 (text) or 53 43 7E 7E 7E 7E 7E 7E 7E 7E 54 32 (HEX)	
11	^C+BAUDATE	Value accepted : 115200,57600,38400,19200,9600,4800,2400,1200	
		Example : ^C115200. After this command you must reset the device.	



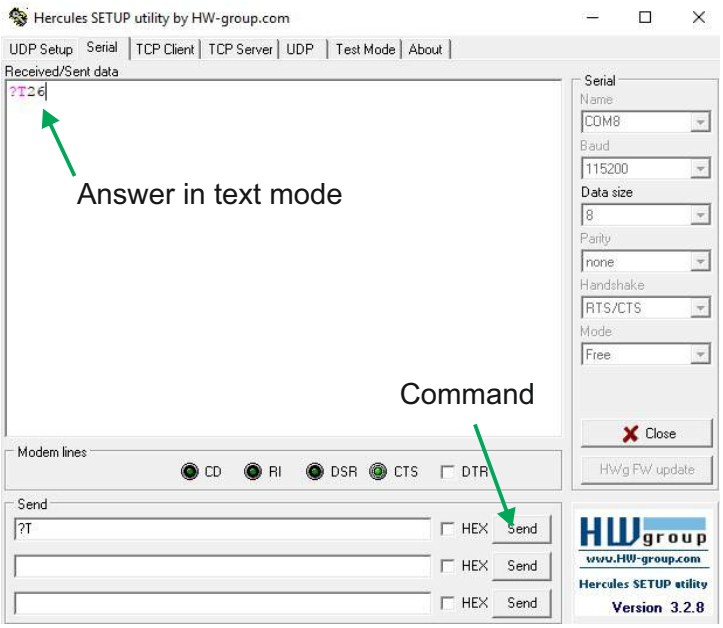
Remote Address = 7E7E7E7E
Local Address = 7E7E7E7E

2.4.1 «?C» Command

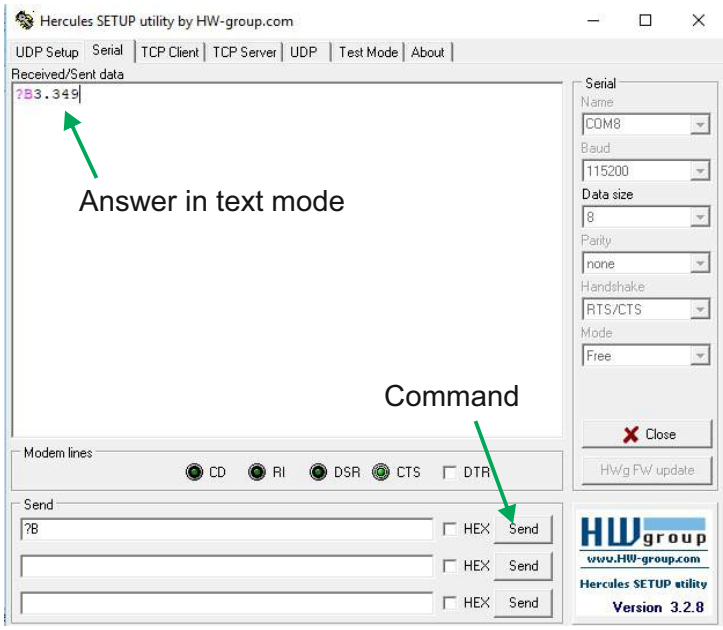




2.4.2 «?T» and «?B» Command

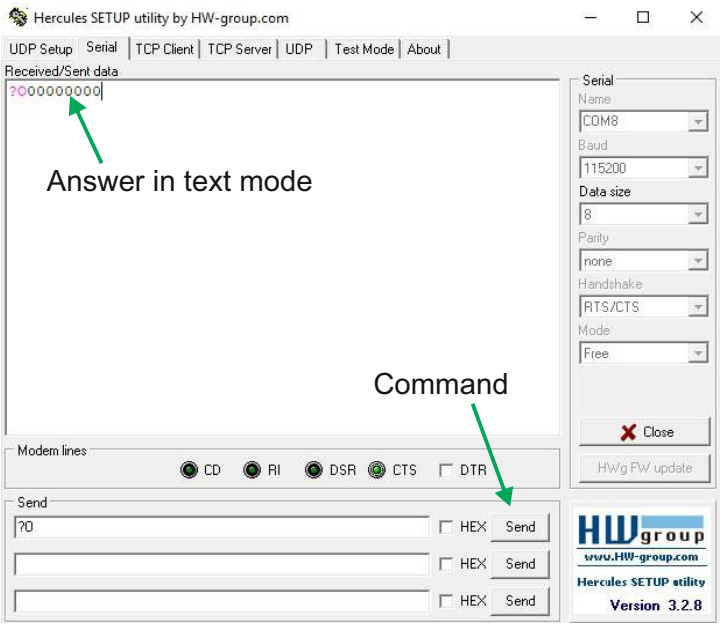


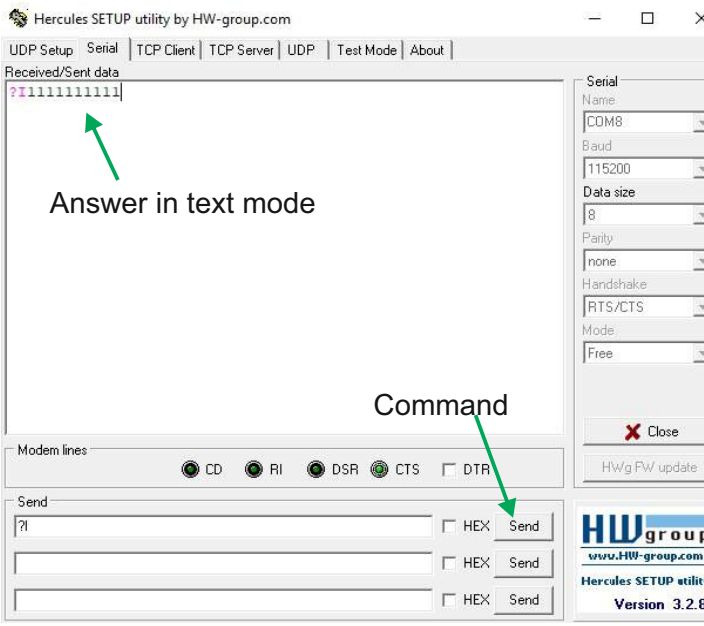
Return the value in °C.



Return the value in Volt.

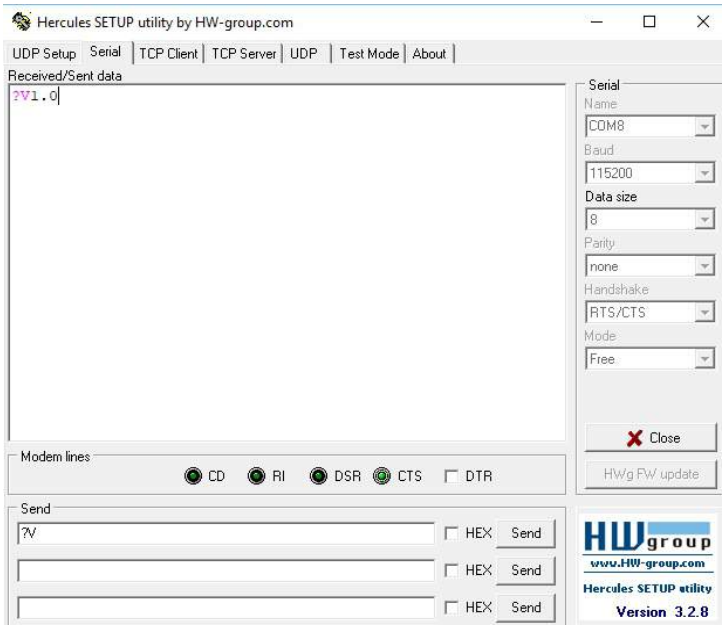
2.4.3 «?O» and «?I» Command



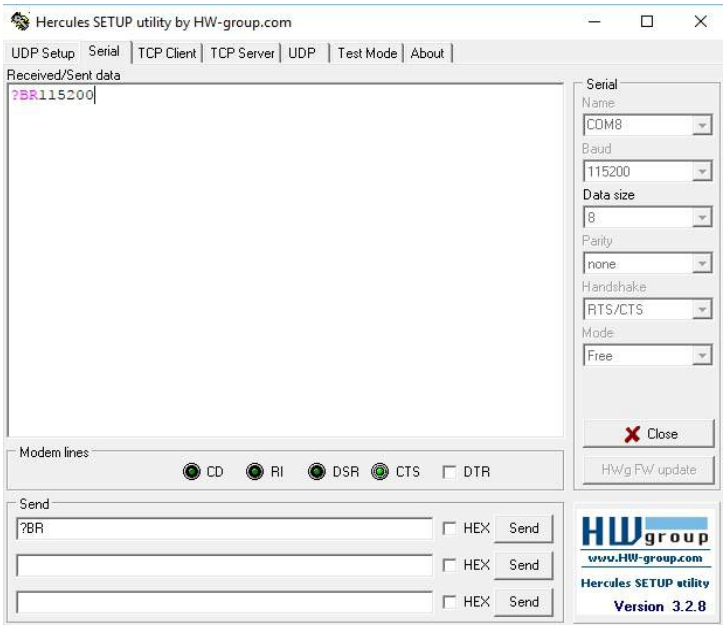


00000000 means that the 8 output RL1,RL2,RL3, Rl4, RL5,RL6,RL7,RL8 are a Low level.

2.4.4 «^V+ Configuration» and «?BR» Command

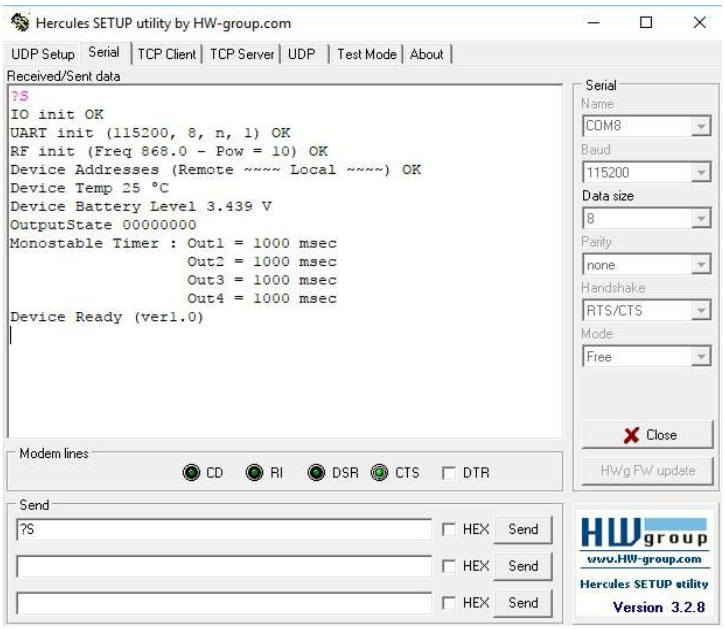


Firmware version

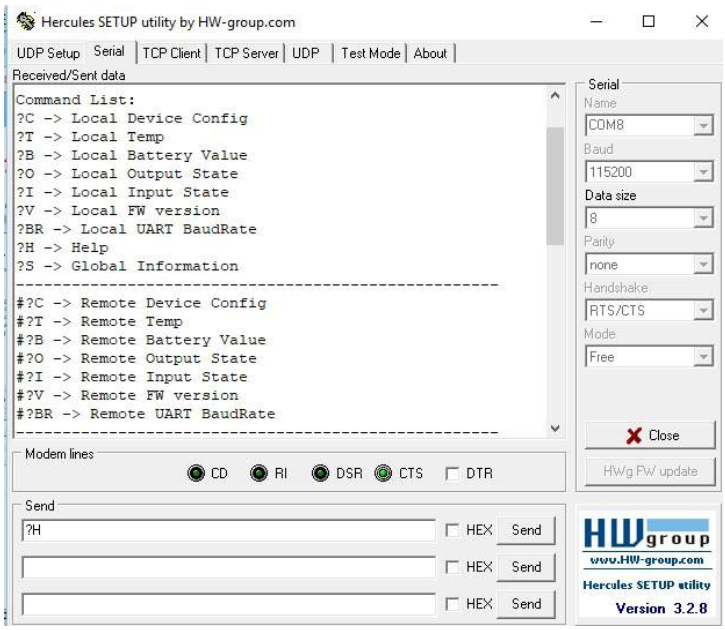


Baud rate

2.4.5 «?S» and «?H» Command

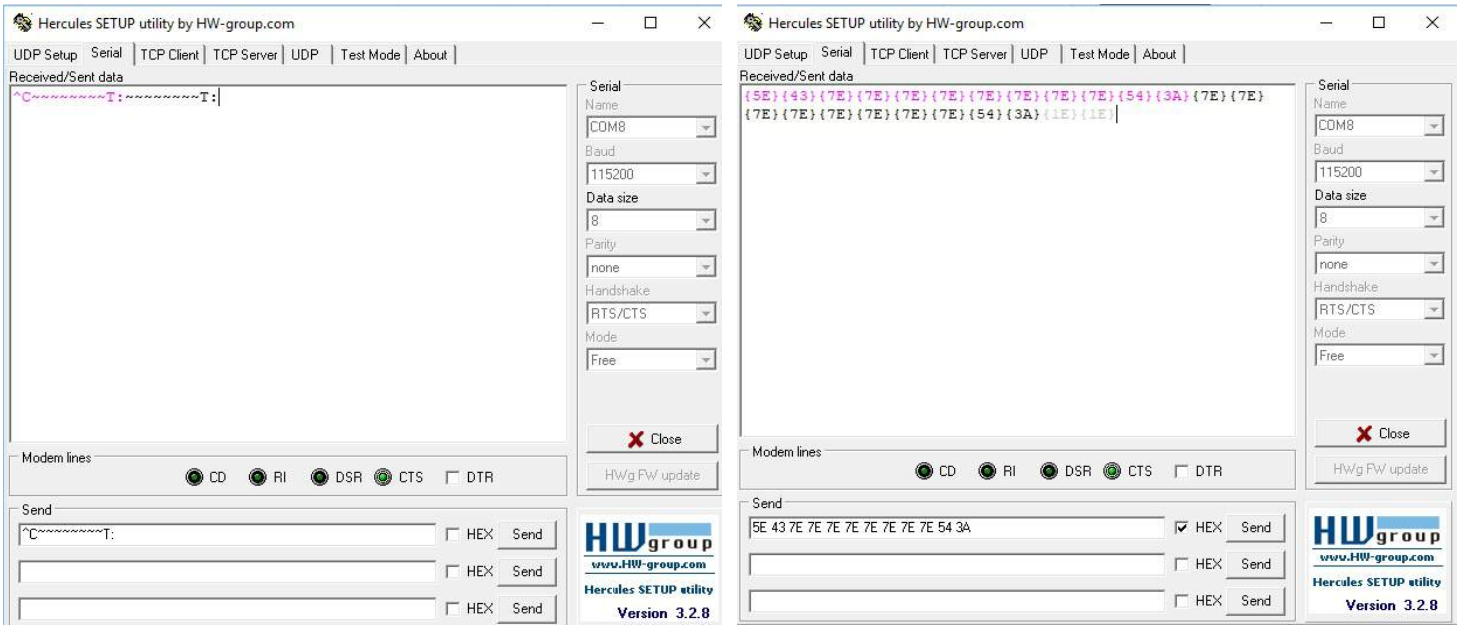


Initial information



Command List

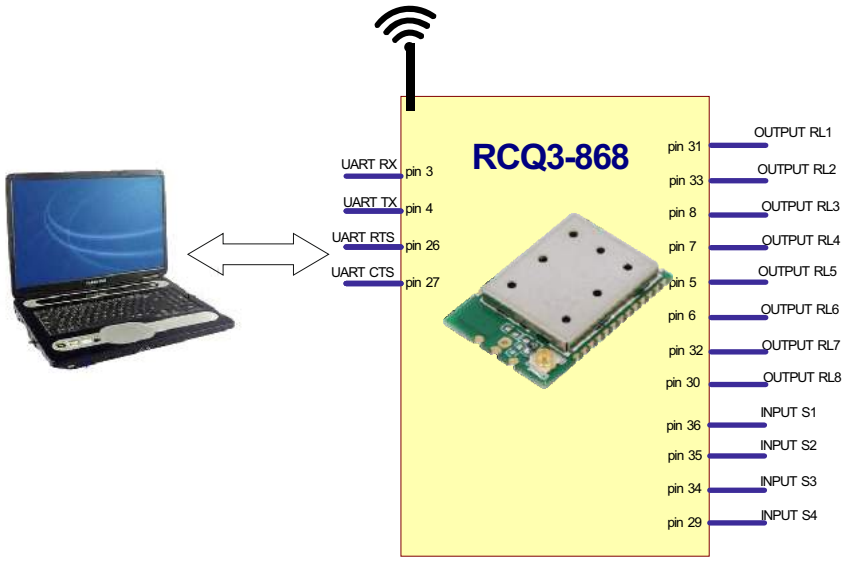
2.4.6 «^C+ Configuration»



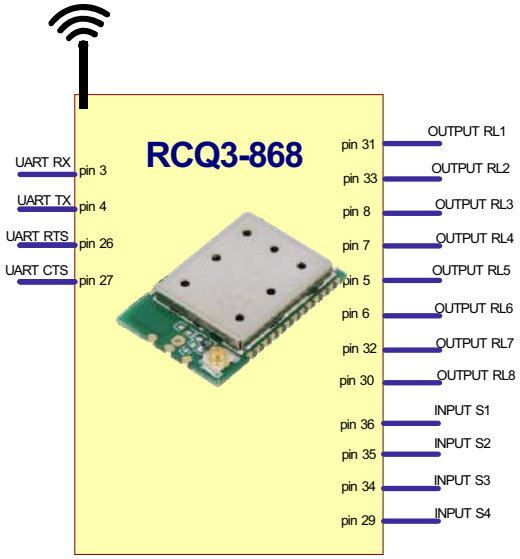
Example of configuration in text mode and in Hex Mode

2.5 Remote List Command

Remote Command		Description	Example
1	#?C	Return the configuration parameters :SB	See par. 2.5.1
		1) Remote Address, 2) Local Address, 3) Frequency, 4) Power Value	
2	#?T	Returns the temperature value (°C)	See par. 2.5.2
3	#?B	Returns the value of Battery (Volt)	See par. 2.5.2
4	#?O	Returns the state of the Outputs : RL1,RL2,RL3,RL4,RL5,RL6,RL7,RL8	See par. 2.5.3
5	#?I	Returns the state of the Inputs : K1,K2,K3,K4,K5,S1,S2,S3,S4,Test Mode	See par. 2.5.3
6	#?V	Returns the firmware version	
7	^C+CONF	Allow to modify the configuration of the module example:	See par. 2.5.4
		^C~~~~~~~~~T2 (text) or 53 43 7E 7E 7E 7E 7E 7E 7E 7E 54 32 (HEX)	

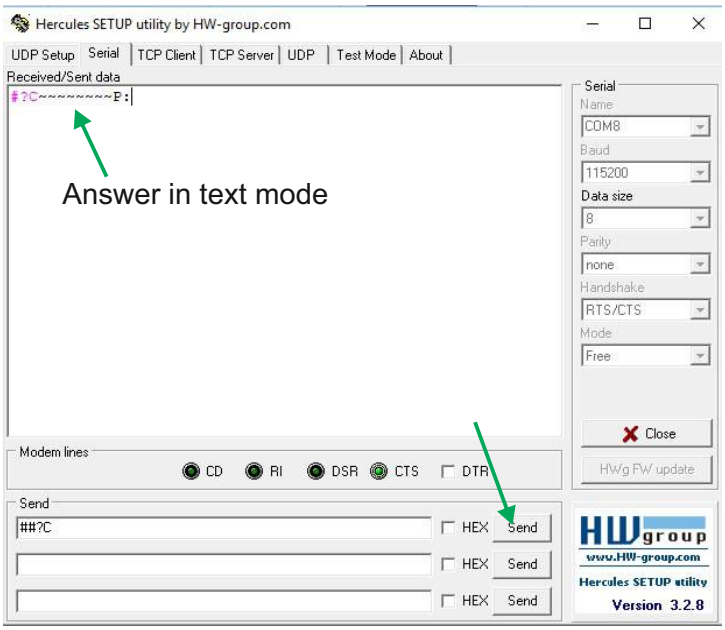


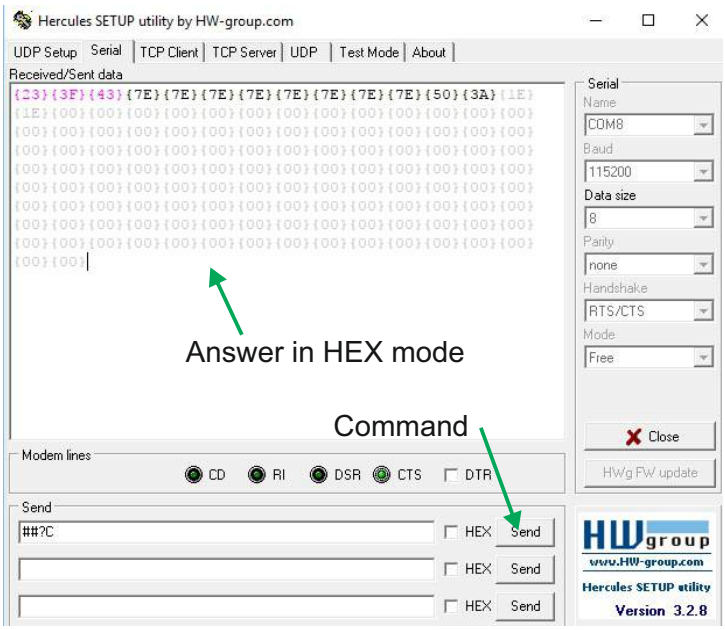
LOCAL DEVICE



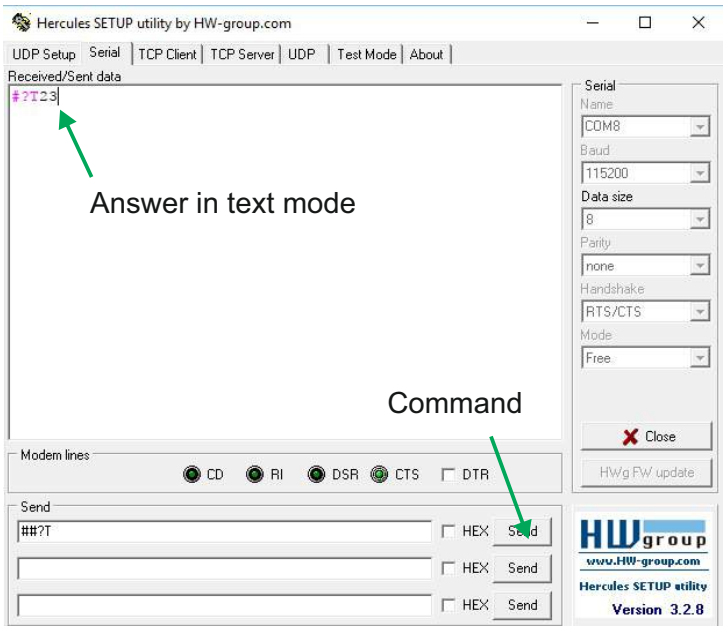
REMOTE DEVICE

2.5.1 «#?C» Command

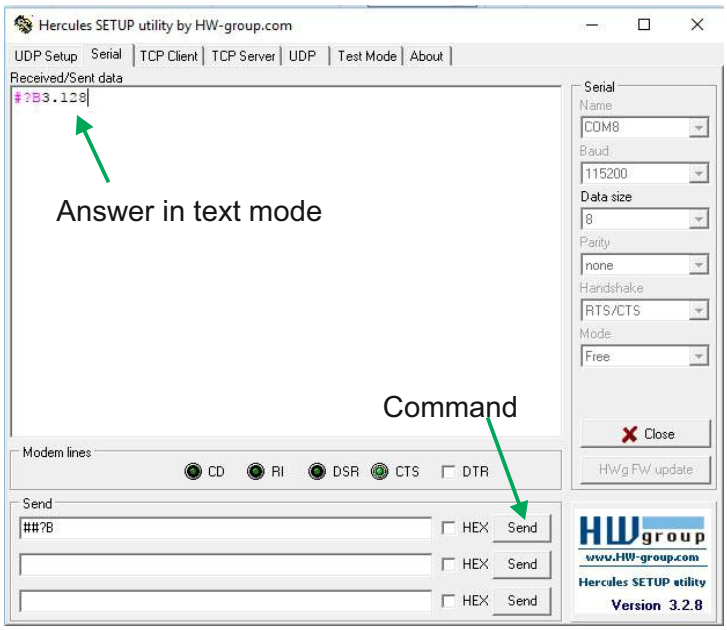




2.5.2 «#?T» and «#?B» Command

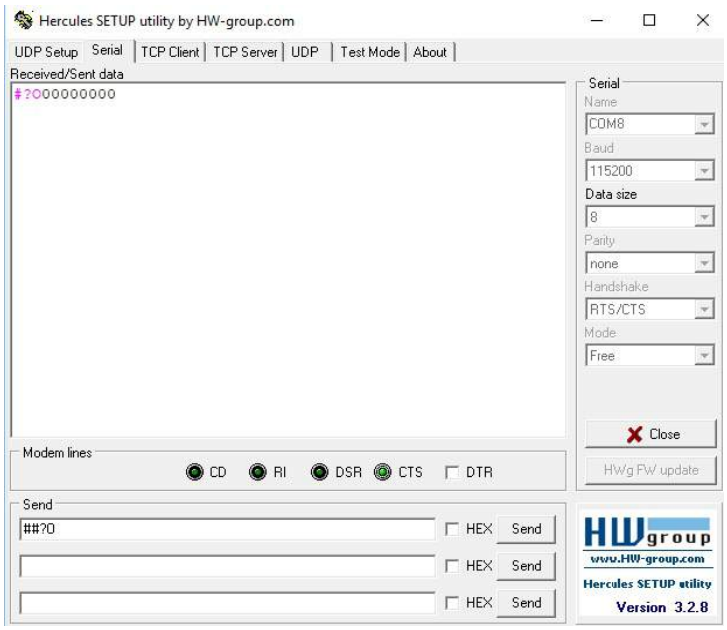


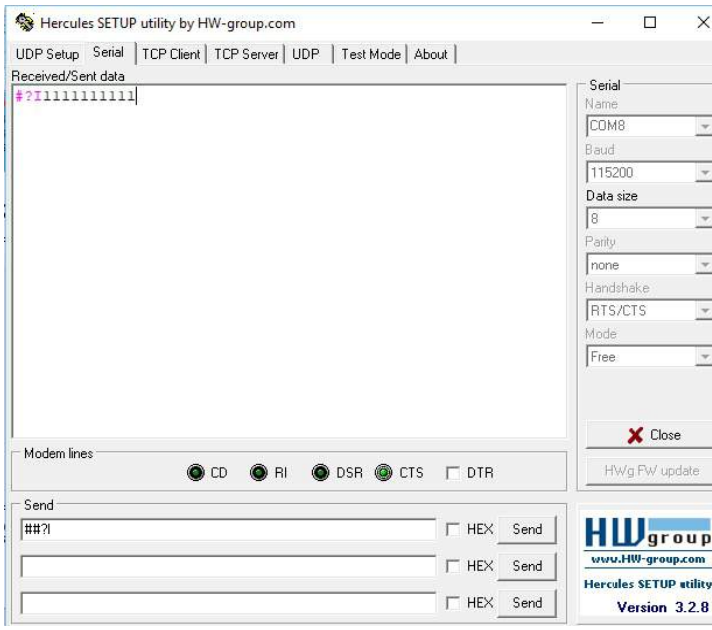
Return the value in °C.



Return the value in Volt.

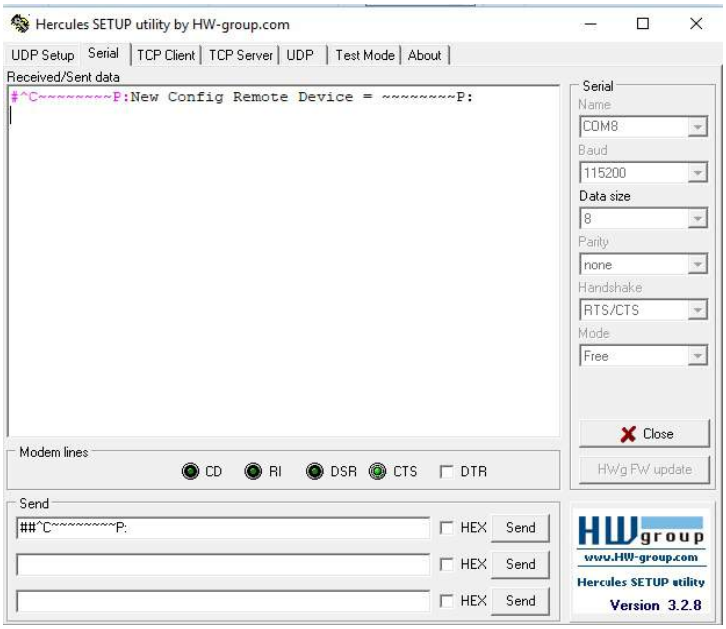
2.5.3 «#?O» and «#?I» Command



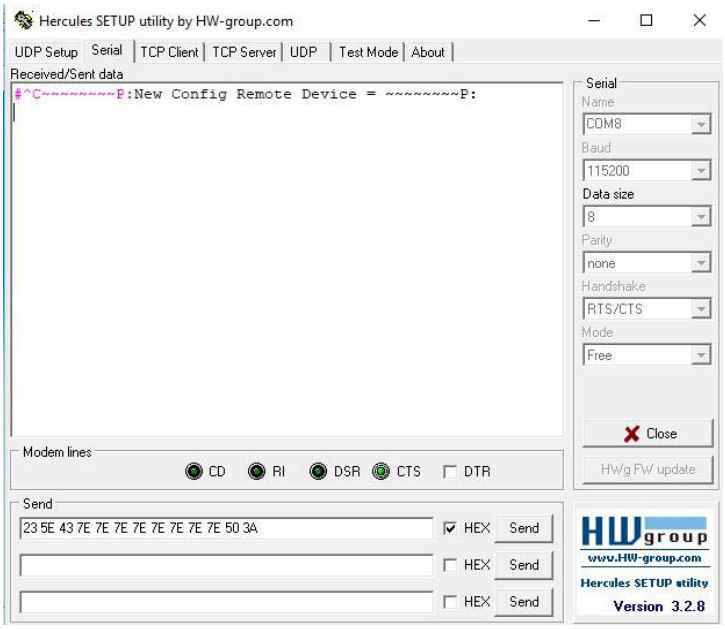


00000000 means that the 8 output RL1,RL2,RL3, Rl4, RL5,RL6,RL7,RL8 are a Low level.

2.5.4 «#^C+ Configuration»



TEXT Mode



HEX Mode

3.0 Wireless Switch

It's an 8 channels wireless switch module with pairing function, it provides maximum 8 channel signal input and maximum 8 channel control output (4 bistable channels and 4 monostable channels).
The configuration is the same of Radio Modem functionality (see pag. 6), Local address and Remote address must be set up appropriately.

3.1 One to one operation

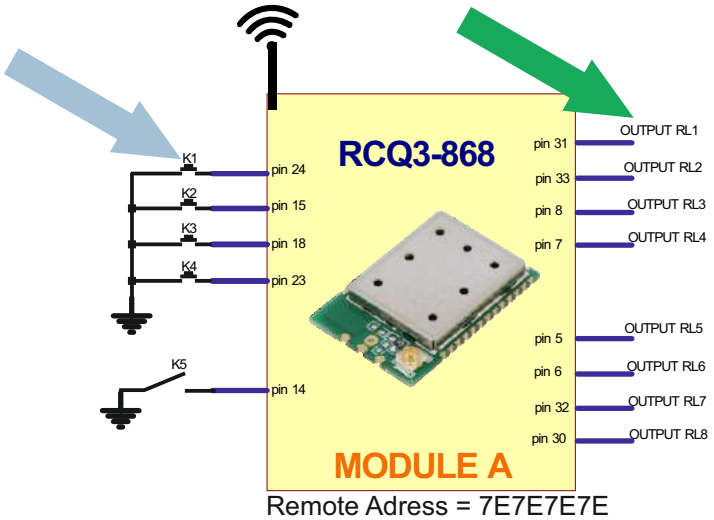
Example of communication between modules A and B :

The 4 output of **module A** (RL1,RL2,RL3,RL4) is corresponding to the 4 input of **module B** (K1,K2,K3,K4 and K5=open), these 4 outputs are of the bistable type (see picture).

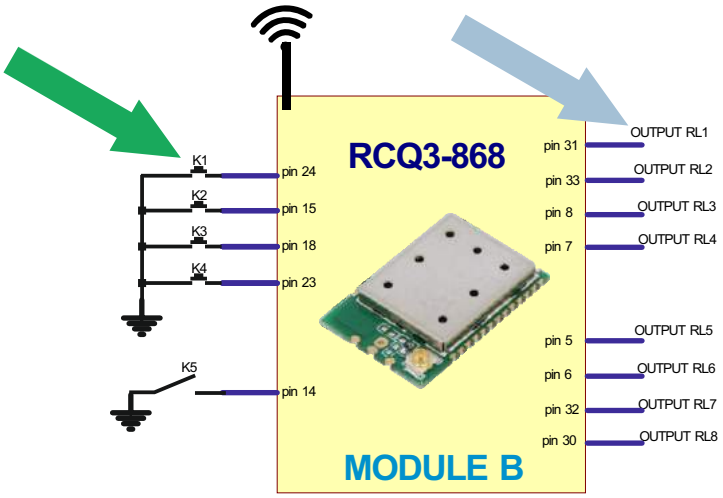
The 4 output of **module B** (RL1,RL2,RL3,RL4) is corresponding to the 4 input of **module A** (K1,K2,K3,K4 and K5=open), these 4 outputs are of the bistable type (see picture).

The 4 output of **module A** (RL5,RL6,RL7,RL8) is corresponding to the 4 input of **module B** (K1,K2,K3,K4 and K5=GND), these 4 outputs are of the monostable type (see picture).

The 4 output of **module B** (RL5,RL6,RL7,RL8) is corresponding to the 4 input of **module A** (K1,K2,K3,K4 and K5=GND), these 4 outputs are of the monostable type (see picture).



Remote Adress = 7E7E7E7E
Local Address = 7E7E7E7E



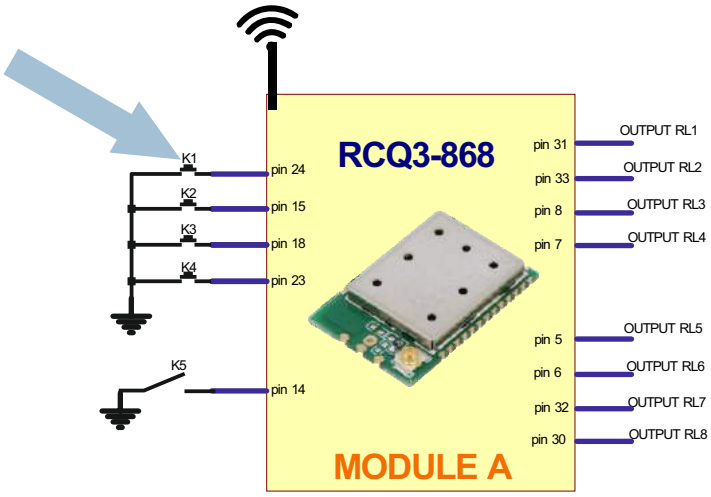
Remote Adress = 7E7E7E7E
Local Address = 7E7E7E7E

Push K1 **MODULE A** and RL1 of **MODULE B** will be Active

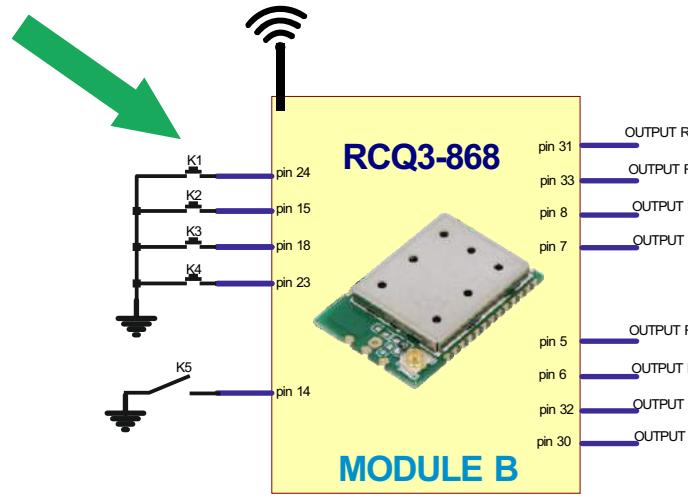
Push K1 **MODULE B** and RL1 of **MODULE A** will be Active

3.1 One to many operation

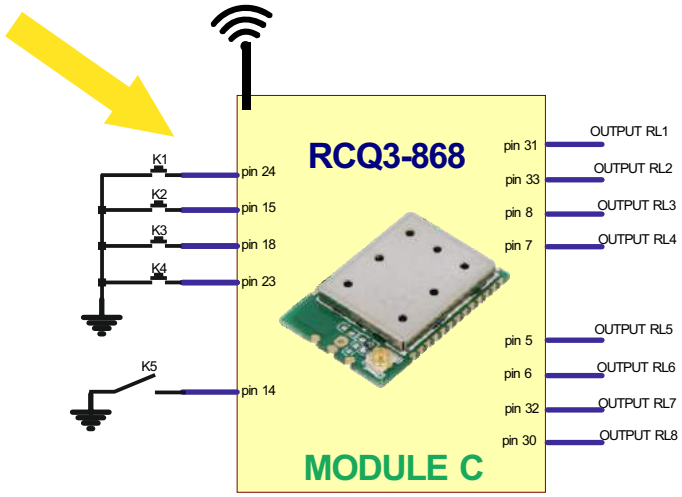
Example of communication between modules A , B, and C, in this case the Remote Address and Local Address are in default condition.
By changing remote and Local address you can get different types of configuration.



Remote Adress = 7E7E7E7E
Local Address = 7E7E7E7E



Remote Adress = 7E7E7E7E
Local Address = 7E7E7E7E



Remote Adress = 7E7E7E7E
Local Address = 7E7E7E7E

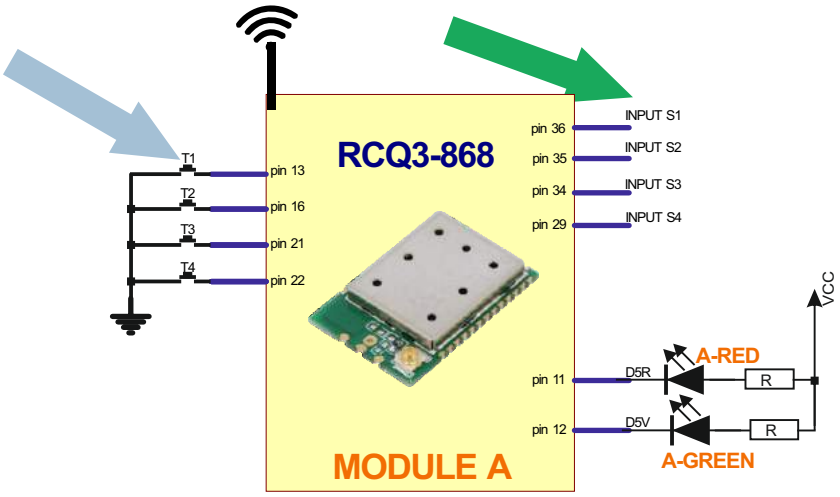
Push K1 **MODULE A** ---> RL1 of **MODULE B** and RL1 of **MODULE C** --> ACTIVE

Push K1 **MODULE B** ----> RL1 of **MODULE A** and RL1 of **MODULE C** --> ACTIVE

Push K1 **MODULE C** ----> RL1 of **MODULE A** and RL1 of **MODULE B** --> ACTIVE

4.0 Wireless Controller

It's an 4 channels wireless controller module with pairing function, it's possible to control and verify the logic state (open or close) of the Remote Module.



Remote Adress = 7E7E7E7E
Local Address = 7E7E7E7E

1) Push T1,T2,..T4 on **MODULE A**

2) Will be done a control on **MODULE B** (Input S1,S2,..S4)

3) If (S1-S4)=GND the led A-RED will be ON and the led A-GREEN will be OFF.

4) If (S1-S4) will be different from GND the led A-GREEN will be ON and the LED A-RED will be OFF.

5) If there is not any comunication, both LED (A-GREEN and A-RED) will be OFF.

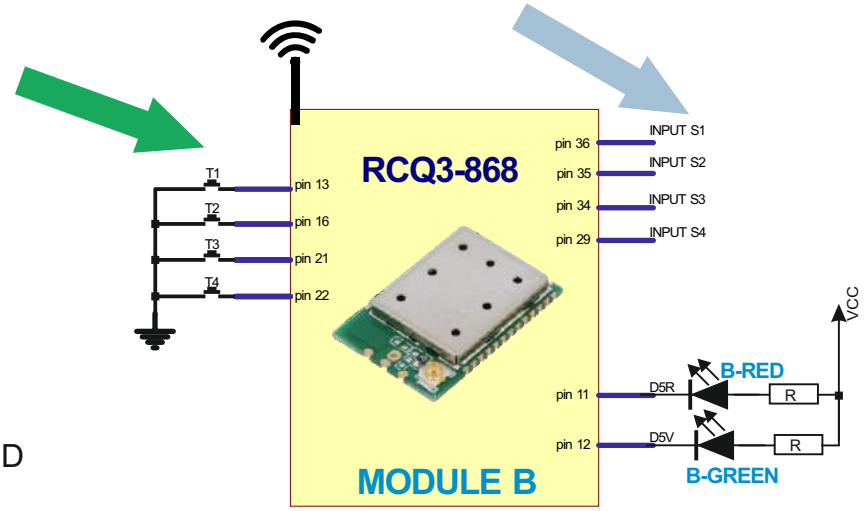
1) Push T1,T2,..T4 on **MODULE B**

2) Will be done a control on **MODULE A** (Input S1,S2,..S4)

3) If (S1-S4)=GND the led A-RED will be ON and the led A-GREEN will be OFF.

4) If (S1-S4) will be different from GND the led A-GREEN will be ON and the LED A-RED will be OFF.

5) If there is not any comunication, both LED (A-GREEN and A-RED) will be OFF.



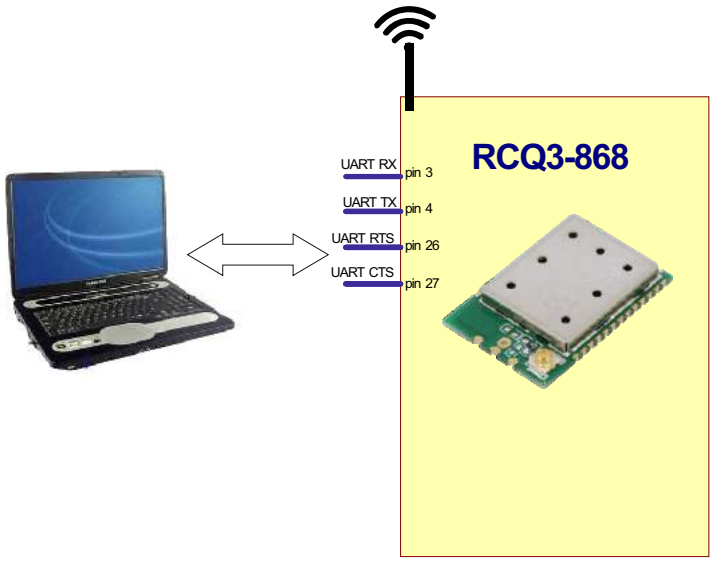
Remote Adress = 7E7E7E7E
Local Address = 7E7E7E7E

5.0 Wireless Actuator

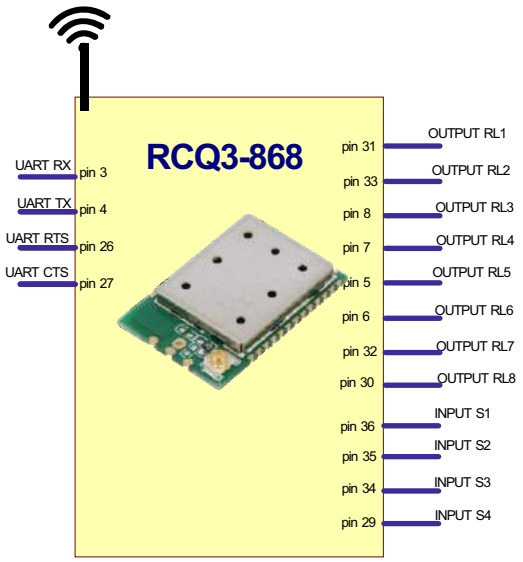
Wireless actuator for home automation, it's possible use 1 unit as Transmitter (controllable via RS232 serial interface) and by one or more RX units with the possibility to switch 4 astable channels and 4 bistable channels for every RX units.
The unit denominated used ad Transmitter can be controlled by a normal PC by a Raspberry device or by an Arduino microcontroller. It is possible to have a "point to point" configuration (No.1 TX unit - No.1 RX unit) or a "point-multipoint" configuration (No. 1 TX unit more RX Unit).

LIST COMMAND TO SEND BY RS-232 port

	Command Sent from RS232	Description
1	**#0X0**	Set the bistable Output «X» to Low Level (»X» can be 1,2,3,4)
2	**#0X1**	Set the bistable Output «X» to High Level (»X» can be 1,2,3,4)
3	**#0XB**	Change the state of the bistable Output «X» (»X» can be 1,2,3,4)
4	**#0XD**	Change the state of the monostable Output «X» (»X» can be 1,2,3,4)
5	**#0XM**	Change the state of the monostable Output «X» for 1 minute
6	**#?0XSM**	Request the state of the monostabel outputs , returns the string on a serial port type : 1111 (all high)
7	**#?0XSB**	Request the state of the bistable outputs , returns the string on a serial port type : 1111 (all high)

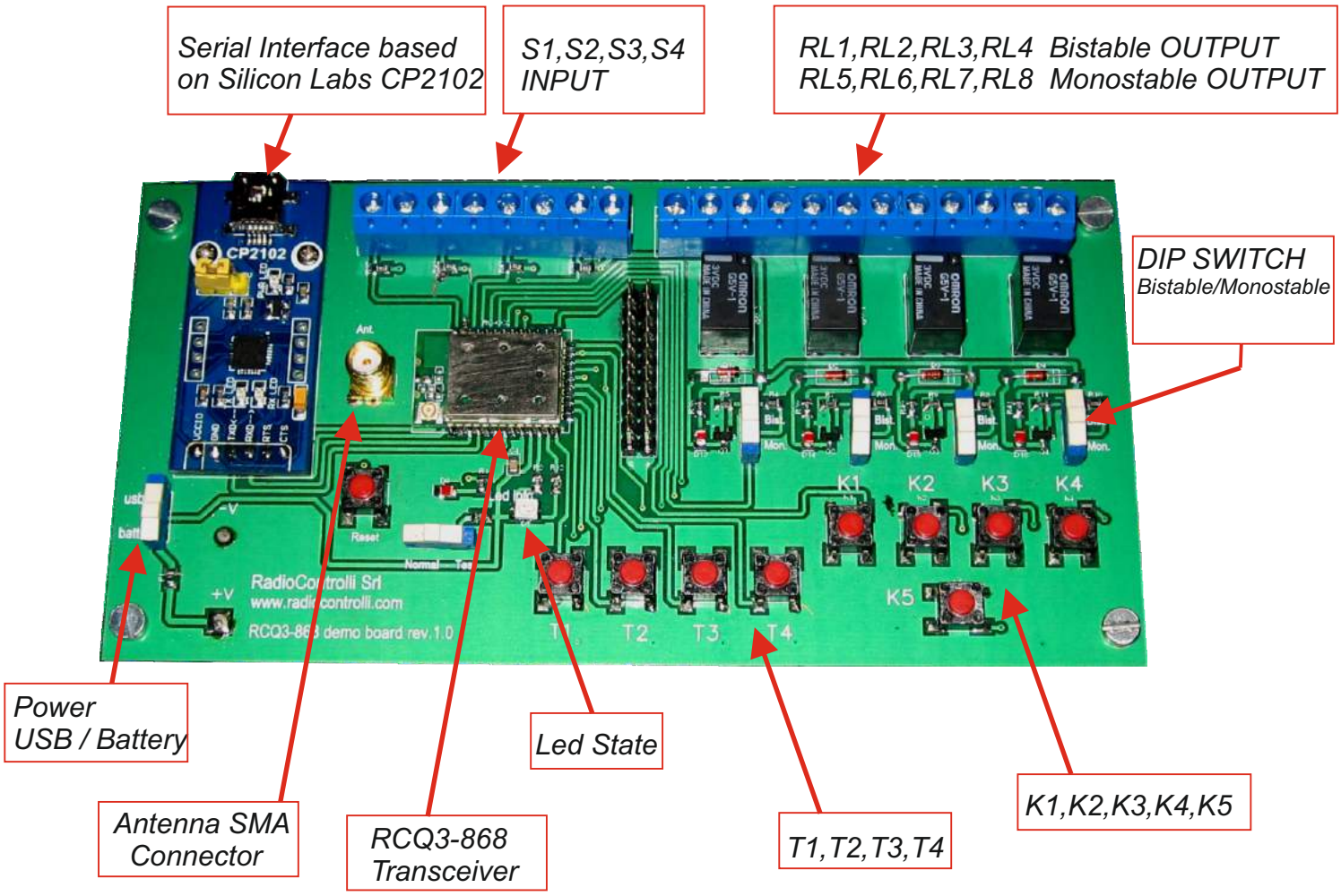


LOCAL DEVICE



REMOTE DEVICE

6.0 Evaluation board



- The Evaluation kits is composed from N. 2 RCQ3-868 demo board complete with 868MHz Antenna and N. 2 cable USB (USB A plug, USB B mini plug).
- It's necessary install the Cp2102 driver on your computer, you can find this driver or on Silicon Labs website or on this **HYPERLINK**

- The RCQ3-868 demo board has a battery pack (in the back) to make stand-alone operation.
- T1, T2,T3, T4 are buttons to check the state of the remote unit (S1, S2, S3, S4 inputs).
- K1,K2,K3,K4,K5 are buttons to switch the state of the remote unit (RL1 to RL8 Outputs).

6.1 Evaluation board electrical schematics