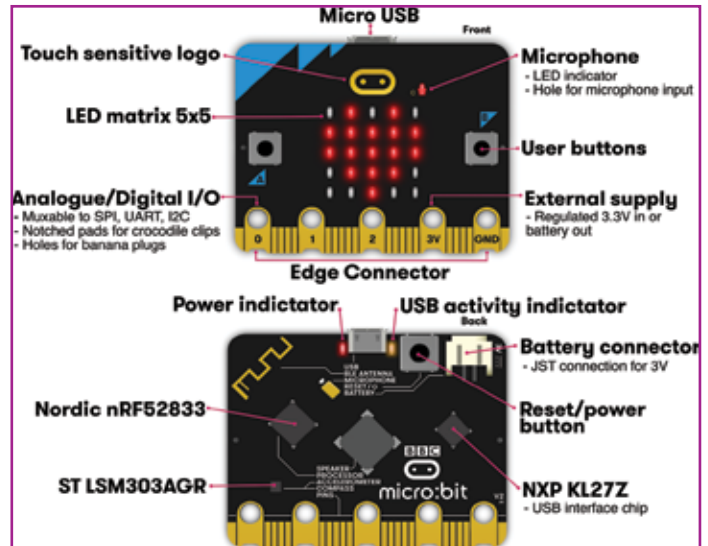


# Morse Texting!



The three girls Morse texting.



The front and back of BBC micro:bit.

## A amateur radio fun with the BBC micro:bit V2

We are three girls in year 6 of primary school – Milly, Caitlin and Alice. We call ourselves the Morse Ninja STEAMettes because we like Science, Technology, Engineering, Art and Maths and we are learning Morse code. Rob Zarges, K2MZ of the Long Island CW club is teaching us and we really love the sessions. They are fun and we learn quickly. Also we are training for the Foundation amateur radio licence.

We found a way to send Morse code on a BBC micro:bit just like when we text on our phones – with our thumbs!\_

### What's new?

The new BBC micro:bit V2 has more features compared to the first version introduced in 2016. It now has a built-in microphone and a built-in speaker, which makes it really easy to receive and send Morse Code to each other. A cool feature is the capacitive touch sensitive logo, which works a bit like the screen on our phone. Also it has more computing power!

All the projects described in this article can be done with the original micro:bit using an external speaker except when a Morse key is used. Therefore it is worth buying a new one for its ease of use!

### Coding fun

The 5x5 matrix of LEDs will be great to display our name and callsign, when we get our licence.

You can use the two buttons to display images such as a duck or a dog. There are lots of tunes it can play, such as 'happy birthday', 'the wedding song' and even 'Frère Jacques'. And it can be programmed to speak! We have learned all about variables, if-then-else statements, and loops. We get ideas and challenges from the micro:bit.org website [1].

### Morse Texting



The code used for the project.

So what is Morse texting? We have written the code for the two buttons A and B so that pressing A gives a dit for 100 milliseconds and B gives a dah for 300 milliseconds. We press the buttons with our thumbs just as we would when we text on our smart phone. It's important to note that the Morse is sent when the button is released, so it is not helpful to keep your thumb pressed for too long. The code 'On button A is pressed' is actually sensing a press and a release for its triggering.

The code is very simple using Microsoft's MakeCode editor. We have put the code for all our projects on the Hilderstone Radio Society website, under the heading 'amateur radio' and then 'other resources' [2].

A dah needs to be three times longer than a dit. If we had used the beat option for playing the High C this is not possible, as the beats are all two or four times longer.

### Arduino

There are lots of Morse Code programs on the Internet for the BBC micro:bit and the Arduino. We like using the Arduino, having constructed different projects using the Cytron Maker UNO [3]. We worked through the Cytron guide, which is really helpful with explanations, and then we chose a project to make. Caitlin made a device with a fan that blew a ball up a slope when it got too close. Milly made a piano with lots of push buttons and Alice built a car parking sensor.

So we decided to convert the BBC micro:bit into an Arduino. To do the conversion we simply followed the instructions in the Adafruit



Alice and her traffic lights.

learning tutorial [4]. You have to install the Nordic Semiconductor nRF5 boards into the boards manager. In the Arduino IDE there are lots of examples you can upload to the micro:bit.

**Blink**


Our first program, or sketch, was Blink, where an LED blinks on and off. It's easy to code for a red LED on the LED matrix using the MakeCode editor but how do you make a green or yellow LED blink? We could have used the 'pins' coding block using the MakeCode editor but we wanted the simplicity of the Arduino. Alice used a breadboard to construct traffic lights as explained by Simon Monk [5]. However she changed the code to give the correct timing sequence. (The red light stays on for one second together with the amber light).

To make an LED flash for a dit or a dah, we set up a function for each of them. The only downside of using the BBC micro:bit V2 as an Arduino at the moment is that we have to use an external speaker. Hopefully Adafruit will add the internal speaker to its library soon. We simply put a buzzer parallel to the LED to make the sound. We wrote a simple sketch for the BBC micro:bit to send 'hi' in Morse Code to the speaker which worked. Then we included a dah by sending 'oh'. Of course, the next step was to send our names.

A good example of translating Morse code on the Arduino is by Saeed Hosseini [6], despite making a dit sound for 250 milliseconds! We copied the code and uploaded it to the BBC micro:bit and it worked fine, having changed the timing to 100 milliseconds.

**NanoKey**

We have been learning Morse Code with

	1	2	3	4	5	6	7	8	9	0
	•	•	•	•	•	—	—	—	—	—
	—	•	•	•	•	•	—	—	—	—
	—	—	—	•	•	•	•	•	—	—
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Battleships



The girls with their keys.

straight Morse keys, kindly loaned by the Hilderstone Radio Society. We wanted our own Morse key so we built the Nanokey from PhoenixKitsonline [7]. We had to do some soldering and then construct it from all the different screws and washers. We were very proud of our finished product!

We had fun using the NanoKey and micro:bit to play battleships, sending the Morse code for the coordinates of our attacking missiles such as 'B6'. We used the grid in the Battleships

Milly, Caitlin & Alice



The girls playing telegraph with the Nanokey.



The cable sign.

activity designed by Joe, VK3YSP and Julie, VK3FOWL on the SARCNET website [8]. To code the micro:bit we started with the example of a telegraph [9] and changed it to send Morse code with our Nanokeys. When the Nanokey is pressed, the micro:bit sends a signal to the other micro:bit. On receiving the signal the other micro:bit makes a note. If it is a miss you send a full stop, ‘.-.-.’. If it is a hit you send a ‘t’ as ‘-’.

We all enjoyed playing the game, guessing where the battleships were, and we got to practise our Morse code too.

### Local Broadstairs telegraph history

The engineer Thomas Russell Crampton was born in Broadstairs and he was responsible for the laying of the first international undersea cable in 1851 at Dover [10]. We learned that telegraphy was important during World War 1 and that an undersea telephone cable goes under the beach at Dumpton Gap in Broadstairs [11, 12, 13].

The ship CS Alert was dispatched to cut German telegraph cables in the English Channel, preventing Germany from communicating with her allies. In World War 2, HTMS Alert was repairing the Dumpton Gap-La Penne cable when it was torpedoed with the loss of 59 crew members [14, 15]. There is a commemorative plaque on the Old Harbour Master’s House in Broadstairs.

### Radio Morse

The BBC microbit has an on-board antenna and transceiver. It uses the 2.4GHz band with channels spaced at 1MHz intervals, from 2.400GHz to 2.499GHz [16]. There are 256 group codes, meaning we can send to 256 different people in private! According to Lancaster University this guarantees user privacy [17]. In fact, if we use the channels, that makes 256 times 100 or 25,600 possible stations that we could communicate with! In the program you start with the function ‘radio set group’, with the same group number for everybody. We could



The plaque.

also set the frequency too, with the function ‘radio set frequency band’. We sent our dits and dahs by radio when we pressed buttons A and B. Morse texting by radio for real. Better still, we used our NanoKey to send the Morse. The connection of the NanoKey is simply across the 0 the 3v edge connectors. The range was so great we ran out of space at our club!

### Other cool projects

The BBC microbit has a built in magnetometer and it can be used to find North, which can be useful when tracking satellites, such as the FUNcube satellite. It has a thermometer and light meter. We want to investigate how it can do voice recognition. Also, the Bluetooth facility means we can link it to a computer and send temperature data to the Internet. The nice people at Adafruit will set up an account for you to store your data. A group of girls called the Essex Steamettes are learning about electronics using the BBC micro:bit with the Kitronik Inventor’s Kit [18]. We hope to communicate with them by amateur radio soon with the help of Essex Ham.

### Conclusion and References

The BBC micro:bit V2 is a brilliant device for children and adults to learn how to code and to learn Morse code. It makes us laugh when



Milly with her Nanokey and micro:bit.

the other children in our class have no idea what we are saying if we say a word to each other such as, ‘dah, di, dah, dah dit di, di, dit’. With the help of the BBC micro:bit you too can become a Morse Code Ninja!

We would like to thank John Hislop, G7OHO and Bob Fidler, MOZRF for their help and guidance in our projects. Also we would like to thank our mums, Breeda, Kirsty and Christine, for their support and for working with us. Thanks go to Mark Williams, Technical Support Engineer at the Micro:bit Educational Foundation, and David Whale, Director of Thinking Binaries Ltd, for reviewing the article.

Websearch

[1] <https://microbit.org>

[2] [www.g0hrs.org](http://www.g0hrs.org)

[3] [www.cython.io/p-maker-uno-edu-kit-arduino-compatible](http://www.cython.io/p-maker-uno-edu-kit-arduino-compatible)