



The **Arduino Bluetooth Module HC-05**, **XBee**, and **HC-05 XBee** (a common misnomer) are wireless communication modules used with Arduino for different purposes. Below is a breakdown of each:

1. HC-05 Bluetooth Module

- **Type:** Bluetooth (Classic, **not BLE**)
- **Range:** ~10 meters (depending on environment)
- **Interface:** UART (Serial)
- **Voltage:** Typically **3.3V** (but often 5V-tolerant)
- **Pairing:** Uses standard Bluetooth pairing (default password: **1234**)
- **Common Uses:**
 - Wireless serial communication between Arduino and a smartphone/PC.
 - Remote control of Arduino projects via Bluetooth.

HC-05 Wiring with Arduino

HC-05 Pin	Arduino Pin
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VCC	5V (or 3.3V if available)
-----	---------------------------

GND	GND
-----	-----

TXD	RX (Pin 0 or SoftwareSerial)
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RXD	TX (Pin 1 or SoftwareSerial)
-----	------------------------------

STATE	Optional (for connection status)
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EN/KEY	Optional (for AT mode configuration)
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Basic HC-05 Arduino Code (SoftwareSerial)



```
#include <SoftwareSerial.h>

SoftwareSerial BT(10, 11); // RX, TX (connect HC-05 TX to 10, RX to 11)


void setup() {

  Serial.begin(9600);

  BT.begin(38400); // Default HC-05 baud rate
}


void loop() {

  if (BT.available()) {

    char data = BT.read();

    Serial.print(data);

  }

  if (Serial.available()) {

    char data = Serial.read();

    BT.print(data);

  }

}
```

2. XBee Modules (S1, S2, S3)

- **Type:** RF (Zigbee protocol, mesh networking)
- **Range:** Up to **100m (indoor)**, **1-2km (outdoor, with line of sight)**
- **Interface:** UART (Serial)
- **Voltage:** **3.3V** (not 5V-tolerant)
- **Pairing:** Requires configuration (using XCTU software)



- **Common Uses:**
 - Wireless sensor networks.
 - Long-range serial communication.
 - Mesh networking (multiple XBees communicating).

XBee Wiring with Arduino

XBee Pin	Arduino Pin
VCC	3.3V (must not use 5V!)
GND	GND
DOUT (TX)	RX (Pin 0 or SoftwareSerial)
DIN (RX)	TX (Pin 1 or SoftwareSerial)

Basic XBee Arduino Code

cpp

Copy

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```
#include <SoftwareSerial.h>
```

```
SoftwareSerial XBee(10, 11); // RX, TX (connect XBee TX to 10, RX to 11)
```

```
void setup() {
```

```
  Serial.begin(9600);
```

```
  XBee.begin(9600); // Default XBee baud rate
```

```
}
```

```
void loop() {  
  
  if (XBee.available()) {  
  
    char data = XBee.read();  
  
    Serial.print(data);  
  
  }  
  
  if (Serial.available()) {  
  
    char data = Serial.read();  
  
    XBee.print(data);  
  
  }  
  
}
```

3. HC-05 XBee (Misconception)

- Some sellers market **HC-05** as "**XBee-shaped**", but it's **not an XBee**.
- It is just an HC-05 Bluetooth module in an **XBee form factor** (for XBee socket compatibility).
- **Does not support Zigbee or mesh networking**—only Bluetooth.

Comparison Table

Feature	HC-05 (Bluetooth)	XBee (Zigbee)
Range	~10m	Up to 2km (with line of sight)
Protocol	Bluetooth Classic	Zigbee (mesh networking)
Power	Low (~8mA)	Higher (~40mA in transmit)

Feature	HC-05 (Bluetooth)	XBee (Zigbee)
Speed	~1-3 Mbps	~250 Kbps (Zigbee)
Cost	Cheap (~\$5)	Expensive (~20-25-50)
Use Case	Short-range control (phone/PC)	Long-range sensor networks

Which One Should You Use?

- **HC-05:** Best for **short-range phone/PC-to-Arduino** communication (e.g., Bluetooth remote control).
- **XBee:** Best for **long-range, low-power sensor networks** (e.g., weather stations, industrial monitoring).

