RemoteBox

RemoteBox
Hardware Reference & Operational Manual

Feb/2019 **Rev 1.7a ENG**

Introduction

The **RemoteBox** family of controllers is comprised of several universal antenna switching controllers.

There are 6 models based on the number of inputs and number of antennas it can control.

These are the available models:

- RemoteBox 4-Square (4 Square antennas)
- RemoteBox 1x6 (1 RF IN and 6 Antennas)
- RemoteBox 1x8 (1 RF IN and 8 Antennas)
- RemoteBox 2x6 (2 RF IN and 6 Antennas)
- RemoteBox 2x8 (2 RF IN and 8 Antennas)
- RemoteBox 2x12 (2 RF IN and 12 Antennas)

📖 The RemoteBox 4-Square was added in October 2016, and use ANT1 output (3 wires) to control the antenna direction of the 4 verticals.

📖 There is a special firmware based on the RemoteBox 1x8 and compatible with Ameritron RCS-10 that uses a BCD Output (Ant1, Ant2 and Ant3 output pins)

The RemoteBox devices are NOT antenna switches but the controller with which to use a commercial switch or a homemade one.

Some of the commercially available switches tested with RemoteBox are Array Solutions - SixPack (2x6), SJ2W switch kits (1x6, 2x6), DX Engineering or MicroHAM switches such as Six Switch, Double Six Switch, RemoteQTH, ForDXrs, Ameritron RCS-10, DX4DXr's and many others.

One of the great advantages of the RemoteBox family of controllers is the capability to auto switch the antenna port based on Band Data and band changes on the radio. It also adds the option to control the antenna switch remotely with a computer, both locally or remotely by IP. This is ideal for a remote station.

The RemoteBox can also automate band pass filter selection through the auxiliary port.

The user can always see the selected antenna through the LCD display as well as the customized labels defined by the user.

🔷 ***It is very important to read the full manual.*** This product is pretty much Plug & Play and very user friendly, however, familiarity with all the software and hardware features will yield better results and allow the user to realize the full potential of the RemoteBox.

About the Manual

This manual is divided in several sections.

There are also annexes with several switch and radio connection diagrams.

Please read carefully the manual prior to making any connections. If any issue or problem arises from the use of this device please do not hesitate to contact the manufacturer at:

Address:

Definit Data SL
Att: Mr. Pablo García - EA4TX
Fresno 67
28522 Rivas
Madrid - SPAIN

E-mail:

sales@definitdata.com

Web:

http://www.ea4tx.com

IMPORTANT NOTICE

READ BEFORE OPERATING THIS UNIT

PRECAUTIONS

! – THIS UNIT IS NOT A TOY. IT MUST NOT BE HANDLED BY CHILDREN NOR PLACED/OPERATED WITHIN REACH OF CHILDREN.

! – DO NOT LEAVE PACKING MATERIAL FOR THIS UNIT UNATTENDED. IT MAY BE HARMFUL TO CHILDREN IF MISUSED.

! – THIS UNIT CONTAINS SMALL PARTS THAT COULD BE A CHOKING HAZARD TO SMALL CHILDREN. DO NOT LEAVE ACCESSORIES UNATTENDED.

! – DO NOT OPERATE THIS UNIT IN POTENTIALLY EXPLOSIVE ENVIRONMENTS.

! – NEVER ATTEMPT TO INSERT WIRES OR ANY TOOLS INTO THE INTERIOR OF THIS UNIT DURING OPERATION. THIS MAY CAUSE FIRE OR ELECTRIC SHOCK.

! – NEVER CONNECT OR DISCONNECT ANTENNAS WHILE IN TRANSMIT MODE. THIS MAY CAUSE ELECTRICAL SHOCK OR RF BURNS TO YOUR SKIN AND DAMAGE TO THE UNIT.

! –USE CAUTION AND OBSERVE PROPER SAFETY PRACTICES REGARDING YOUR SYSTEM CONFIGURATION. THIS DEVICE IS CAPABLE OF CHANNELING RF ELECTROMAGNETIC FIELDS WHICH REQUIRE EVALUATION ACCORDING TO YOUR NATIONAL LAW TO PROVIDE ANY NECESSARY ISOLATION OR PROTECTION REQUIRED, WITH RESPECT TO HUMAN EXPOSURE!

Δ - This unit must only be opened and/or serviced by a qualified technician. Opening the unit may void the manufacturer's warranty

Δ - Do not operate this unit in areas of extreme humidity.

Δ - Avoid operating this radio in direct sunlight or other areas of extreme heat, excessive vibration, or mechanical force.

Δ - If this unit is intended for use in commercial applications, special safety regulations and cautions may apply to prevent accidents.

Δ - If any defect, abnormal result, or other observations occur that are not covered by the Manual; immediately cease operation and contact the manufacturer or local distributor for operational advice or repair of the unit.

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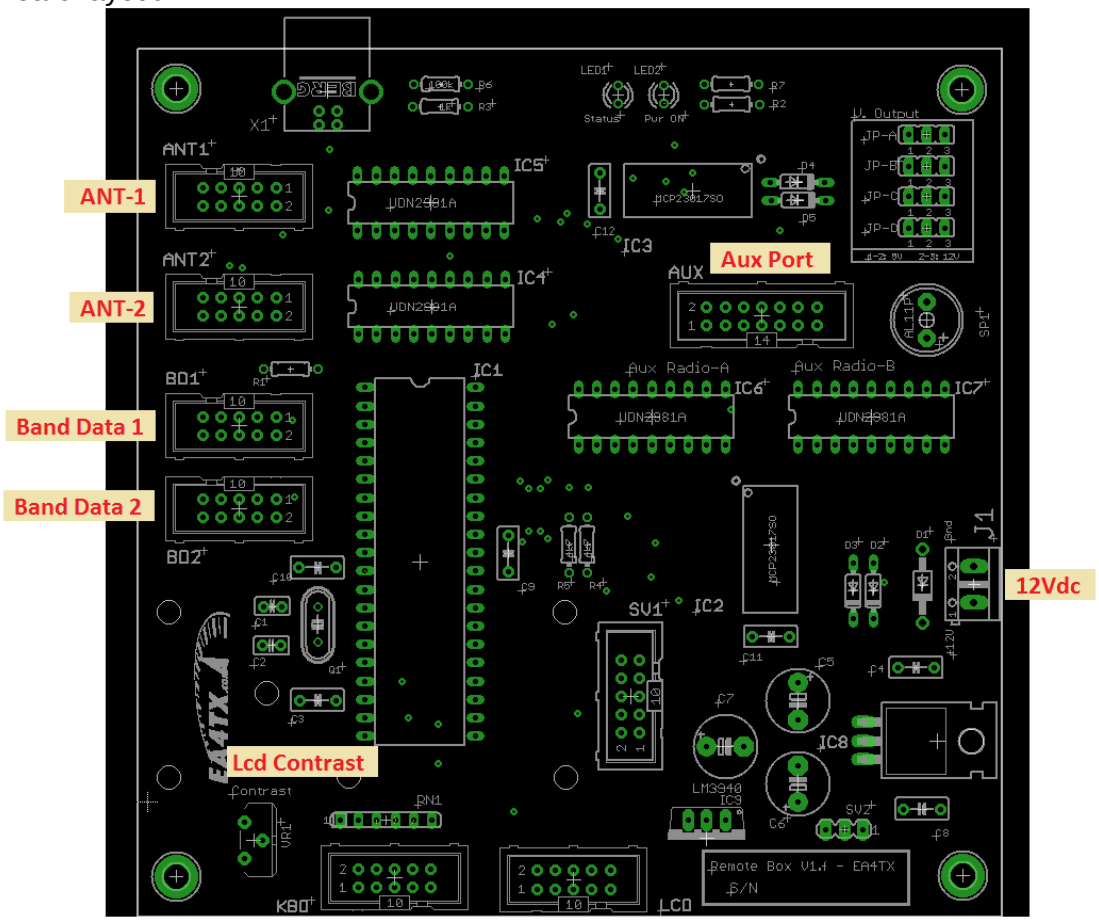
RemoteBox Hardware

RemoteBox has the following connections:

- 12-14Vcc power cable.
- Antenna switch connector: Ant1 or Ant2 (based on model)
- Band Data Input 1 or 2 Radios (based on model).
- Auxiliary Interface (i.e. band Pass Filter control) or Antenna 9-12 output
- USB Port for computer connection and software control through the RBM software program.

Board layout.



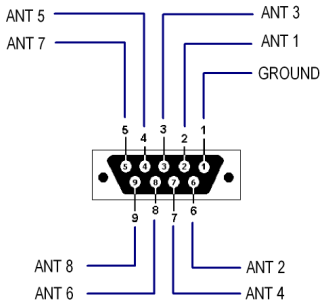
PCB inside view and layout for RemoteBox

1.1 ANT1/ANT2 Ports: Antenna Switch Connection

You can use the Female DB9 port labeled ANT1 to send signals to an antenna switch. If you have a 2x6 or 2x8 RemoteBox model it will also have an ANT2 port to control a second switch or a 2x RF IN switch.

This is the pin out of the ANT1/ANT2 ports:

- Pin-1: Common Ground
- Pin-2: Antenna 1
- Pin-3 Antenna 3
- Pin-4 Antenna 5
- Pin-5 Antenna 7
- Pin-6: Antenna 2
- Pin-7: Antenna 4
- Pin-8: Antenna 6
- Pin-9: Antenna 8



DB9 female

RB 2x12 version:

This model uses the Aux Port as an expansion for the Ant 9-12 outputs of ANT1 and ANT2

- Pin-1: ANT2-9
- Pin-2: ANT2-10
- Pin-3: ANT2-11
- Pin-4: ANT2-12
- Pin-5:

Pin-6:
Pin-7: Ground
Pin-8: Ground
Pin-9: Ground
Pin-10: ANT1-9

Pin-11: ANT1-10
Pin-12: ANT1-11
Pin-13: ANT1-12
Pin-14:
Pin-15:

Ameritron RCS-10 Version:

The special firmware compatible with Ameritron RCS-10 uses a BCD output. This output is available at:

- Pin-1: Ground
- Pin-2: **"A"** Output
- Pin-6: **"B"** Output
- Pin-3: **"C"** Output

📖 It's simple to know that this special firmware is used by the firmware during the startup sequence of the unit. It's displayed at the LCD a message as:

EA4TX RB1x8 BCD

4 Square Version:

The RemoteBox 4-Square model uses 3 pins of the ANT1 output (plus ground). Generating different values on those pins, it can command the TK5EP phased switch

ANT1/2/6 and 2 signals and ground are used to select the antenna direction. This output is available at:

- Pin-1: Ground
- Pin-2: **"K1"** Output
- Pin-6: **"K2"** Output
- Pin-3: **"K3"** Output

It uses the following table by TK5EP:

Directions, phasing and relay powering							
Direction	K1	K2	K3	Ant 1	Ant 2	Ant 3	Ant 4
NW	1	1	1	180°	-90°	0°	-90°
NE*	0	0	0	-90°	180°	-90°	0°
SE	1	1	0	0	-90°	180°	-90°
SW	0	0	1	-90°	0°	-90°	180°

(*) is the default position, with no supply. It should be your favorite working direction.

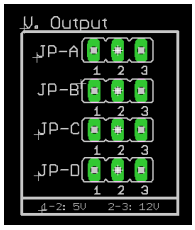
RemoteBox voltage level output:

The RemoteBox can provide two different voltage levels to power the switches:

- 5V
- 12V

The voltage can be switches with jumpers **JP-A** for ANT1 and **JP-B** for ANT2

- Jumper in **1-2** provides **5V** output
- Jumper in **2-3** provides **12V** output



Jumpers JP-C and JP-D provide identical functionality on the AUX port.

IMPORTANT NOTE:

Since April/2018 all equipments use a **PTC resettable fuse** instead those jumpers, so it allows to protect the outputs. The output voltage is by default fixed to 12Vdc

📖 When an antenna is activated only one pin will be active (12 or 5V); the rest of the outputs will have 0V.

1.2 BD1/BD2 Ports: Radio Band Data connection

You can use the Band Data input with a Yaesu or Elecraft K3 transceiver; also ICOM Band Voltage input is supported. RemoteBox will receive Band Data and will allow for automation of antenna selection based on band information. This adds practicality and error proofs the radio shack.

This is the Pin Out of the Band Data port:

- Pin-1: Common Ground
- Pin-2: Band Data A
- Pin-3 Band Data B
- Pin-4 Band Data C
- Pin-5 Band Data D
- Pin-6: Inhibit (see *Note 1)
- Pin-7: PTT In (see *Note 1)
- Pin-8: Not used
- Pin-9: Band Voltage Input (ICOM)

Note 1: Those options are available adding an additional module.

📖 You can also use any device that reads CAT information and translates it into standard Yaesu/Elecraft type Band Data.

Important Note: Firmware versions before April 2016 don't support the **Inhibit** and **PTT IN** control signals

The RemoteBox can read which is the band active for each radio and with the INHIBIT option enabled (SET 4), if it detects that both radios are at the same band, it will inhibit both radios to transmit.

The "PTT In" will allow to control if the Radio is transmitting so it can be used to avoid a hot-switching. So in case you want to avoid to change the antenna relays meanwhile the radio is in TX mode, you must connect the PTT from the radio to pin 6 and enabled the PTT for that Radio (SET 5)

You have to activate the Band Data options (SET1 and/or SET2) as well as configure the **RBM** band data/antenna matrix prior to using this functionality.

📖 The Band Voltage input (ICOM) provides the same level for 17m/15m. In a similar way the ICOM supplies the same voltage for 12m/10m so the RemoteBox cannot detect the difference between 17-15m or 12-10m

1.3 AUX Port: Auxiliary port

This auxiliary port allows the control of Band Pass filters such as ICE 419 type (or similar). When RemoteBox senses Band Data information in the Band Data ports it will automatically activate a signal in the DB15 female port to activate the appropriate filter.

6 different signals can be activated based on 6 Band Data signals (12 for models with 2x Models) for the following ham radio bands:

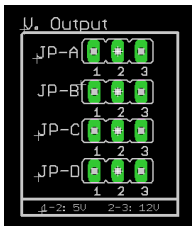
- 10, 15, 20, 40, 80 and 160m

RemoteBox can provide two different voltage levels to this port:

- 5V
- 12V

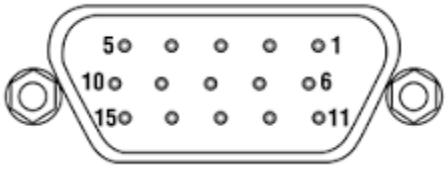
Voltage can be switch with jumpers **JP-C** (Band Data1) and **JP-D** (Band Data2)

- Jumper in **1-2** provides **5V** output
- Jumper in **2-3** provides **12V** output



This is the Pin Out of the AUX Port:

- Pin-1: 10m Band Data 1
- Pin-2: 15m Band Data 1
- Pin-3 20m Band Data 1
- Pin-4 40m Band Data 1
- Pin-5 80m Band Data 1
- Pin-6 160m Band Data 1
- Pin-7: Common Ground
- Pin-8: Common Ground
- Pin-9: Common Ground
- Pin-10 160m Band Data 2
- Pin-11 80m Band Data 2
- Pin-12 40m Band Data 2
- Pin-13 20m Band Data 2
- Pin-14: 15m Band Data 2
- Pin-15: 10m Band Data 2



DB9 Female connector

Remember: RemoteBox 2x12 version use this output for the antennas output 9-12.

Configuration

Programming the RemoteBox is easy. To access the different configuration menus press the RED button on the front of the device. The RemoteBox will go into *programming mode* showing the following subset of screens.

- Next menu, press the ⇧button (Up arrow).
- To return to the previous menu, press the ⇩button (Down arrow).
- To change to the next option, press the ⇨button (Right arrow).
- To return to the previous option, press ⇦button (Left arrow).

Pressing the RED button, it will Save and exit the configuration menu.

🕮 RemoteBox will exit the Configuration menu automatically after 9 seconds of inactivity.

These are the configuration options:

SET1: RA Select

Select the Antenna for Radio 1 (Radio A) for Manual or Automatic mode. In the automatic mode the RemoteBox will select the antenna when it senses a band change on Radio A.

These are the available options:

- **Manual**: Manual selection of the antennas
- **Band Data**: Antenna selection based on Band Data (BD1).
- **ICOM Band Voltage**: Antenna selection based on voltage levels compatible with ICOM.

SET2: RB Select

Select the Antenna for Radio 2 (Radio B) for Manual or Automatic mode. In the automatic mode the RemoteBox will select the antenna when it senses a band change on Radio B.

These are the available options:

- **Manual**: Manual selection of the antennas
- **Band Data**: Antenna selection based on Band Data (BD2).
- **ICOM Band Voltage**: Antenna selection based on voltage levels compatible with ICOM.

🕮 This option is only available in the “2x” models. (2x6 or 2x8)

SET3: Priority

We can select the default Radio when both Radios select de same Band.

Only one antenna can be connected to one Radio (Radio A or B) so this option will define which Radio has priority on the antenna in case of a conflict.

These are the available options:

- **Radio A**: Antenna will always connect to Radio A (Radio A wins)
- **Radio B**: Antenna will always connect to Radio B (Radio B wins)
- **Last Radio:** Antenna will connect to the last Radio that was selected.
- **First Radio**: The first Radio that selected the antenna has priority.

📖 This option is only available in the "2x" models. (2x6 or 2x8).

📖 If RemoteBox has to reassign an antenna because it is being use by a higher priority Radio it will automatically connect it to an available antenna.

SET4: Inhibit

The RemoteBox can read via Band Data input which are the band active for each Radio and it can avoid if this option is enabled that any of the radios will transmit. So remember you will need to use the band data and activate this option. Then in case the RemoteBox reads that both radios are at the same band, it will send an Inhibit signal (see section 1.2)

📖 This option is only available in the "2x" models. (2x6 or 2x8).

📖 Read Annex for cables

SET5: PTT IN

To avoid a hot-switching you can use this option. In this way, the RemoteBox will not change the antenna relays meanwhile the radio is transmitting.

📖 This option is only available in the "2x" models. (2x6 or 2x8).

📖 Read Annex for cables

SET6: Demo

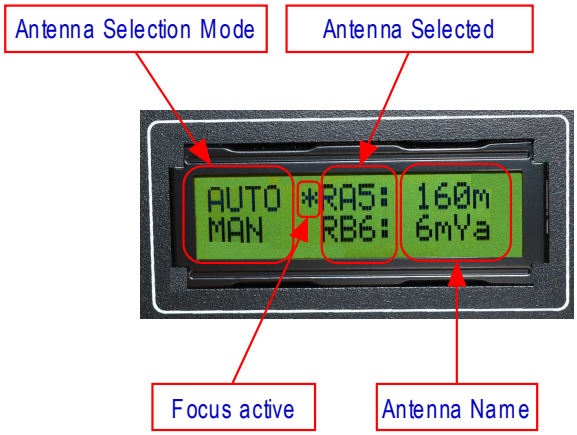
This option will demo/test the RemoteBox automatically changing antenna and radios on a set interval.

SET7: USB Port

This option sets the use of the USB port. If RemoteBox is not going to be connected to a computer it is better to deactivate the USB port.

Operation

Operating the RemoteBox is very straight forward. The device has a 2 line by 16 character LCD display. For models “2x” models each radio output (Radio A and B) will present the following information:

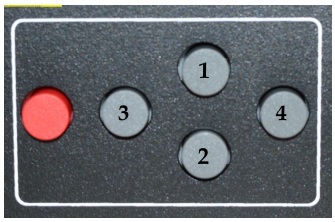


- **Antenna Selection Mode**: It shows the mode (AUTO or MAN) for manual or automatic (i.e. using Band Data)
- **Active Focus**: An asterisk (*) will indicate the Radio focus for Radio A or B. Focus on a specific Radio implies that any manual change will affect that particular radio.
- **Selected Antenna**: This will show the selected antenna (1 through 12) used for each radio (RA or RB). **RA5** shows that Radio A is using Antenna 5 and **RB6** shows that radio B is using antenna 6.

  Note: If the PTT is enabled and connected the cable to the Radio, when the Radio changes to TX, the LCD will add a “**!**” character.
- **Antenna Label**: This presents the label assigned to each antenna. In the above image antenna 5 is labeled **160m** and antenna 6 is labeled **6mYa** (6m yagi). The labels can be customized with the RBM software as explained in the next section of this document.

The front panel also houses 5 buttons:

- RED button: to enter into configuration mode
- Button 1: To set focus on Radio A.
- Button 2: To set focus on Radio B
- Button 3: To select the previous antenna.
- Button 4: To select the next antenna.



IMPORTANT NOTE:

Even with automatic (AUTO) mode enabled we can manually change the antenna without changing to manual (MAN) mode. The manually selected antenna will remain until the device detects a band change through the Band Data port or through the ICOM voltage change.

RemoteBox 4-Square version

This special RemoteBox version will display 4 directions at the LCD

- **Radio Status:** If the PTT is connected to the radio and it's enabled (SET1) the RB will monitor the Radio PTT. At this area a "TX" could be displayed when the Radio is in TX. When this option is enabled, the RB will monitor the radio PTT and will not change the antenna direction meanwhile the radio is in TX mode.
- **Antenna Status:** An asterisk * is placed beside the name of the direction selected and only when that direction command was activated. If PTT is enabled and the Radio is TX, a command order will be delayed till the radio is again in stand-by. During this time, instead a *, it will be displayed a !.
- **Antenna Direction:** The direction is displayed by a flashing.
- **Selection:** This is the "TK5EP truth table" (page 9) of the output (DB9-ANT1)

RemoteBox Manager

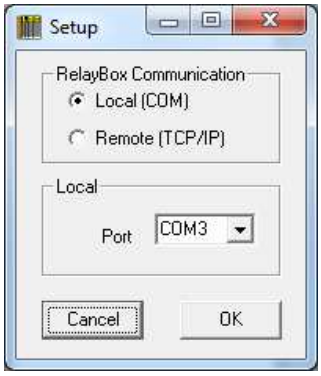
We can use this program (RBM) in addition of the manual and automatic modes of the RemoteBox. This software will require the use of a computer and the USB port.

We can also use the software to change the antenna labels.

The enclosed CD-ROM contains the setup file to install RBM. The filename is: Setup.exe

Once it is installed we can execute the program.

The first screen will present us with a communication selection. We have the option of local connection through the virtual COM port or Remote through TCP/IP. We can also open this menu from the RBM program by selecting Options>Communications in the drop down menus.

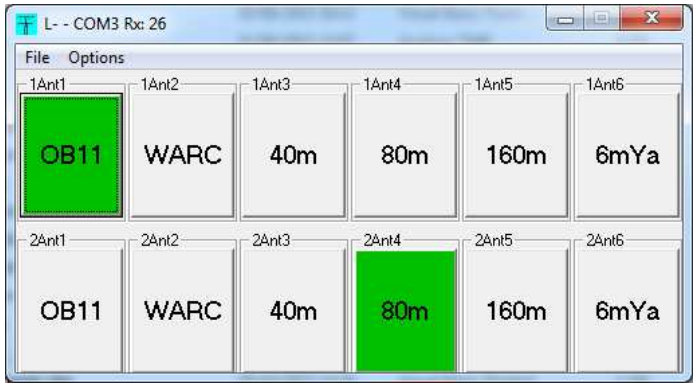


For a locally USB connected RemoteBox we select: **Local**

We have to select the windows assigned COM port under Local > Port.

For a remotely connected RemoteBox through TCP/IP (i.e. with a Raspberry Pi) we choose **Remote** (TCP/IP).

Once communication is established with the device RBM with read the RemoteBox configuration and present a screen based on the model.



This is the screen of a 2x6 model

📖 Remember to install the Windows USB drivers available in the CD-ROM (see Annex III)

4.1: Antenna Operation

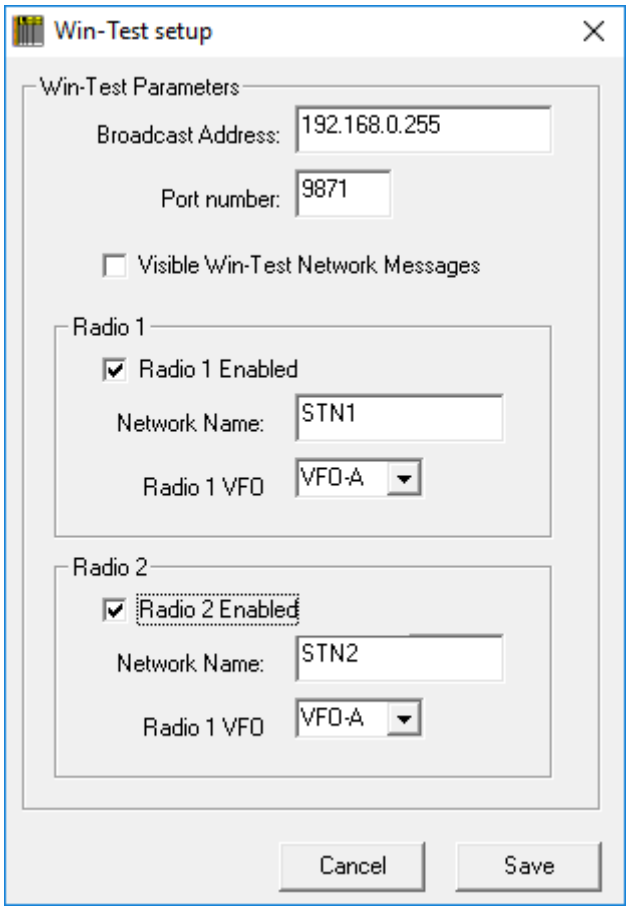
Antenna operation with RBM is easy and very intuitive. The selected antenna is highlighted in GREEN and the rest are GREY. A “2x” model (2x6 or 2x8) will present two rows of antennas for Radio A and Radio B.

To manually activate any antenna all we have to do is to left click on it. Only one antenna can be active per Radio.

📖 With the “2x” models (2x6 or 2x8) we could run into conflicts if both Radios try to use the same antenna. The Priorities menu will solve those conflicts.

4.2: Win-Test Setup

If you are a contester and use the Win-Test program, you can read the band both radios (Radio 1 and 2). In this way, RBM can know the band for each radio and automatically select the antenna of the 2 outputs. If you use 2 radios, for instance you can configure as follows:

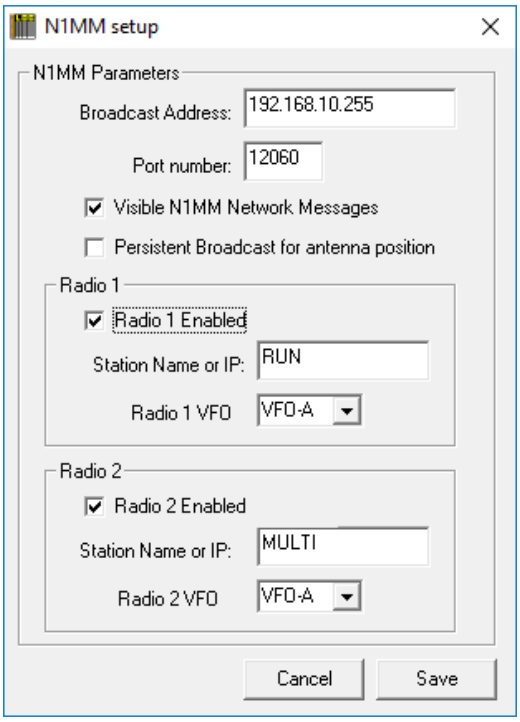


You must use the same broadcast address and port as it was configured at the Win-Test program

When Radio-1 is enabled and it gets information from the “STN1” station at VFO-A, automatically will configure the ANT1 Output for that band.

4.3: N1MM Setup

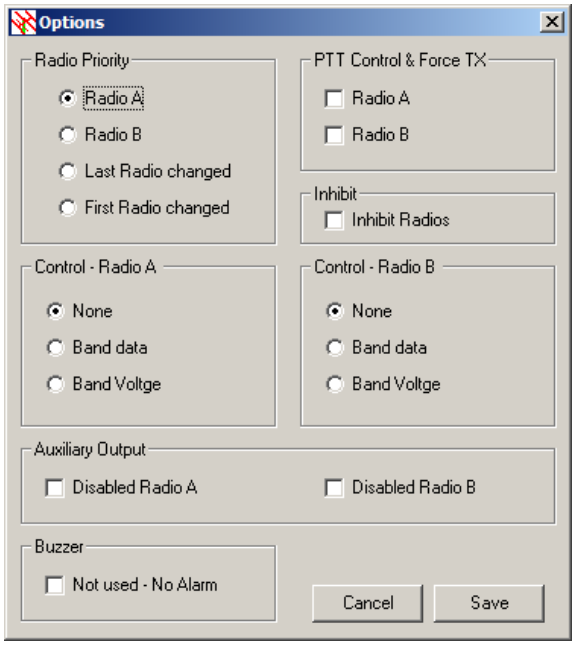
In a similar way, the RBM can read N1MM network messages and automatically select the antennas (ANT1 and ANT2 Outputs).



In this example RBM will read network messages from the broadcast address from the Station “RUN” & VFO-A for Radio 1 and from the Station “MULTI” & VFO-A for the Radio 2.

4.4: Options

Most of the options of the RemoteBox (see Section 3) are also available and can be configured via this menu.



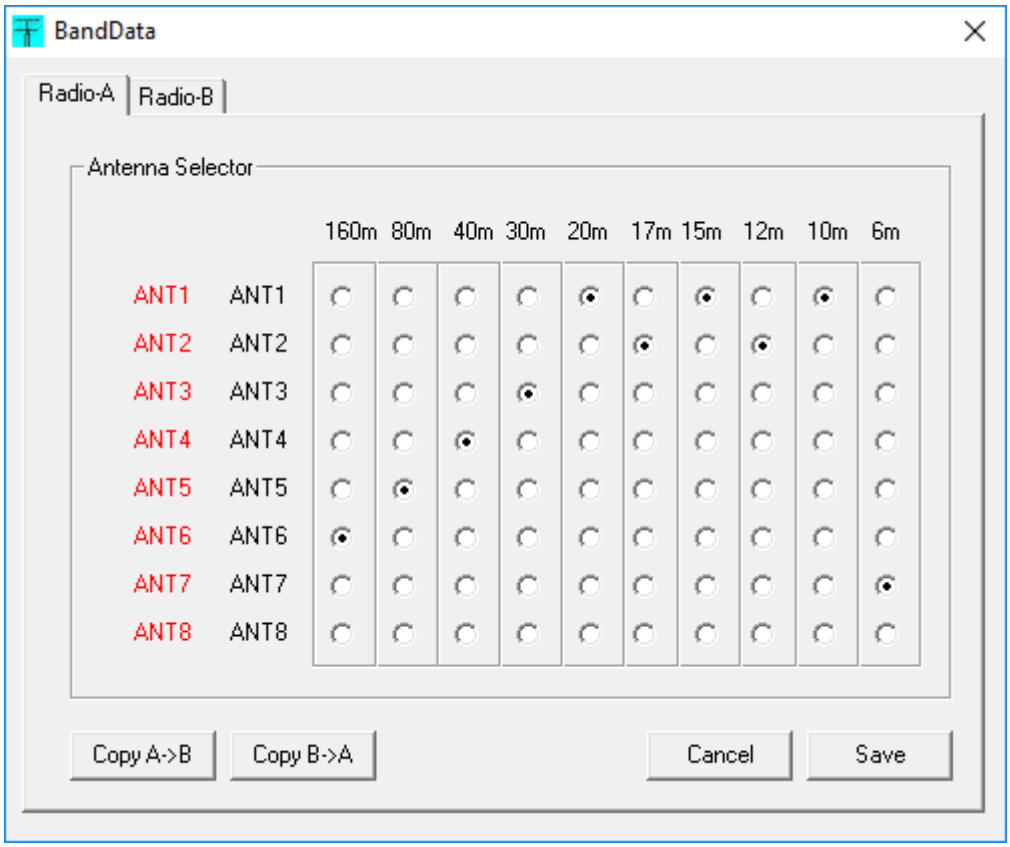
- **Radio Priority:** You can select the priority for the Radios in case you try to select the same antenna in both radios.
- **PTT Control & Force TX:** You can use the PTT to control one of the following options:
    - Avoid Hot-switching: So the antenna will not be changed when the Radio is in TX.
    - Force TX: When the Radio changes to TX, a defined antenna will be automatically activated. So you can use an antenna for TX and any another for RX.
- **Control Radio A/B:** You can use Band data (Yaesu, K3) or Band Voltage (Icom) for automatic antenna selection.
- **Auxiliary Output:** On models with 2x6 or 2x8 this output can be used to select a band pass filter. In case you want to disabled this feature, you can disabled the output.
- **Buzzer:** The Buzzer is activated when the same antenna is selected on both Radios. You can disabled the buzzer with this option.

4.5: Antenna configuration based on Band Data

This is the matrix or true table that will assign the ANT1 and ANT2 outputs based on the band for each Radio (A or B).

In this way, when it detect that the Radio A is on 10-15-20m will select ANT1.

This information can be read via: Band Data, Band Voltage Input (Icom) or networking messages (Win-Test or N1MM)



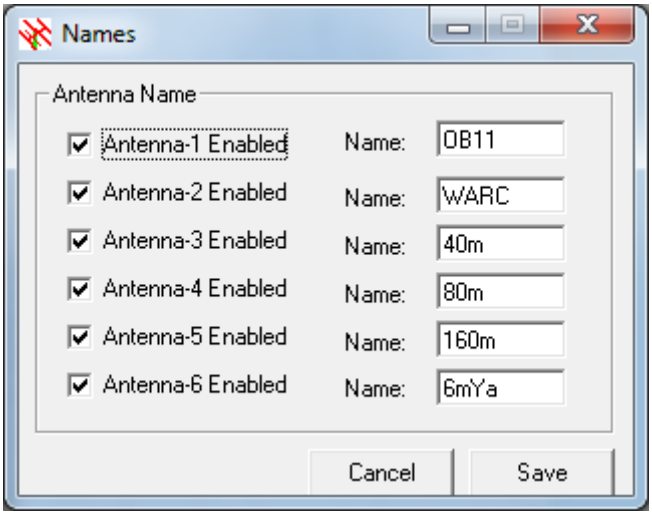
It can be configured different outputs for Radio A and Radio B.

🕮 Remember to select the true table for Radio A and then for Radio B. You can use the “Copy A->B” to use the same setting at Radio B as used at Radio A.

🕮 When it’s used a RemoteBox of 6 antennas, that setup will be fixed to 6 Antennas.

4.3: Antenna Labeling

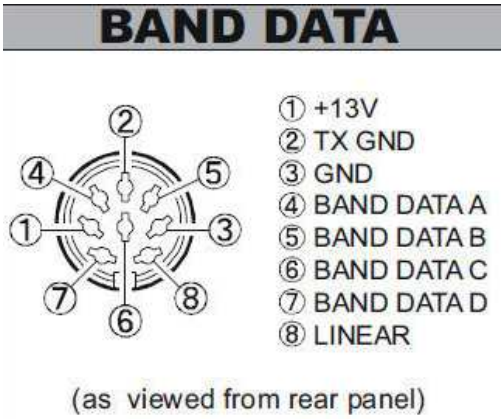
This menu allows the user to label the different antenna ports of a controller. You can even disable a particular antenna port if it not being used.



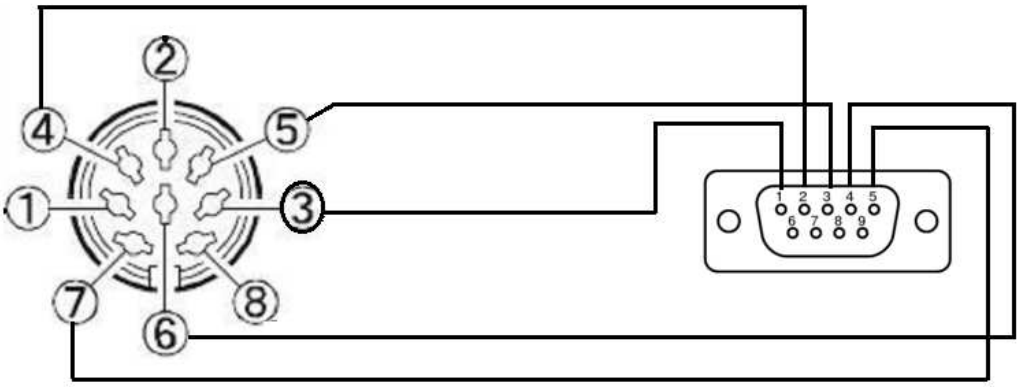
📖 The name of the antenna is limited to 4 characters.

Annex I –Yaesu Band Data Connection

Yaesu transceivers (FT1000, FT1000MP, 2000, etc.) have a DIN port similar to the image below:



This is the connection diagram between a Yaesu DIN8 Band Data port and the RemoteBox Band Data DB9 Female port. Any transceiver that uses the Yaesu (A,B,C and D) Band Data standard can be connected to the same pins in the female DB9 port of the RemoteBox:



Annex II – Elecraft K3 Band Data Connection

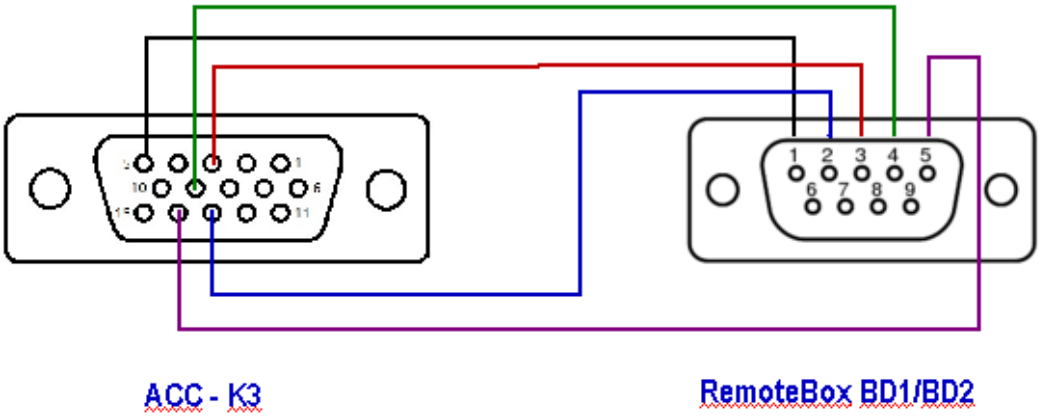
The Elecraft K3 has a Band Data port in the transceiver labeled ACC. It is a DB15 port that sends 4 band signals called:

BAND0, BAND1, BAND2 and BAND3

These 4 signals and the common ground are located in the following pins of the ACC connector:

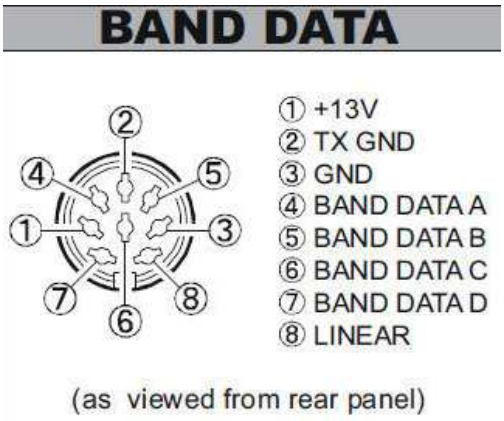
Pin 3:	Band1 OUT
Pin 5:	Common Ground
Pin 9:	Band2 OUT
Pin 13:	Band0 OUT
Pin 14:	Band3 OUT

This is the connection diagram between the ACC port of a Elecraft K3 and the RemoteBox (DB9 female) Band Data port:

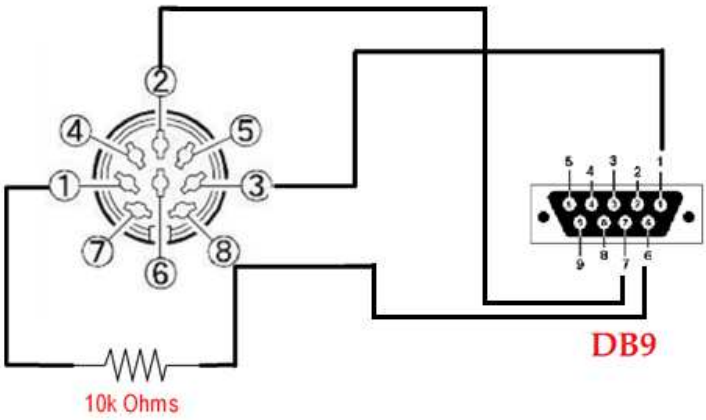


Annex III – Inhibit and PTT signal - Yaesu

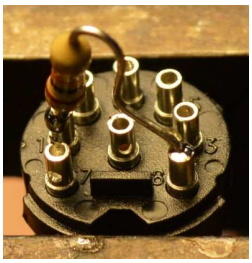
Yaesu radios (FT1000, FT1000MP, 20000, etc) use a DIN connector like this one:



The connection that needs to be made between the RemoteBox interface (DB9) and the DIN connector is as follows:



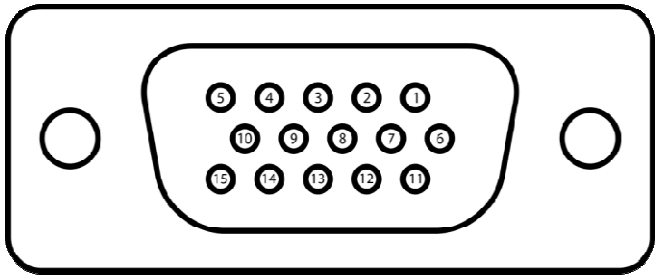
📖 Remember that you need to insert a 10K Ohm resistor between pins 1 and 8 of the connector, as shown in this photo:



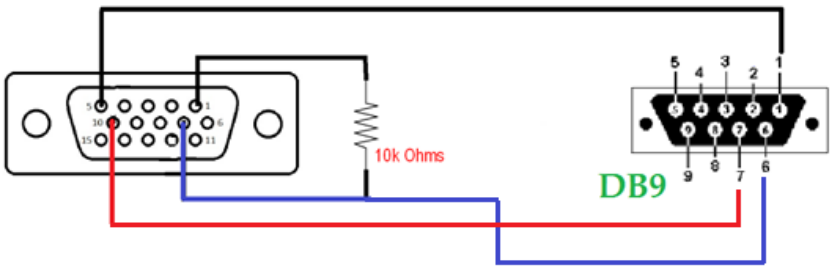
Annex IV – Inhibit and PTT signal – Elecraft K3

In the K3 we use the ACC connector. The pins used are as follows:

Pin1	FSK IN (pullup a +5V)
Pin5	Gnd
Pin7	TX Inhibit
Pin10	Key Out



The connection that needs to be made between the RemoteBox's DB9 and the ACC is as follows:



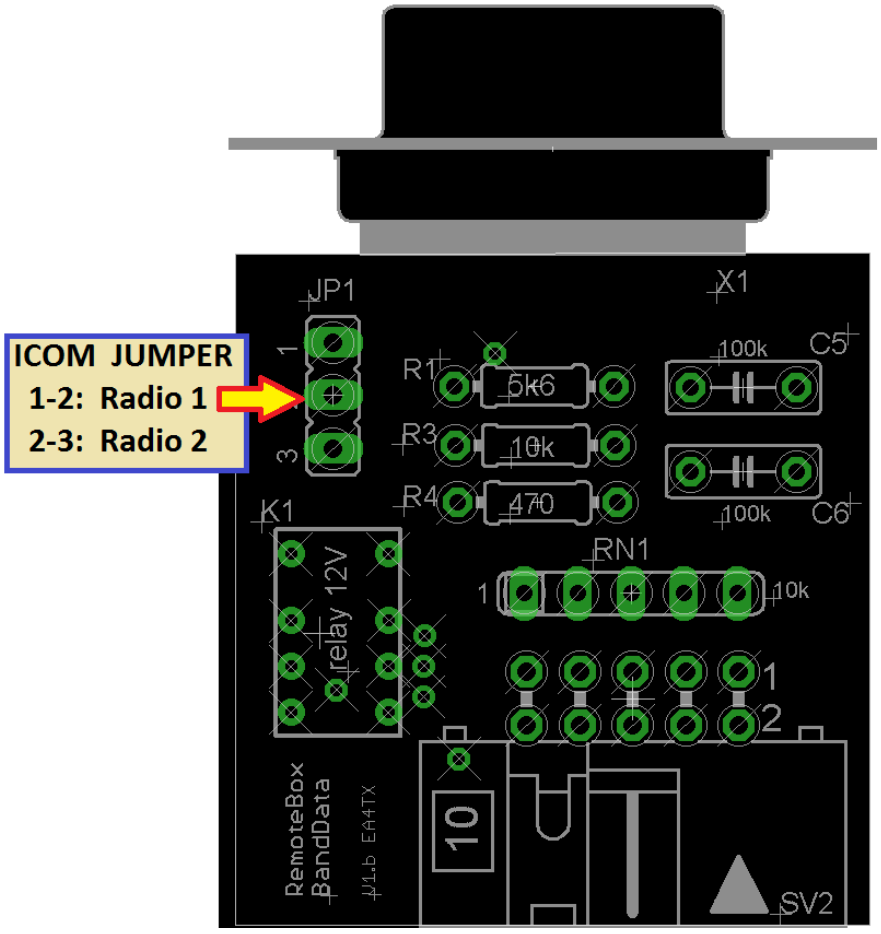
📖 Remember that you need to insert a resistor (10K ohm for example) between pins 1 and 7 of the ACC connector. Additionally, you will need to enter the SETUP menu and change the **CONFIG:TX INH to HI** so that pin 7 works as **TX Inhibit**

Annex V – Band Data on ICOM – Band Voltage

The RemoteBox can select automatically the antenna if you use the Band Data (Yaesu or Elecraft K3) or Band Voltage (Icom) cable to the Radio.

Additionally to enable the software option, there is a jumper that must be set or removed, in order to activate it. The jumper should not be placed when the Band Data is used (Yaesu or K3) but must be placed for the Icom Band Voltage.

Band Data	Band Voltage
No Jumper	Jumper 1-2: Radio A Jumper 2-3: Radio B



🕮 Remember to remove the jumper when you want to use the Band Data instead the Band Voltage

🕮 Previous versions will have the jumper in another position.

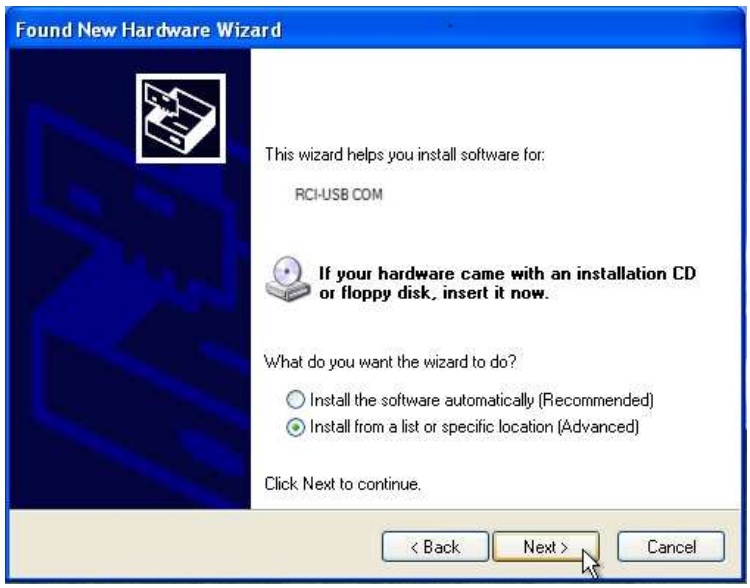
Annex VI– USB (Virtual COM) Driver Install

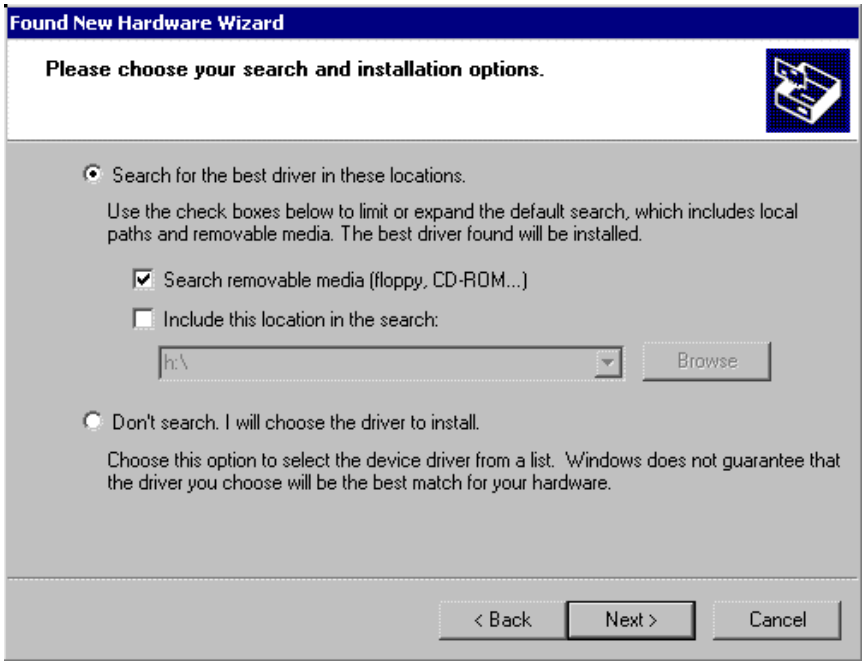
The first time you plug the RemoteBox to a computer through the USB port you will receive a “New Hardware Found” message and the following screen will appear.

🕮 Windows 10 has default drivers for this hardware and will automatically assign a COM port.

Select: **“No, not this time”.** The assistant will detect the new Hardware.

Select **Install from a list or specific location (Advanced)**, and select the location of the device drivers.





The Drivers are included in the enclosed CD-ROM. Select "**Search removable media (floppy, CD-ROM,..)**, and then click "Next".

Once installed Windows will automatically create a Virtual COM port to communicate with the RemoteBox.

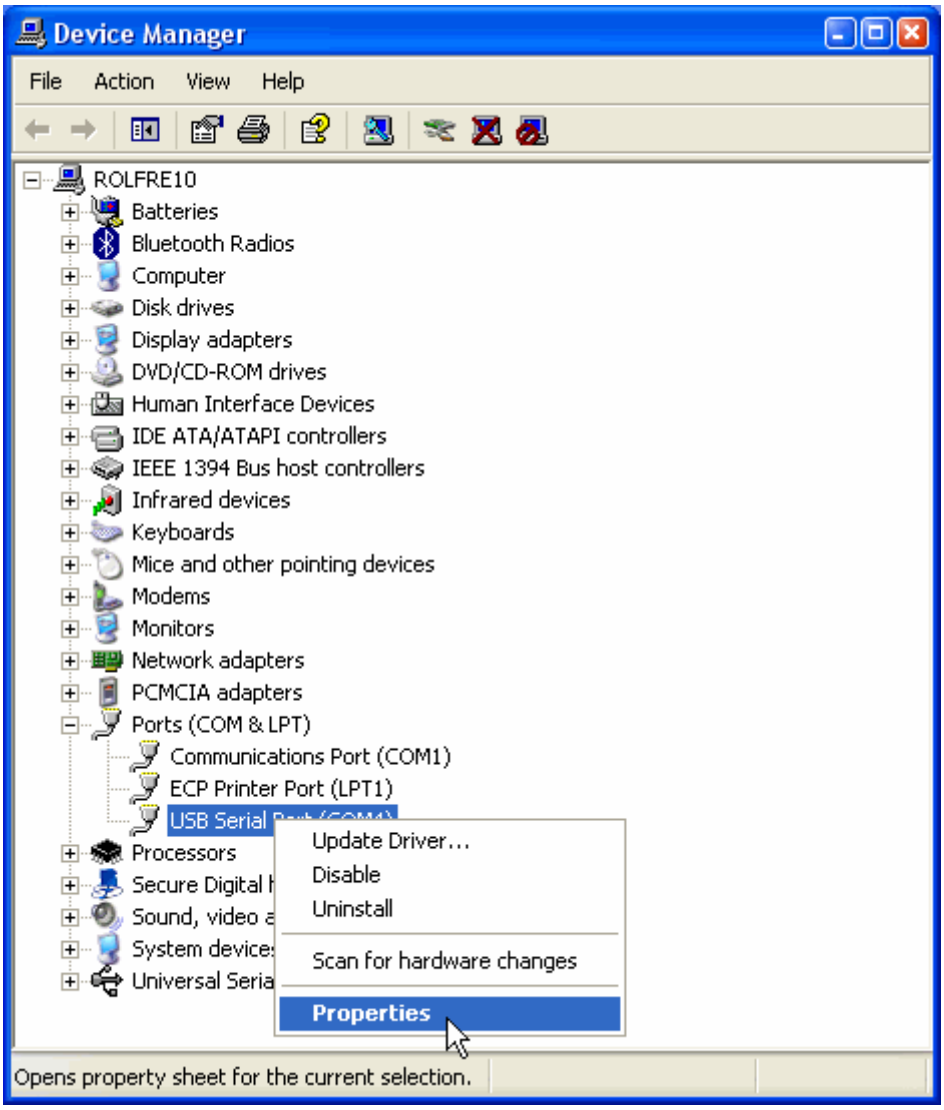
🕮 A Virtual COM port is the simulation of a serial port in software in order to allow a USB port to take its place. Virtual serial ports are necessary to enable an application that was written for the serial port to run on a computer that does not have that interface. Once the driver is installed, the RemoteBox device will always connect to the appropriate Virtual COM Port to communicate with the computer and the RBM software.

How to change the USB Virtual COM Port number in Windows

1. To change the Port Number of the USB COM Port open Device Manager by clicking Start -> Control Panel -> System (or hold down the "Windows" key and press "Pause-Break") select the Hardware Tab and click the Device Manager button.

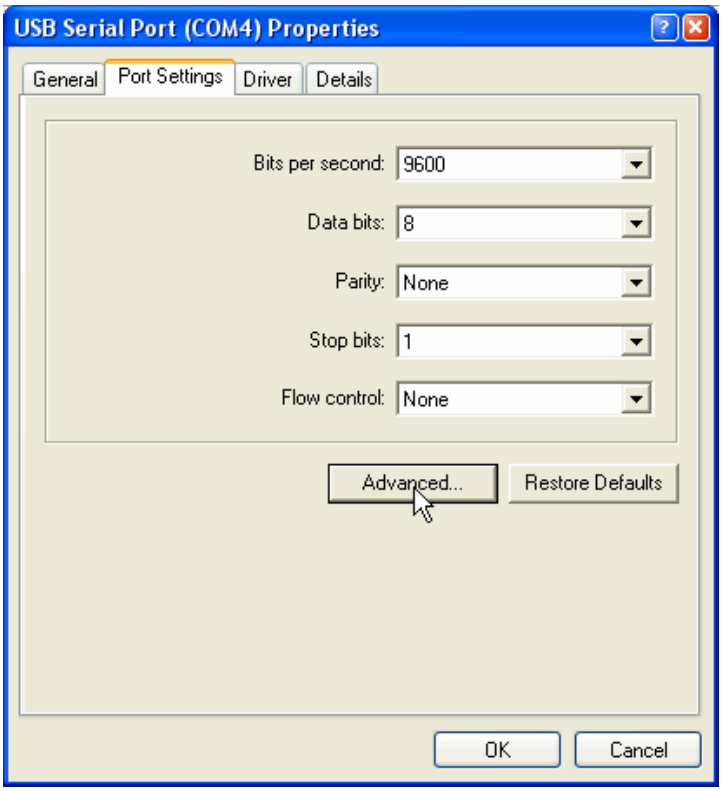
or

Click Start -> Run... and enter *devmgmt.msc*



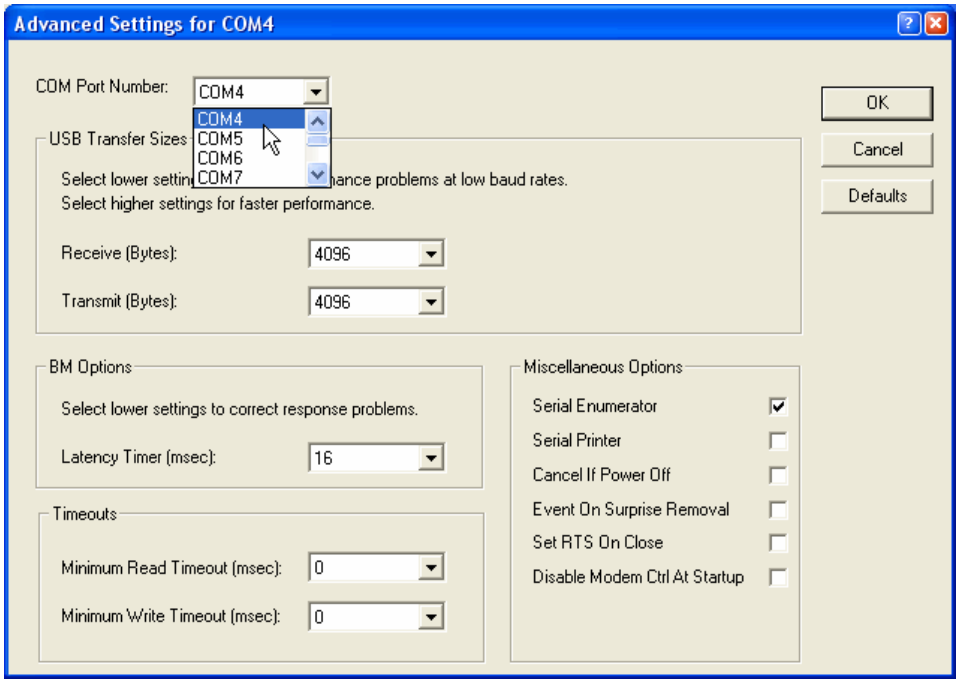
2. The USB Serial Port (COMX) is in the Ports section

   To change the Port number right-click the USB Serial Device and select Properties



3. Select the "Port Settings" Tab and click "Advanced"

   You do not have to change any parameter.



4. Now you can select the Port Number you like to use.

5. Click OK and close all open Dialogs

🕮 Windows might not suggest restarting the computer but in some cases it might be necessary to manually restart the operating system.

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