

## Configuring Bluetooth HC-05 in AT mode with Arduino Uno

The HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup [1]. In order to configure the module, it is necessary to enter into AT command mode and to transmit data the Bluetooth module will need to be out of AT command Mode.

AT mode refers to the form of communication to the HC-05 Bluetooth Module. AT Commands are short for Attention Commands which is a command language used for modems known as the Hayes command set. Hayes command set is a specific command language originally developed by Dennis Hayes for the Hayes Smartmodem 300 baud modem in 1981 [2]. The HC-05 Bluetooth Module was used due to its ability to be configured as Master or Slave mode as well as adding a password to the module. Initially for this project the HC-06 module was going to be used which is only in Slave Mode and it does not have the ability to be configured.

Parts used to configure are the following:

- 2 HC-05 Bluetooth Modules
- Arduino Uno
- Breadboard
- 4 wires
- USB A to B cable
- Computer
- open-source Arduino Software (IDE)

To enter AT Command mode using an Arduino Uno wired to a HC-05 Bluetooth Module one must first familiarized with the physical Bluetooth Module.

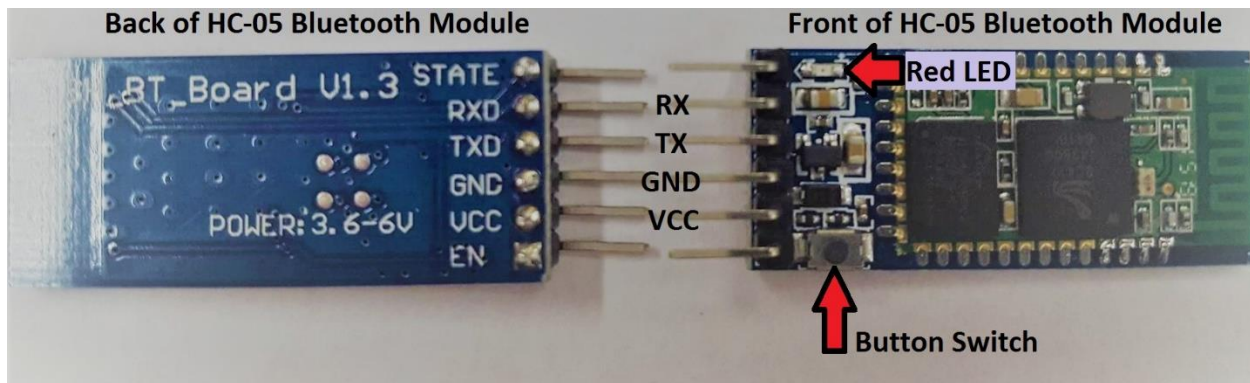
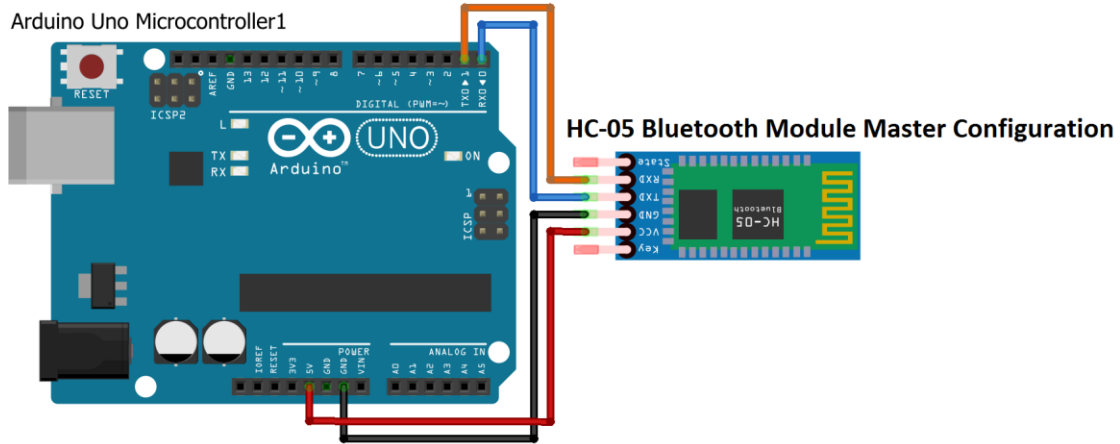


Figure 1. HC-05 Bluetooth Module

The Data sheet for the module can be found at: [https://www.itead.cc/wiki/Serial\\_Port\\_Blutetooth\\_Module\\_\(Master/Slave\)\\_:\\_HC-05](https://www.itead.cc/wiki/Serial_Port_Blutetooth_Module_(Master/Slave)_:_HC-05) which has a list of AT commands as well as specifications of the module. The Module needs a minimum of 3.3V to work and a maximum of 6V. The default Baud rate is 38400 and for this project out of the 6 pins that the module has, the outermost pins (STATE and EN) will not be used. The module can communicate up to 30 feet. As seen in Figure 1 the pins that will be used are RX, TX, GND, VCC. Additionally, from figure 1 the front of the has a red LED and a Button Switch.



The red LED has 3 continuous flashing modes: ON for 2 seconds and Off for 2 seconds (AT Command Mode), fast blinking (searching for a connection), Off for 2 seconds and blinks twice (connected). Figure 2 as well as Table 1 show the connections needed to configure the Bluetooth Module.

HC-05 Bluetooth Module Pin	Arduino Uno Pin
VCC	5V
GND	GND
TXD	TXD
RXD	RXD

Table 1. Connection between the pins of the Bluetooth Module and Arduino Uno

Figure 2. Entering AT Command Mode Schematic

To enter AT Command Mode the following must be done:

1. Arduino Uno must be connected to the Computer via USB and Arduino software opened
2. The Module must be disconnected from Arduino
3. Arduino needs to have a Blank Sketch downloaded

```
void setup() {
  // put your setup code here, to run once:
}

void loop() {
  // put your main code here, to run repeatedly:
}
```

4. The Button Switch must be held pushed and simultaneously connected to the Arduino as seen in figure 2 (This is done most easily if using a breadboard)

- The Button Switch can be released once connected to Arduino and the Bluetooth Module LED should be blinking ON for 2 seconds and Off for 2 seconds indicating it has entered AT Command Mode
- The Correct COM Port should be Selected and Serial Monitor needs to be opened as seen in

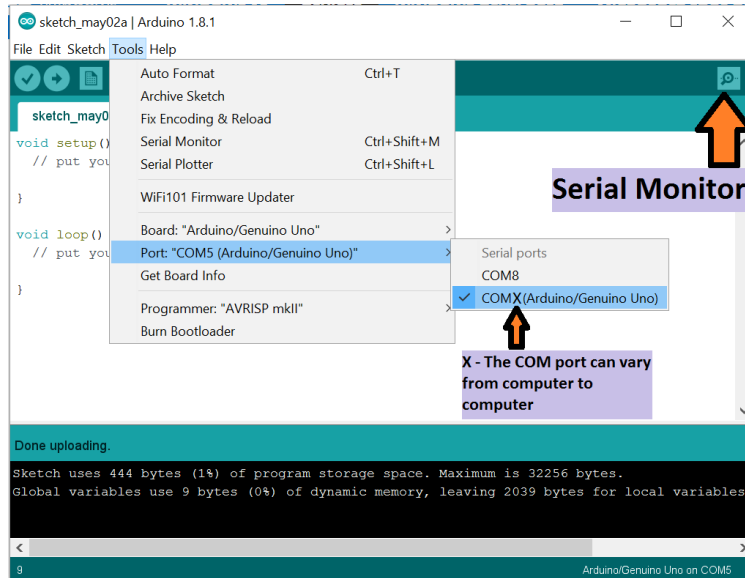


figure 3

- 38400 baud rate should be selected and "Both NL & CR" as seen in figure 4

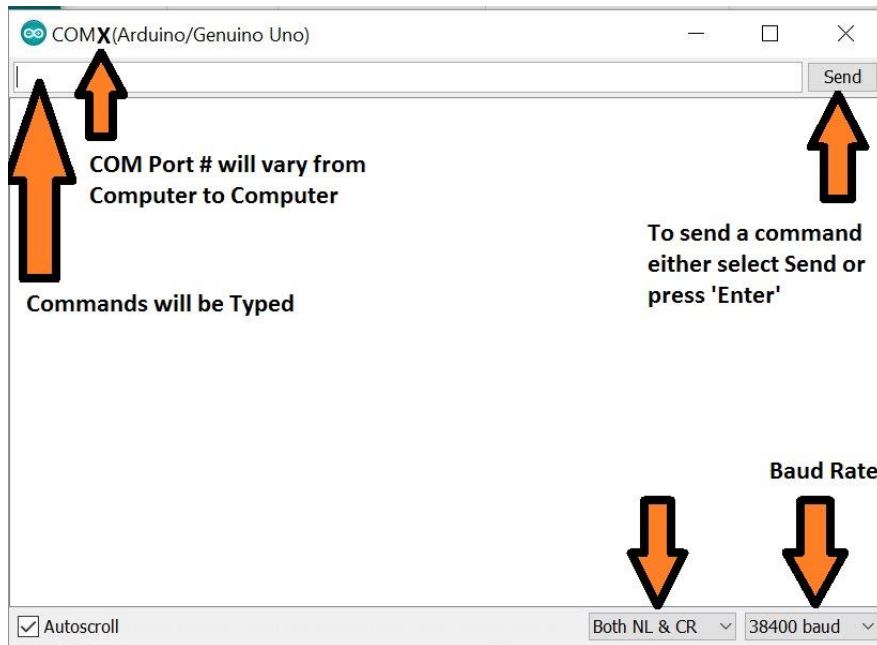


Figure 4. Arduino Serial Monitor

## AT Command Mode

Using the commands found in reference [2] the following table 2 and table 3 are formed for Master and Slave Configuration and Table 4 and Table 5 are formed for fixed connection. Each Module is connected one at the time and must be in AT command Mode as explained above. The module is connected to the Arduino with a Blank Sketch and configure using the selected AT commands in tables 2,3,4,5. Figure 5 shows a screen capture of the Serial Monitor screen as a result of following Table 2 as an example of what to expect when using the Serial Monitor. **Commands have to be typed in capital letters**, when a command is typed it will disappear and a response from the module appears.

Commands Typed	Response from Module	Info
AT	Error: (0)	Make sure module in AT mode from Red LED blinking on 2 seconds and off 2 seconds
AT	OK	Communication Stablished
AT+ORGL	OK	Resets Module to factory settings <b>Slave mode, pin code :1234, device name: H-C-2010-06-01 ,Baud 38400bits/s.</b>
AT+UART=38400,0,0	OK	Setting Baud Rate
AT+UART?	+UART:38400,0,0 OK	Response of Module indicating set Baud Rate
AT+ADDR?	+ADDR:18:91:d8fff6 OK	Module Address Should be written for later use
AT+NAME=Latch-M	OK	Setting name for Module as Latch-M
AT+ROLE=1	OK	Setting Module as Master Mode
AT+ROLE?	+ROLE:1 OK	Returns That it is in Master Mode
AT+PSWD=LATCH1	OK	Setting Password
AT+PSWD?	+PSWD:LATCH1 OK	Returns that password is LATCH1 <b>(Password must match the Slave Mode Module Password)</b>

Table 2. Configuration used for the Master Mode Module

Commands Typed	Response from Module	Info
AT	Error: (0)	Make sure module in AT mode from Red LED blinking on 2 seconds and off 2 seconds
AT	OK	Communication Stablished
AT+ORGL	OK	Resets Module to factory settings <b>Slave mode, pin code :1234, device name: H-C-2010-06-01 ,Baud 38400bits/s.</b>
AT+UART=38400,0,0	OK	Setting Baud Rate
AT+UART?	+UART:38400,0,0 OK	Response of Module indicating set Baud Rate
AT+ADDR?	+ADDR: 18:91:d9198e OK	Module Address Should be written for later use
AT+NAME=Latch-S	OK	Setting name for Module as Latch-M
AT+ROLE=0	OK	Setting Module as Slave Mode

AT+ ROLE?	+ROLE:0 OK	Returns That it is in Slave Mode
AT+PSWD=LATCH1	OK	Setting Password
AT+ PSWD?	+PSWD:LATCH1 OK	Returns that password is LATCH1 <b>(Password must match the Master Mode Module Password)</b>

Table 3. Configuration used for the Slave Mode Module

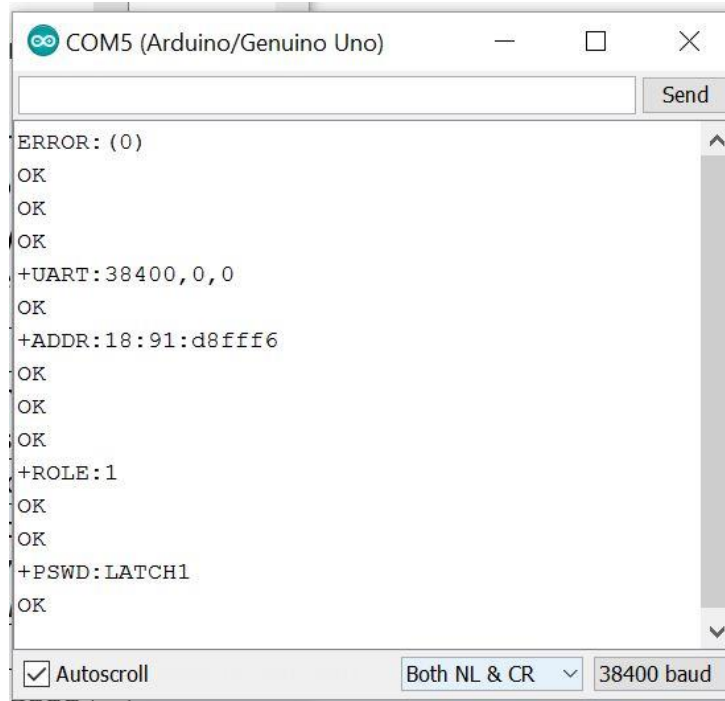


Figure 5. Screenshot of Serial Monitor of Configuring Master Mode Module

Table 2 and 3 will result in different address since each Bluetooth module is has a different address and changing the name and password is optional. Once one module is set as a Master and the other as a Slave the modules will connect automatically as long both are ON and within 30 feet assuming default password of 1234 is kept. If the password and name of each module are change the following Table 4 and Table 5 can be followed to set the modules to connect to each other with the new password and name.

Commands Typed	Response from Module	Info
AT	Error: (0)	Make sure module in AT mode from Red LED blinking on 2 seconds and off 2 seconds
AT	OK	Communication Stablished
AT+CMODE=0	OK	Set to connect to a fixed address
AT+CMODE?	+CMOD:0 OK	Confirms that module is set to connect to a fixed address

AT+BIND=18,91,d9198e	OK	Using the address from Slave mode module from Table 3 the fixed address to connect to is set <b>(Notice that the address uses , instead of :)</b>
AT+BIND?	+BIND:18:91:d9198e OK	Confirms that it is set to connect to the set address

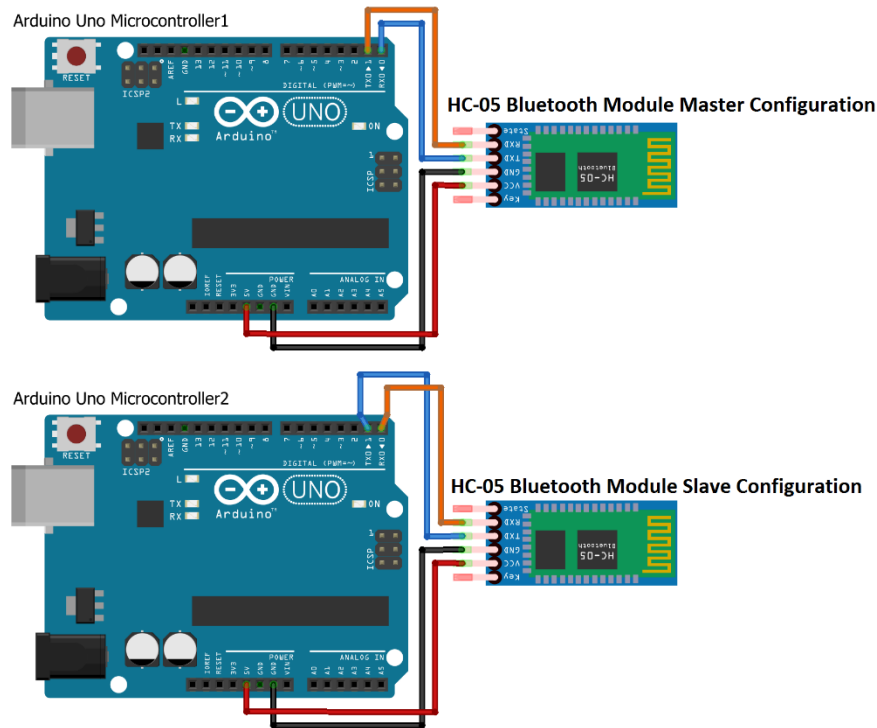
Table 4. Table for Master Mode Module Auto connect to Slave Mode Module

Commands Typed	Response from Module	Info
AT	Error: (0)	Make sure module in AT mode from Red LED blinking on 2 seconds and off 2 seconds
AT	OK	Communication Stablished
AT+CMODE=0	OK	Set to connect to a fixed address
AT+CMODE?	+CMOD:0 OK	Confirms that module is set to connect to a fixed address
AT+BIND=18,91,d8fff6	OK	Using the address from Slave mode module from Table 3 the fixed address to connect to is set <b>(Notice that the address uses , instead of :)</b>
AT+BIND?	+BIND: 18:91:d8fff6 OK	Confirms that it is set to connect to the set address

Table 5. Table for Slave Mode Module Auto connect to Master Mode Module

#### Connecting HC-05 Master Mode Module to a HC-05 Slave Mode Module

Once both Modules have been connected they can be wired to their own Arduino Uno Board with the Arduino Uno boards having the desired Code and start transmitting data. The Master Module is wired the same way that the module was wired in figure 2 to enter AT Command Mode. The Slave Mode Module will have the TX and RX wires switch as seen in Figure 6 and Table 6.



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Figure 6. Master and Slave Mode Module Wiring Configuration

HC-05 Bluetooth Master Mode Module Pins	Arduino Uno Master Board Pins	HC-05 Bluetooth Master Mode Module Pins	Arduino Uno Slave Mode Board Pins
VCC	5V	VCC	5V
GND	GND	GND	GND
TXD	TXD	TXD	RXD
RXD	RXD	RXD	TXD

Table 6. Pin connectors for HC-05 Bluetooth Module to Arduino Uno

When downloading code to Arduino Uno the HC-05 Module must be disconnected otherwise the download will not complete. **Unless the Arduino Uno will not be modified in the future the HC-05 Bluetooth Module should not be permeably connected.** A six pin female header as seen in figure 7

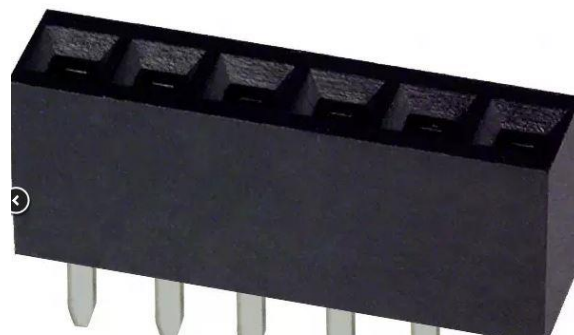


Figure 7. Example of 6-pin Female Header [3]

would be ideal solution for mounting Arduino so it can be removed when loading new code to Arduino Uno.

#### Troubleshooting HC-05 Bluetooth Module

Problem	Solution
Module red LED <b>NOT</b> blinking on for 2 seconds and off for 2 seconds, indicating that it is in AT Command Mode	<ul style="list-style-type: none"> <li>• Remove power from System to check wires to make sure properly wired as seen in Figure 2. If properly connected apply power to system again</li> <li>• Disconnect Module and Reconnect while holding the Button Switch and releasing the Button Switch after it is Connected</li> </ul>
Serial Monitor not communicating with HC-05 Bluetooth Module	<ul style="list-style-type: none"> <li>• Make sure Arduino Uno has Blank code downloaded</li> <li>• Make sure red LED in module blinking 2 seconds and off for 2 seconds, indicating that it is in AT Command Mode</li> <li>• Make sure as seen in Figure 3 that the correct COM Port is selected</li> <li>• Make Sure Wired Correctly as seen in Figure 2</li> </ul>
Code not downloading to Arduino Uno	<ul style="list-style-type: none"> <li>• Make sure HC-05 Bluetooth is removed from the system while the code downloads</li> <li>• Make sure code does not have errors</li> <li>• Make Sure USB is properly connected to computer</li> <li>• Reset Arduino and try download again</li> <li>• Restart Arduino software and re-download code</li> </ul>
HC-05 Bluetooth Module getting HOT	<ul style="list-style-type: none"> <li>• <b>Immediately but Safely</b> remove power from system</li> <li>• <b>Wait until module has cooled down because now Module is a Burning Hazard</b></li> <li>• After it has cooled Check wiring as seen in figure 6</li> <li>• If module not turn On it will need to be replaced</li> </ul>
Master and Slave Mode Bluetooth Modules not pairing	<ul style="list-style-type: none"> <li>• Make sure Modules with in 30 feet of each other</li> <li>• Check power and connections as seen in figure 6</li> <li>• Confirm that Master and Slave Modules are properly wired as seen in Figure 6 especially look at RXD and TXD pins</li> </ul>