



QT-5000 Module & Remote Control Audio System

Rev: 6

Description

This document describes the use of the QT-5000 transmitter module and Remote Control Audio System (RCAS).

History

Rev 1	Original
Rev 2	Updates
Rev 3	Added information about QT-5000 LED colours and blink patterns.
Rev 4	Update Software section
Rev 4.1	Added Technical detail for 802.15.4
Rev 5	Updated to Windows 7. Added any related changes.
Rev 6	Added Mounting Instructions

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FCC Notices:

Information to users:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1.) This device may not cause harmful interference and (2.) This device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Warning: *Changes or modifications not expressly approved by Quantum5X Systems Inc, could void the user's authority to operate the equipment.*

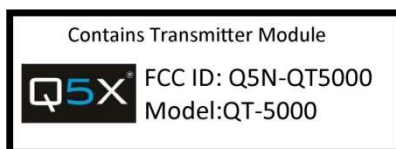
Warning: *This device has been designed to operate with the permanently attached wire antennas to the PCB for the UHF and the 802.15.4 Radios, both having a maximum gain of 3 dBi. Replacing or modifying these antennas is strictly prohibited.*

IMPORTANT: Final product(s) after integration with this module shall be tested to comply with all applicable FCC requirements and Unintentional radiators (FCC section 15.107 & 15.109) before declaring compliance to Part 15 of the FCC Rules.

Labeling of the End Products:

Following permanent label shall be applied on all final products after module integration.

Product Label



RF Exposure Compliance:

This module is a low-power device and complies with applicable RF exposure requirements as a mobile device. For portable application, it is limited only to the specified host (tap shoe) configurations as shown below as acceptable and approved with this filing.

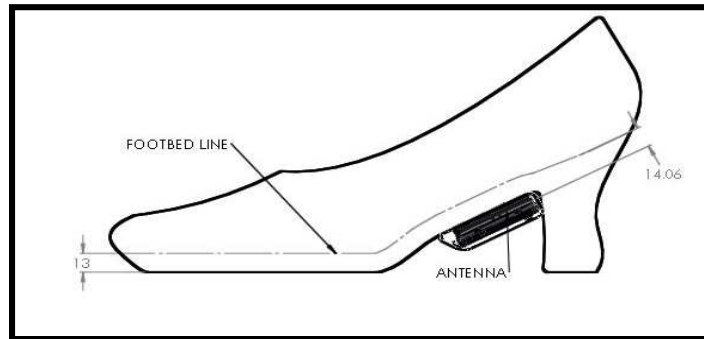


Figure 1 -High Heel Antenna Spacing

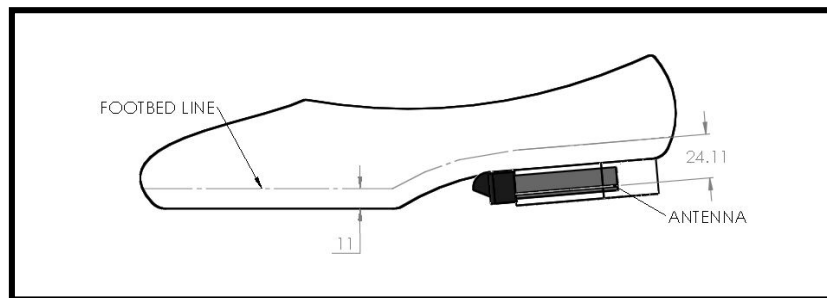


Figure 2 - Low Heel Antenna Spacing

RF Exposure Warning:

The applicant hereby affirms that installation of this module will only be performed on shoe models that have a minimum 10 mm separation distance from the outside surface/antenna of the module to the closest surface of the foot.

The module integrator must:

- 1) Ensure that the QT-5000 module antenna is mounted in such a way that the minimum spacing of 10 mm is maintained between the antenna and the wearer at all times.
- 2) Ensure that the minimum spacing between the wearer and the module antenna must be in free space or non-metallic material.

The module integrator may not:

- 1) Alter, modify or remove the module case.
- 2) Make changes to the Circuit Card Assembly of the module.
- 3) Remove, change or alter the integrated UHF antenna or the 802.15.4 antenna.

Failure to comply with these restrictions will result in violation of the FCC certification.

Introduction

The RCAS consists of the three main components:



Module Integration into Host End Products

The QT-5000 Module Transmitter has been designed by Quantum5X Systems Inc. to be used exclusively by Quantum5X as a building block for their wireless audio transmitter products. The module, as designed, is a standalone unit that is ready for integration into final form factor with the limitation for portable use as specified in RF Exposure compliance. For proper usage of the module, the module integrator must ensure that the input power and input audio signal do not exceed the specified limits as outlined in the specification section. Failure to do so will result in damage to the module.

QT-5000 Module Mounting

Mounting of the QT-5000 module must provide a solid, reliable, mechanical connection between the module and the tap shoe. If the QT-5000 module is not securely fastened to the tap shoe, it may become separated from the shoe during dancing and could cause harm to the wearer, the audience member or the module. Below are two sets of instruction for mounting to two different styles of shoes: high heel and a low heel style of shoe. In each case, it is important to maintain the minimum 10 mm antenna spacing of the module from the wearer.

High Heel Tap Shoe

The tap shoe first needs to be modified to allow the QT-5000 module to be fastened to the shoe.



Figure 3 - Mounting Holes Drilled into

Four holes are drilled into the sole of the shoe, and up through the foot bed.



Figure 4 - T-Nuts installed into sole

The T-nuts provide a threaded insert for the transmitter pod to screw into. The insole is pulled back from the foot bed and the T-nuts are flush mounted into the foot bed from the top side of the shoe.



Figure 5 - Transmitter Pod attached to Shoe

The transmitter pod is held in place by four #4 bolts that are screwed into the T-nuts, which are mounted into the sole of the shoe. It is very important to ensure the correct length of the screws used so that the screw does not protrude above the foot bed of the shoe.

Low Heel Tap Shoe

In order to mount the transmitter module to the low heel tap shoe, the heel must first be modified. It is recommended that the heel of the tap shoe be modified by a professional shoe maker to ensure the modification is done in the correct manner.



Figure 6 - Heel Cavity

The heel of the tap shoe needs to be modified to allow for the transmitters module to slide into the opening. The opening needs to be 58.4 mm X 36.75 mm X 15.3 mm.



Figure 7 - Module inserted into Heel

The opening needs to be large enough to allow the transmitter to slide into the opening without friction. If the opening is too tight pressure can be transferred onto the transmitter during dancing and could damage the module.



Figure 8 – Transmitter mounting

The QT-5000 module is then securely mounted to the transmitter with two 1" long #4 screws.

The QT-5000 Transmitter

Out-of-the-Box Setup

Ensure the QT-5000 is sufficiently charged by immediately inserting the charger.



Using the Reset Key after Charge

Earlier hardware revisions of the QT-5000 had an issue where the unit would occasionally need to be reset after being connected to a charger.



It is recommended that each time the charger is disconnected from the QT-5000, the Reset Key (which is attached to the cable of the charger) should be inserted into the charge port, held for 1 second, and then removed.

After the Reset Key is removed, the Status LED will blink green 3 times.

Charge LED Colour

When connected to a charger, the colour of the Charge LED will indicate the progress of the charging cycle. The LED is located on the front of the transmitter.



GREEN - The battery is charged and ready for use.



AMBER - The battery level low, but can be used for short term use, such as setup or quick audio tests.



RED - The battery level is unusable and must be charged.

Note: After the LED changes from Amber to Green, it is recommended it be charged for 15 more minutes while the trickle charge completes.

Status LED

The Status LED indicates both the battery's charge level and whether the transmitter is in ON mode (transmitting audio) or in Standby mode (not transmitting audio).

Status LED Colour

The colour of the Status LED indicates the battery's charge level.

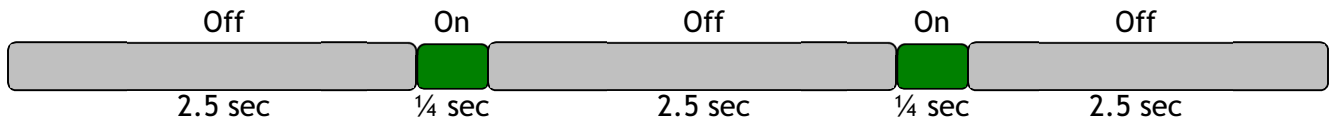
Note: The meaning of the Status LED's colour is slightly different than the Charge LED's colour. See the following:

-  **GREEN** - The battery level is over 50%.
-  **AMBER** - The battery level is less than 50%.
-  **RED** - The battery level is unusable and must be charged.

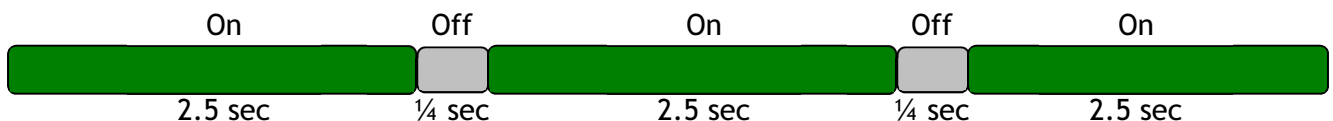
Status LED Blink Patterns

The blink pattern of the Status LED indicates the mode of the QT-5000.

STANDBY Mode (*no audio*) – The LED is off for 2.5 seconds and on for ¼ of a second, and repeats.



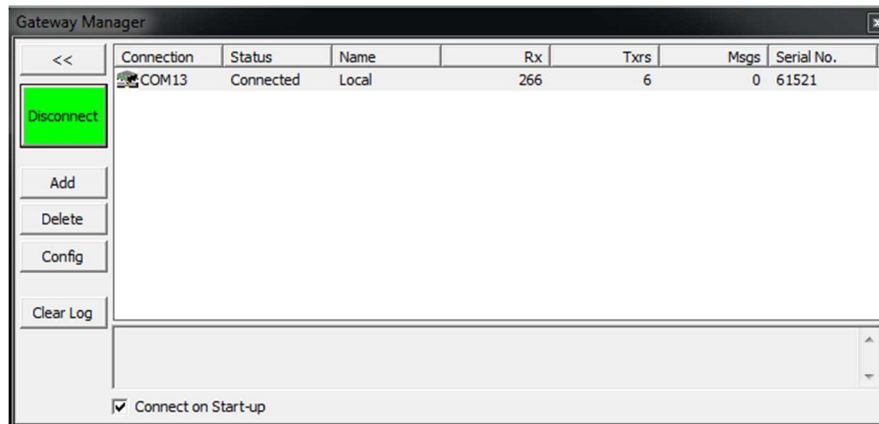
ON Mode (*transmitting audio*) – The LED is on for 2.5 seconds and off for ¼ of a second, and repeats.



MicControl Software

Gateway Manager

All Gateway management (adding, deleting, configuring) is performed from the Gateway Manager window.



Adding Gateways

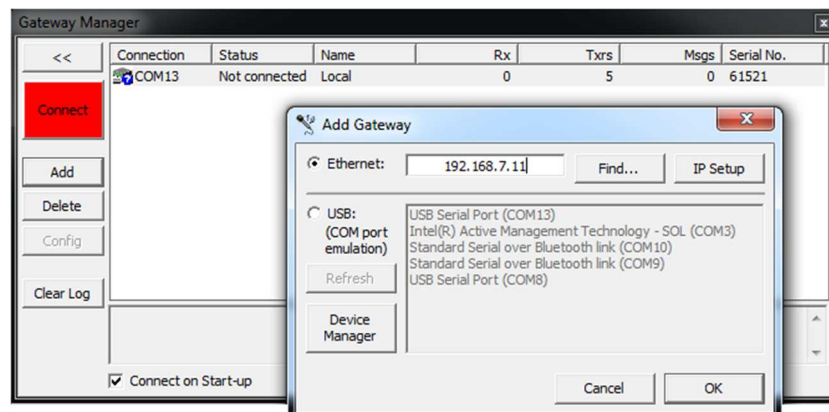
Note: To add or delete gateways, the software must be disconnected from all gateways.

1. Click Add, to add a gateway.

Network Gateway

If adding a Network Gateway, select "Ethernet" and enter the gateway's IP address.

Click "OK".



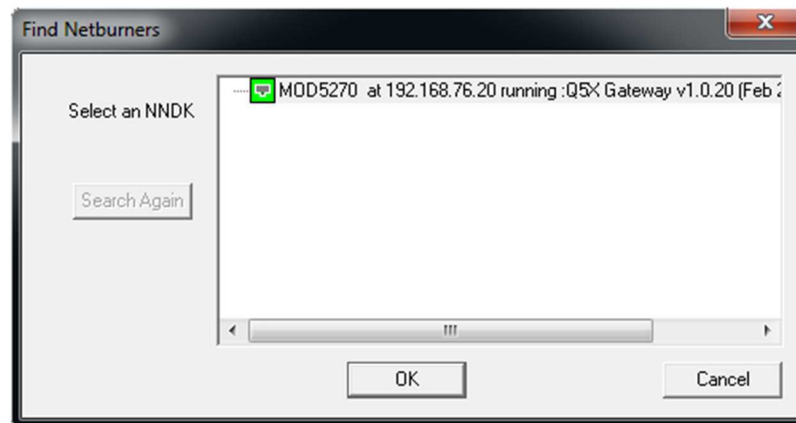
Finding a Gateway

To find a gateway on the net, click the “Find” button and follow the instructions.



Setting the IP Address of a Gateway

If the IP address of the gateway(s) on the network needs to be configured, click the “Find” button. The following tool will appear to determine the IP address.

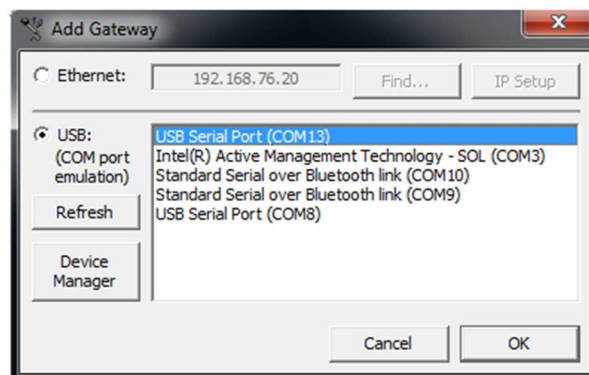


USB Gateways

1. If adding a USB Gateway, select “USB” and select the COM port of the gateway.
2. Click “OK”.

Note: The name of the gateway’s COM port will be “USB Serial Port”.

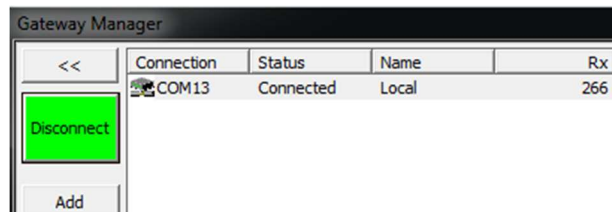
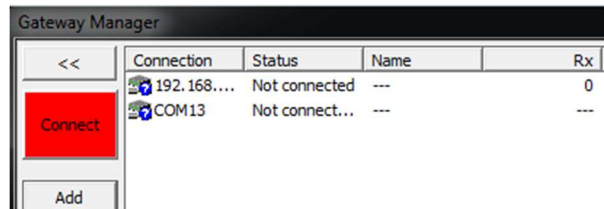
If the USB Gateway does not appear in the list, see the Troubleshooting section on how to diagnose the issue.



IMPORTANT: The COM port must be in the range of COM1 to COM16. If the COM port is above COM16, see the troubleshooting section to change it to a lower COM port.

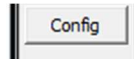
Connecting to the Gateways

To start the communications to the Gateways, from the Gateway Manager window, click the “Connect” button.

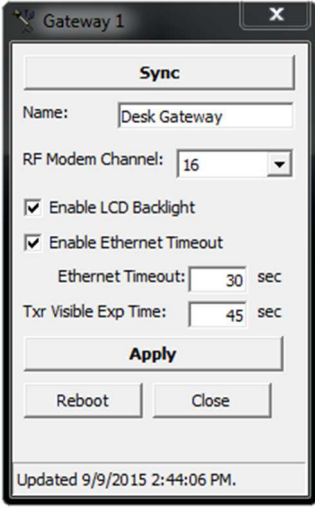


Configuring the Gateway

To configure the Gateway, from the in the Gateway Manager, select the Gateway to be configured, then click on the “Config” button.



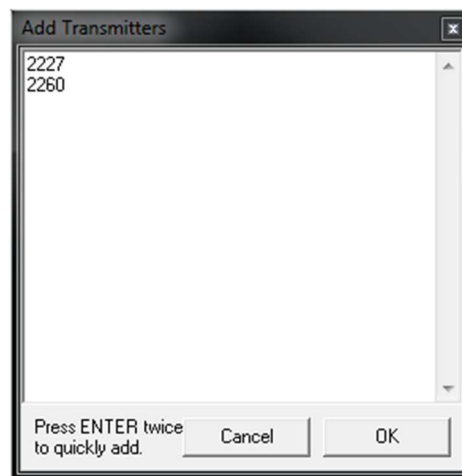
Note: The Gateway must be connected before trying to Configure the Gateway.

The following window will appear.	
Name	This is the friendly name of the Gateway.
RF Modem Channel	The RF Modem Channel is the 2.4 GHz telemetry channel that the Gateway uses to communicate to the Transmitters. Note: The 2.4 GHz spectrum used occupies the same bandwidth as Wi-Fi, Bluetooth and other unlicensed ISM devices. In most environments, channel 16 is the clearest channel.
Enable LCD Backlight	This parameter will enable/disable the backlight of the Gateway.
Enable Ethernet Timeout (Network Gateway only)	In the rare case that the software or gateway loses connection, the Gateway will automatically disconnect after a period of “silence” from the software. The software is designed to send communication at regular intervals to let the Gateway know that it is still active. Check this checkbox to enable this feature.
Ethernet Timeout (Network Gateway only)	This is the period of time (in seconds) of silence from the software that the Gateway waits before disconnecting.
Txr Visible Exp Time	Each Gateway keeps a list of all the transmitters that it receives heartbeats from. The <i>Transmitter Visible Expiry Time</i> parameter is the amount of time (in seconds) that elapses before the Gateway removes the transmitter from the Visible List.

Session Setup

Adding a Transmitter to the Session

1. To add transmitters to the session:
 - From the "Transmitter" menu, select "Add...".
 - Or, click the Add Transmitter button  from the toolbar.
 - Or, type Ctrl+T.
2. Type the serial numbers of the transmitters to be added. Several transmitters can be added at once as seen below.



3. Click OK to add the transmitters to the session.

Saving a Session

After adding the desired transmitters, the list can be saved as a session and opened at a later time.

To save the session:

- From the File menu, click "Save Session..."
- Or, click the Save Session button 
- Or, type Ctrl+S

Opening a Session

To open a previously saved session:

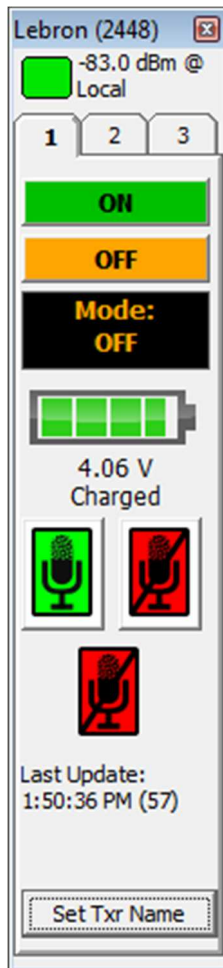
- From the File menu, click "Open Session..."
- Or, click the Open Session button 
- Or, type Ctrl+O

Transmitter Panel

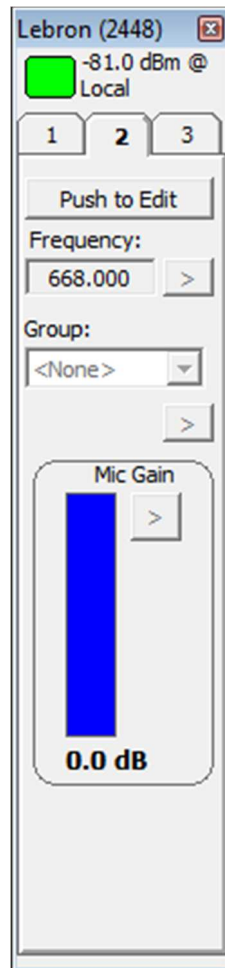
Each transmitter has a panel with 3 tabs:

- Status & Control
- Configuration
- Miscellaneous.

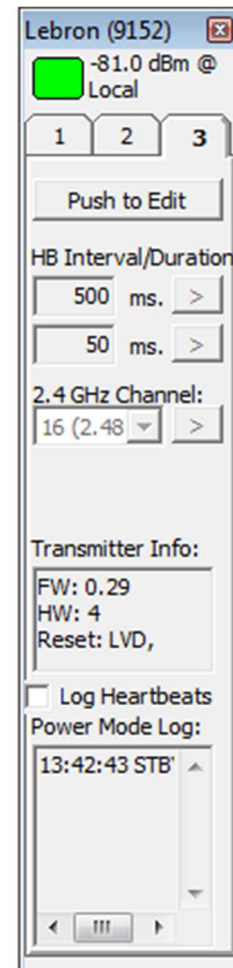
Tab1 - Status & Control



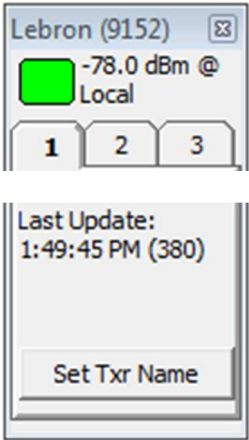
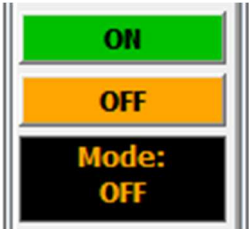
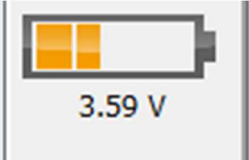
Tab 2 - Configuration



Tab 3 - Miscellaneous



Tab 1 – Status and Control Tab

Heartbeat Indicator 	Each transmitter sends out a heartbeat approximately every 2.5 seconds that contains all status and configuration information. At the top of the transmitter panel is the heartbeat indicator. Each time a heartbeat is received by the Gateway, the indicator will turn to a bright green. As time passes, the indicator will fade to black. When another heartbeat is received, it will return to bright green. At the bottom of the transmitter panel, a timestamp displays the time of the last received heartbeat.
Power Status and Control The following panel contains the power control buttons and status. 	 Power On  Power Off Underneath the power buttons is the current power state.  Indicates that the command to change the power state has been sent and that the software is waiting for a response.
Battery Indicator 	The battery indicator displays the current state of the battery. 4.100 V = 100% 3.300 V = 0% When the transmitter is plugged into a charger, the status will display "Charging..." underneath the battery voltage.

Mute Control

The following panel contains the mute control buttons and status.



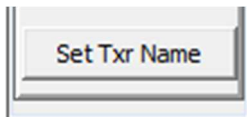
Mute On



Mute Off

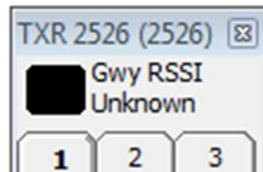


Indicates that the command to change the mute state has been sent and that the software is waiting for a response.

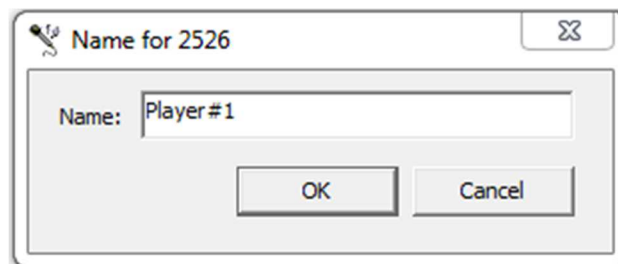
Set Transmitter Name

To simplify the identification of a transmitter, an alias or name can be attached to the transmitter in the session.

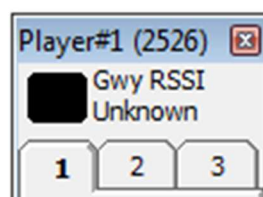
When the name is not set, the title bar of the transmitter panel will display “TXR” and the serial number, for example “TXR 2267”.



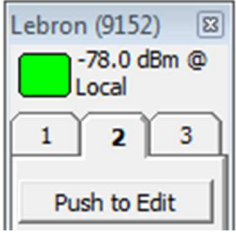
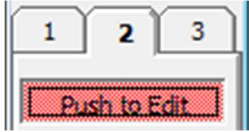
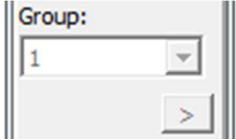
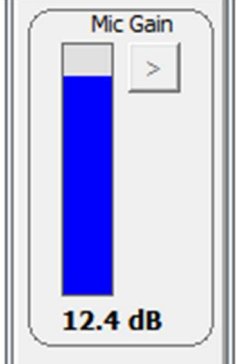
To set the Transmitter's name, press the “Set Txr Name” button and enter the “friendly” name of the transmitter.



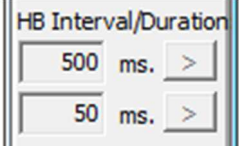
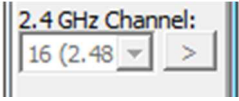
The new name will now be displayed with the serial number in brackets.



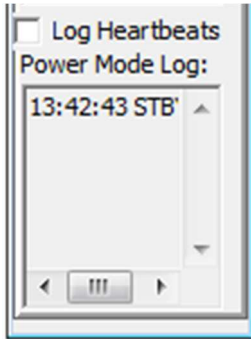
Tab 2 – Configuration Tab

Configuration Tab 	Tab 2 contains most of the configurable settings of the transmitter. To edit any of settings, one must first put the panel into Edit mode by pressing the Edit button. Once it is in Edit mode, the button will turn pink.  Each parameter has a “set” button to the right (indicated by a ‘>’). After the desired value is entered, press the “set” button to send the value to the transmitter. 
Frequency 	This parameter is the frequency that the audio transmits on. Range: 600.000 to 700.000 MHz Step: 25 kHz.
Group 	The transmitters can be powered on and off in groups, making it simpler to control batches of transmitters. A transmitter can be set to one of 31 groups. To set the group names, see the section “Customizing Group Names”.
Mic Gain 	If a microphone is clipping, the Mic Gain can attenuate the gain of the microphone from 0 to -6.5 dB.

Tab 3 – Miscellaneous Tab

Heartbeat Interval/Duration 	The Heartbeat Interval sets how long a transmitter waits until a heartbeat is sent out. The Heartbeat Duration sets how long a transmitter waits for a reply to a heartbeat from the Gateway/Software. It is recommended that the values be left as the defaults.
RF Modem Channel 	The RF Modem Channel is the 2.4 GHz telemetry channel that the Transmitter(s) use to communicate to the Gateway(s). Note: The 2.4 GHz spectrum used occupies the same band as Wi-Fi, Bluetooth and other unlicensed ISM devices. In most environments, channel 16 is the clearest channel. Warning: Exercise caution when changing this parameter – after the channel is changed, the software will not be able to communicate with the Transmitter until the Gateway channel is changed to match.
Version Information 	The hardware and firmware version information of the transmitter is displayed in the transmitter info text box.

Heartbeat Logging

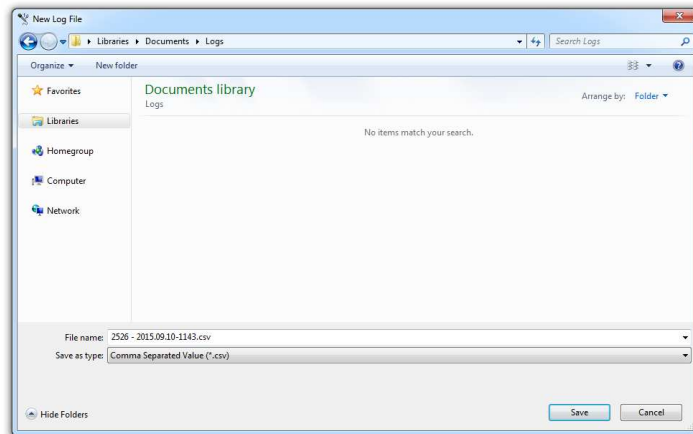


When a heartbeat is received from the transmitter, it contains configuration and status information. This information can be logged for diagnostic and informational purposes.

When enabled, the following information is logged to a comma separated value (CSV) file:

- Timestamp
- Battery Voltage
- Power Mode (On/Standby)
- Transmitter RSSI
- Gateway RSSI

To enable logging, click the “Log Heartbeats” checkbox. The serial number, date and time is the default filename. Click Save.



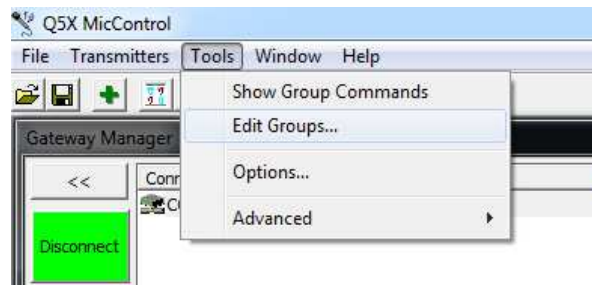
Each time a heartbeat is received, the heartbeat information will be stored in the file. To stop logging, uncheck the “Log Heartbeats” checkbox.

Customizing Group Names

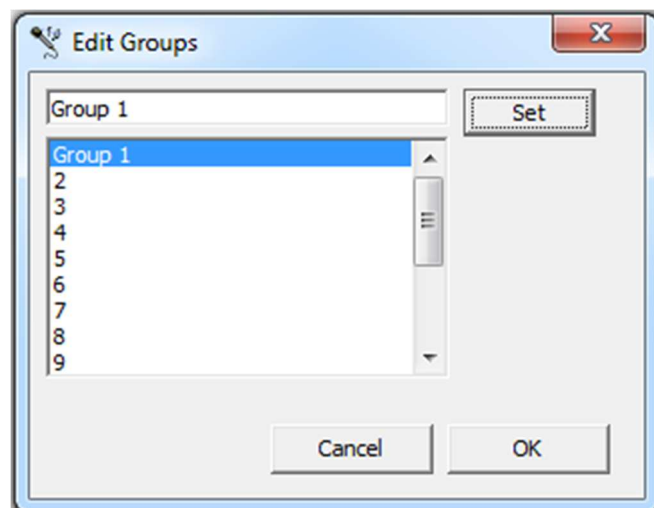
The Transmitters can be configured into groups so they can be powered on and off in batches.

To customize the Group Names:

1. Open the Group Editor by clicking the Tools menu and selecting “Edit Groups...”.



2. Select the group to change. Edit the name and press “Set”.



3. Click OK when all edits are complete.

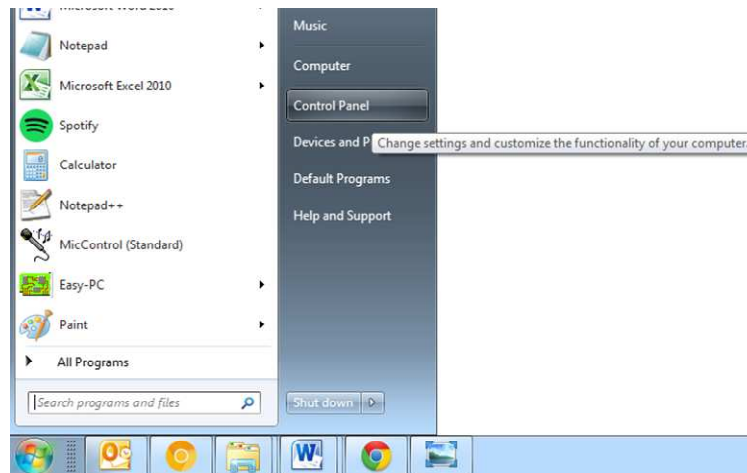
Troubleshooting

The USB port does not appear in the Gateway Manager.

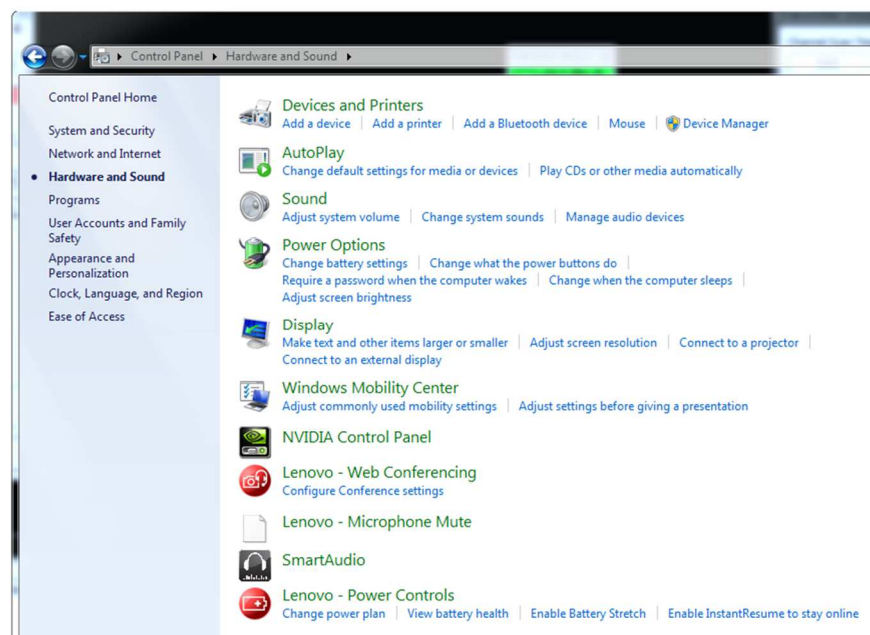
Verify that the drivers are installed properly.

To confirm that the drivers are installed properly, open the Device Manager and locate the installed Gateways (USB Serial Ports).

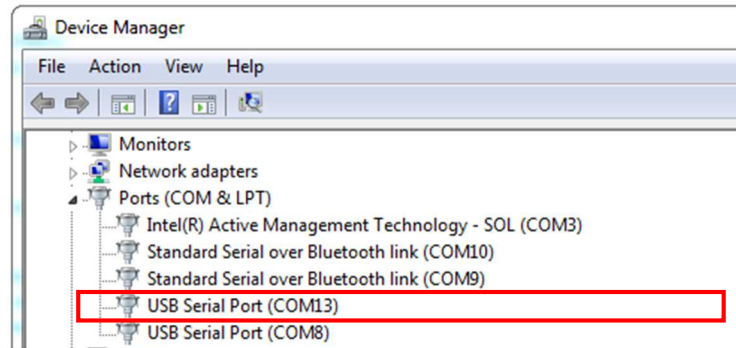
1. Click the Start menu -> Control Panel



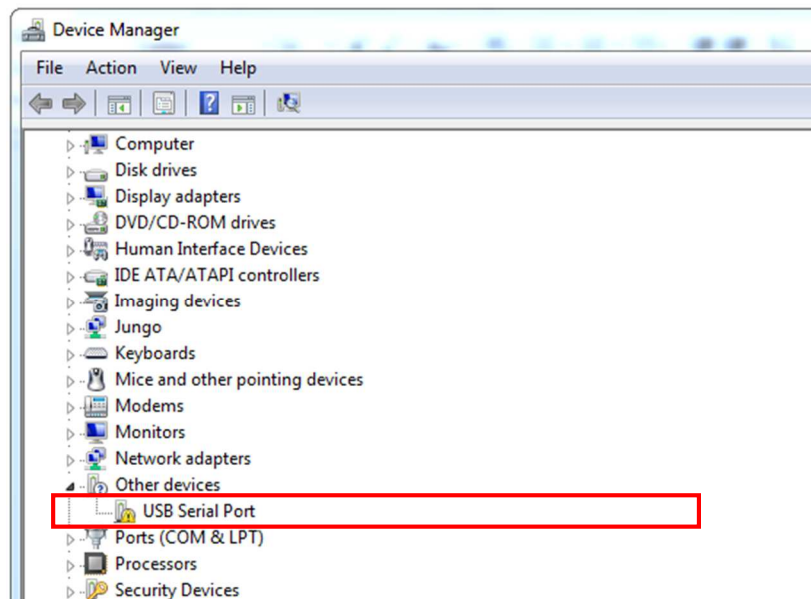
2. Click on "Hardware and Sound". Click on "Device Manager" below the "Devices and Printers" heading. **Note: Depending on the operating system and other Start menu settings, there may be alternate methods of opening the Device Manager.**



3. Scroll down “Ports (COM & LPT)” section. The Gateways should appear as “USB Serial Port (COMxx)”. To confirm if the USB Serial Port driver is installed properly, disconnect and reconnect the Gateway. The Gateway should disappear and reappear in the list.



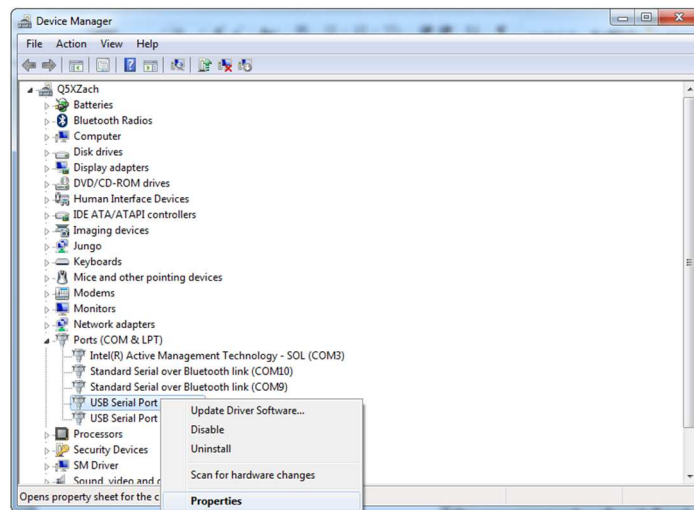
4. If the USB Serial Port does not appear under “Ports (COM & LPT)”, look under “Other Devices” for “USB Serial Port”. If it appears with an exclamation mark, see the Appendix – Installing USB Drivers.



The COM port designation is higher than COM16

The MicControl software will only recognize a valid COM port number up to COM16. If the Gateway is configured as a port higher than COM16, follow these instructions to change the COM port number.

1. Locate the USB Serial Port in the Device Manager (see the instructions above on how to locate the USB Serial Port number).
2. Right-click on the USB Serial Port to be changed and select “Properties”.



3. Select the “Port Settings” tab and click the “Advanced” button.
4. In the “COM Port Number” field, select a port from COM2 to COM16.

Note: Select a COM port that is not marked as “(in use)”. If none are available, choose one that is the least likely to be active. Click “OK” to the warning that will appear.

5. Click “OK”.
6. Disconnect and reconnect the Gateway. Verify that the COM port was changed.

The transmitters are charged and the status light is blinking, but the status heartbeats are not appearing in the software.

Ensure that the 2.4 GHz telemetry channel of the transmitter and the gateway match.

Specifications

Technical Data UHF Radio

RF Carrier Frequency Range: 614 MHz – 698 MHz

Working Range – 500m (line of sight, outdoors for a single system)

Note: Actual working range depends on RF signal absorption, reflection and interference

RF Power Output: 81.1 mW (max)

Antenna impedance: 50 Ω Impedance

Technical Data 802.15.4 Radio

RF Power Output: 0.7 mW (max)

RF Carrier Frequency Range: 2.405 GHz – 2.480 GHz

Technical Data QT-5000 Module

Power Requirements: 3.7V (4.2V Max)

Current Drain: 140 mA

Max Input Audio Signal: 1 VRMS

Audio Gain Adjustment Range: 0 dB – 14 dB

Overall Dimensions: 37mmX12.9mmX57mm (Battery on top of module)

Net Weight: 43 g

QT-5000 Module Antennas

UHF Radio Antenna: Uses a permanently attached wire antenna which is factory installed with max gain of 3 dBi.

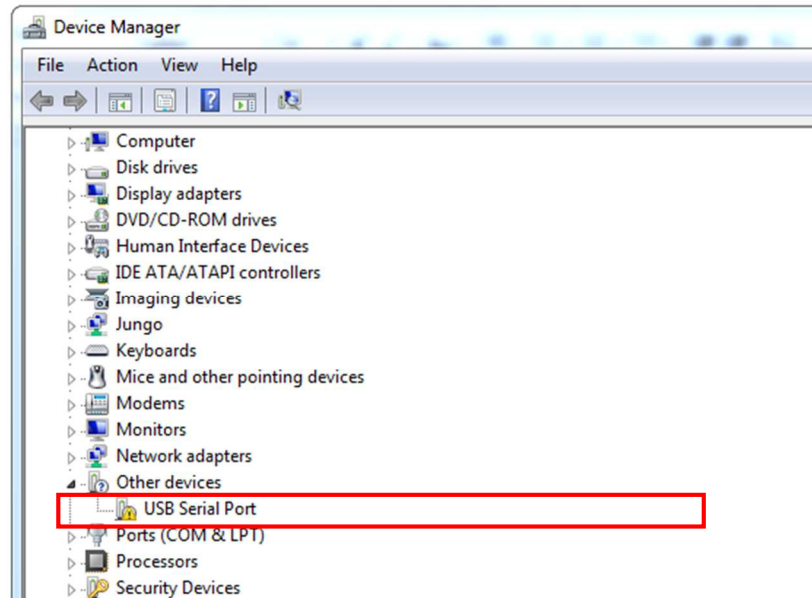
Manufacturer:	Q5X
Type:	¼ Wave UHF Wire antenna soldered to the PCB
Frequency Range:	614MHz – 698MHz
Max Gain (dBi):	3 dBi

802.15.4 Radio Antenna: Uses a permanently attached wire antenna which is factory installed with max gain of 3 dBi

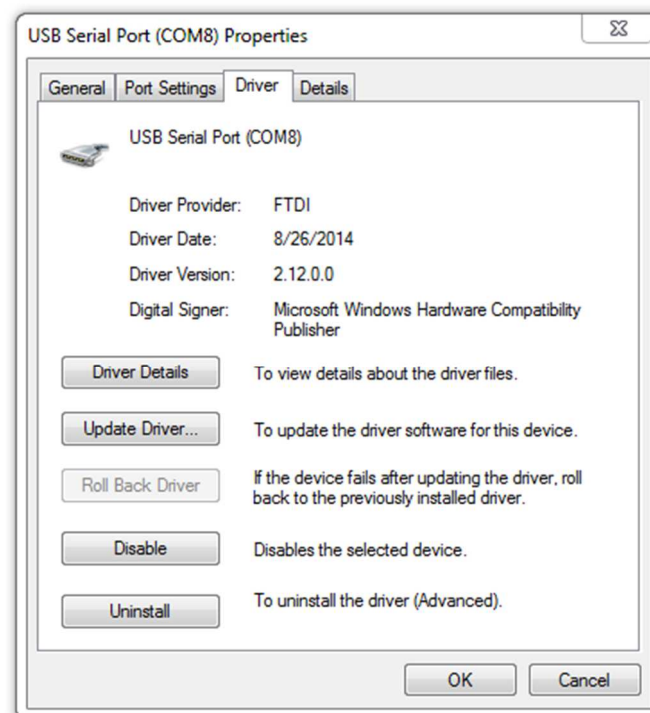
Manufacturer:	Q5X
Type:	¼ Wave 802.15.4 Wire antenna soldered to the PCB
Frequency Range:	2.405GHz – 2.480GHz
Max Gain (dBi):	3 dBi

Appendix - Installing the USB Driver

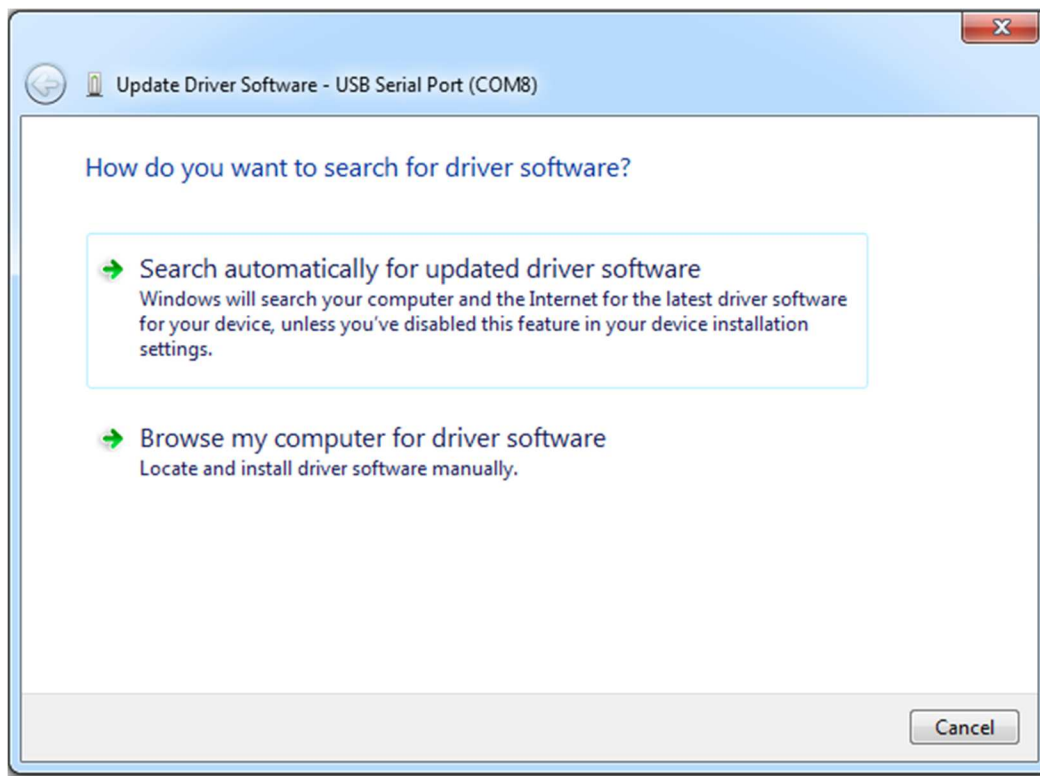
Find the Gateway in the device manager as shown in verify that the drivers are installed properly. Right click on the USB Serial Port and select properties.



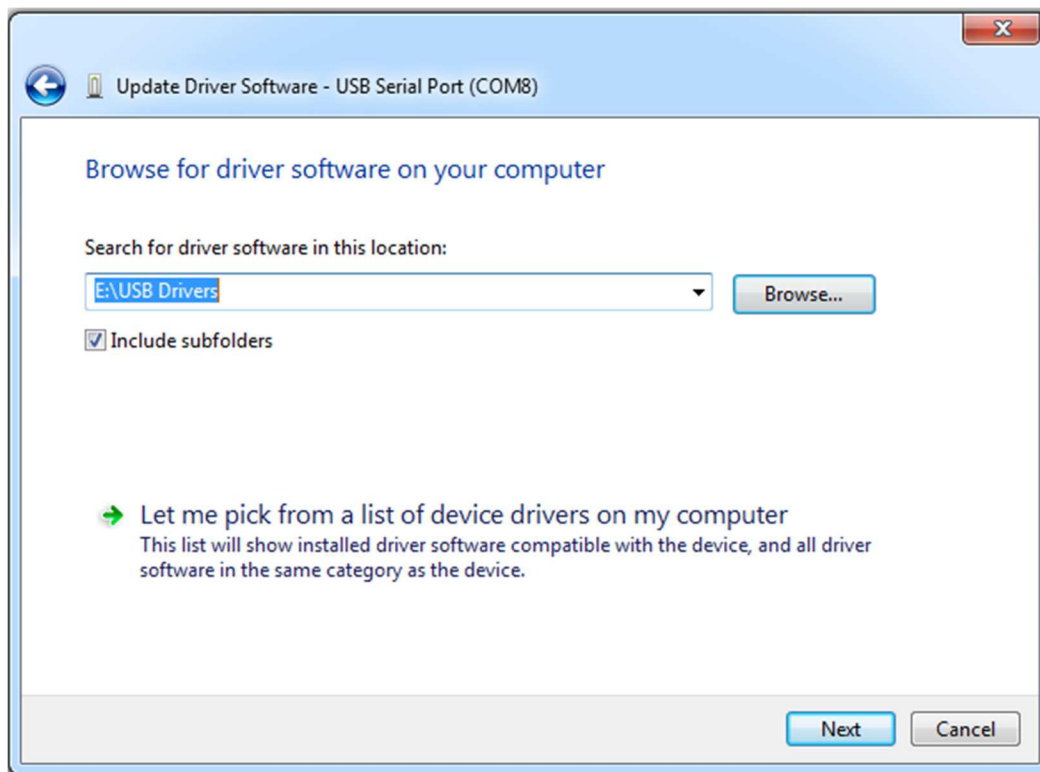
Select the driver tab.



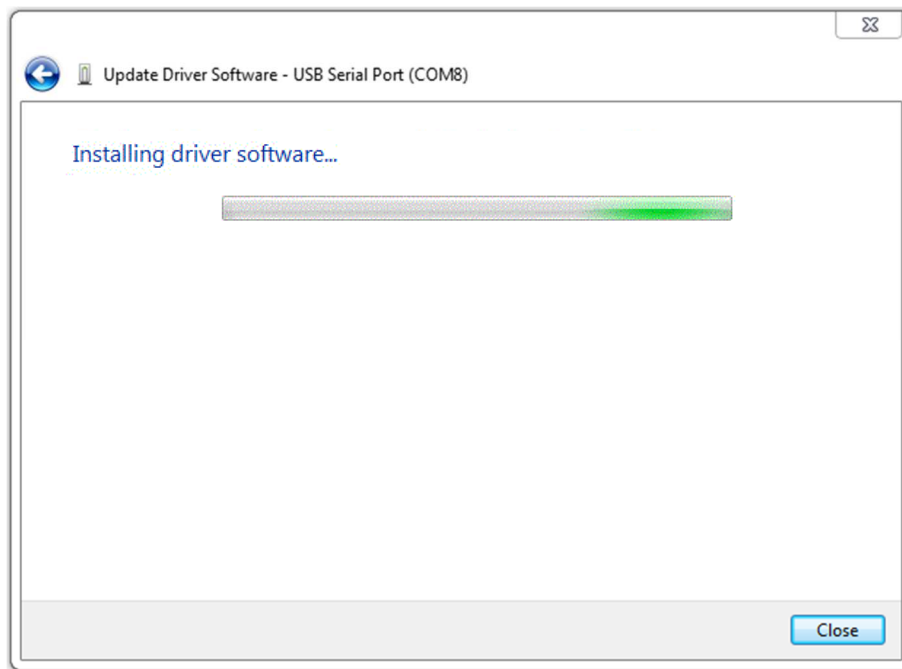
Click on the Update Driver button.



Select Browse my computer for driver software



Browse for the location of the USB drivers. Press next to install the drivers.



Press close to complete the installation.

