zbit:speaker
for the BBC micro:bit

Have Fun while you Learn !

www.zbit-connect.co.uk

zbit:speaker for the BBC micro:bit

zbit:speaker is a member of the **zbit:connect** family
of add-on boards for the **BBC micro:bit** brought to you by
***i*nnovations in *e*ducation** allowing you to
generate sound effects from your **micro:bit** programs!

The **zbit:connect** family is designed to
unleash the potential of the BBC micro:bit
allowing your **micro:bit** to connect to ***multiple* add-on boards**
attached in the **'X', 'Y' or 'Z' axis**!

The **zbit:connect** family is designed to encourage an
understanding of software programming by helping you to
learn how to **write code** to **control external electronics**.

The **zbit:connect** family is also designed to encourage an
understanding of electronics by
encouraging '***positive hacking***' such as
modifying **zbit:connect** boards to change or enhance their capabilities
and/or **attaching your own electronic designs** to the **micro:bit**.

And above all the **zbit:connect** family is designed for you to

'*Have Fun while you Learn*'

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zbit:speaker features

zbit:speaker allows you to generate sound effects from your **micro:bit** programs via GIPO **P0**. Sound effects can be played in the following ways:-

a) via the on-board **8 Ohm 300mW Speaker**
b) via **Headphones** plugged into the 3.5mm **Headphones Jack Socket**
c) via **PC Speakers** plugged into the 3.5mm **Headphones Jack Socket**
d) Wirelessly via **Bluetooth Speakers** with a **Bluetooth Audio Transmitter** (such as the **Aukey BT-C1**) plugged into the 3.5mm **Headphones Jack Socket**

micro:bit connection screw holes

zbit:connector screw holes

on/off switch

amplifier i.c.

headphones jack socket

micro:bit compatible edge connector

speaker

top row header

xy mounting holes

volume control

microphone signals

bottom row header

The **On/Off Switch** turns the on-board **Speaker** On and Off.
(The Headphones Jack Socket is always 'On')

The **Volume Control** adjusts *both* the volume of the on-board **Speaker** *and* the volume from the **Headphones Jack Socket**

zbit:speaker bolts to the **micro:bit** with 5 screw which provide the required electrical connections to GPIO **P0 (audio)**, **3V (power)** and **GND (ground)**. They also provide electrical connection to P1 and P2.

The **micro:bit** compatible edge connector at the bottom of the board allows **zbit:speaker** to be plugged into the edge connector of other **micro:bit** accessories, allows crocodile clips to be attached to the large pads, allows banana plugs to be plugged into the 4mm holes or it allows other **zbit:connect** boards to be bolted on!

If electrical connection to the **micro:bit's** 'small pad' GPIO (P3-P20) is required by an add-on board, **zbit:speaker** can be fitted with the unique elastomeric **zbit:connector** (supplied separately).
See '**zbit:connect family guide**' for details

No soldering required for normal operation

...but **zbit:speaker** is *more* than *just* a **speaker** for the **micro:bit**!
See "*Designer's Guide*" for details **zbit:speaker's** *advanced features!*

Contents

1 x zbit:speaker board
1 x spacer board
1 x clip board
1 x xspacer board
2 x xy board
5 x M3x8 Panel Head Screws
5 x M3x8 Countersunk Head Screws
10 x M3 Nuts
1 x Volume Control Spindle
(zbit:connector* is an *optional* extra - sold separately)
*A **zbit:connector** is only required if the zbit:speaker needs to connect to other boards which use the '**small pad**' GPIO **P3-20.** For more information see the **'zbit:connect family guide'**

Tools Required
(for normal operation)

- Pozidrive Screwdriver
- Pliers
- Small File

Other Tools
(for advanced features - see "***Designer's Guide***")

- Wire Cutters
- Soldering Iron
- Solder

Assembly Instructions

The 5 individual PCB's are supplied as in single piece as shown. The PCB's are attached to each other by 'break-off' tabs.

1) Break off all of the smaller boards (**spacer board**, **clip board**, **xspacer board** and **xy board**) from the main **zbit:speaker** PCB. Snap off both ends of the connecting 'break-off' tabs. This will require a pair of pliers. (Note:- The **spacer board** and **clip board** are only needed if the **zbit:connector** is fitted. The **xspacer board** and **xy board** are only needed for advanced applications - see '**zbit:speaker Designer's Guide**' below)

2) File off any rough edges from where the break-off tabs were attached.

3) place **zbit:speaker** over the **micro:bit's** connector so the top holes on **zbit:speaker** line up with the holes on the **micro:bit**.

4) Insert 2 x **M3 Countersunk Head** Screws into the '**0**' and '**GND**' holes from the **back** of the **micro:bit** and secure with 2 x **M3 Nuts** fitted to the **front** of the **zbit:speaker** board

5) Insert the 3 remaining **M3 Countersunk Head** Screws into the '1', '2' and '3V' holes from the **back** of the **micro:bit** and secure with 3 x **M3 Nuts** fitted to the **front** of **zbit:speaker**.

5) Tighten all 5 x **M3 Screws** (but **do not overtighten!**)

6) Insert the **Volume Control Spindle** into **Potentiometer** (The spindle is normally fitted from the front but can alternatively be fitted from the back)

zbit:speaker is now ready to use !

7) If using **zbit:speaker** with the **zbit:connector**, attach the **zbit:connector**, **spacer board** and **clip board** to **zbit:speaker** using the 5 x **Panel Head** Screws as shown in the "**zbit:connector Assembly Diagram**" **before** attaching **zbit:speaker** to the **micro:bit**. (See **zbit:builder** instructions for more details)
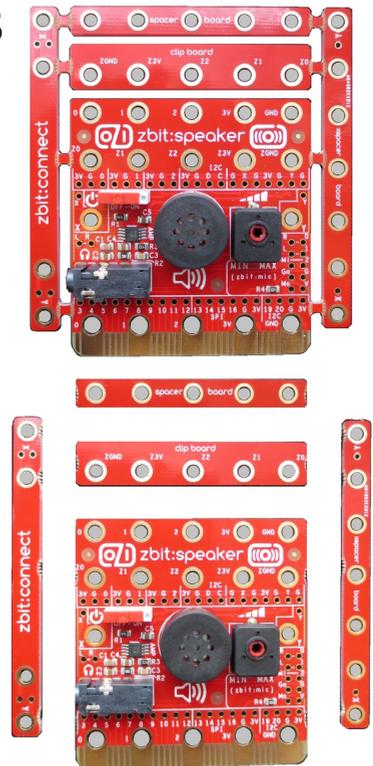
zbit:speaker test software code

zbit:speaker can be driven from software code written in any of the programming languages available for the **micro:bit** – **Block**, **Touch**, **JavaScript** or **Python**.

This example code uses **Block** which is the easiest of the programming languages and will allow you to quickly confirm that your **zbit:speaker** is working correctly.

zbit:speaker is connected to GPIO **P0** since **Block**, **Touch**, **JavaScript** and **Python** normally generates their sound effects on GPIO **P0**.

Is your zbit:speaker alive?

zbit:speaker troubleshooting

If you are running the **zbit-speaker-heartbeat** program and the '**heart**' is flashing on your **BBC micro:bit** but there is no sound from the **Loudspeaker** check the following:-

Is the **zbit:speaker Slide Switch** in the **'ON' position?**

Is the **zbit:speaker Volume Control** turned towards the **'MAX' direction?**

Are all **M3 Screws tightened?** Pay particular attention to the **M3** *Countersunk Head* **Screws** in the positions **'0', '3V'** and **'GND'**. (**'0'** connects the **'P0'** GPIO signal carrying the sound effect signal. **'3V'** and **'GND'** carry the power to the **zbit:speaker** board).

If the **Loudspeaker** is working but there is no sound via the **Headphones Jack Socket** check the following:-

Is the **Headphones Jack Plug** fully inserted into the **Headphones Jack Socket?**

Is the **Headphones Jack Plug** a 'standard' **3.5mm Stereo Plug?** (If the **Headphones** work when plugged into a **PC** they should work when plugged into the **zbit:speaker**)

If using **PC Speakers**, are the **PC Speakers powered up?**

If using **Bluetooth Speakers**, are the **Bluetooth Transmitter** and **Bluetooth Speakers powered up** and **'paired'?**

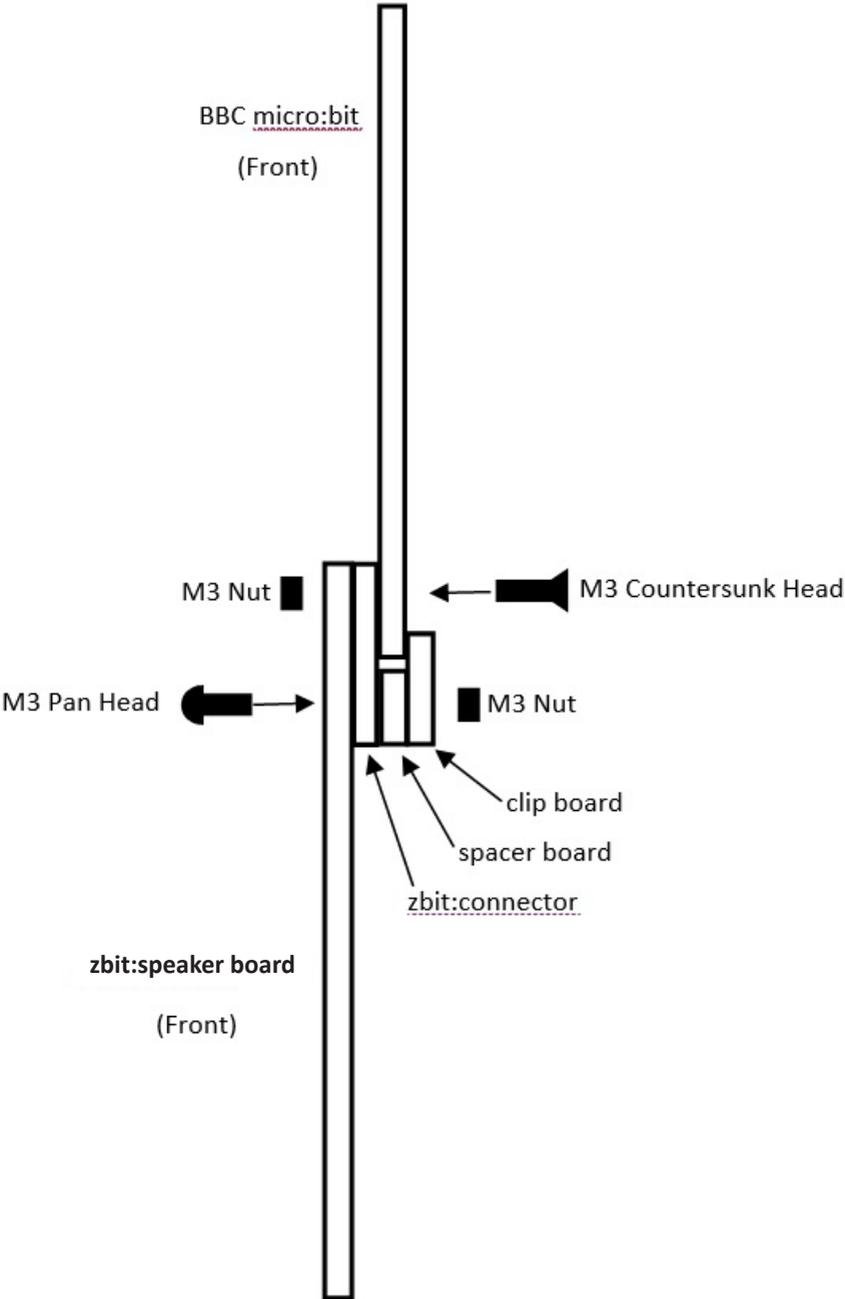If the **Headphones Jack Socket** is working but there is no sound via the **Loudspeaker** check the following:-

Is the **On/Off** switch **'On'**?
(The **Headphones** will work even when the **On/Off** switch **'Off'**)

Is the **3V** Screw fitted and screwed tight?
(The **Headphones** will work with just Screws **'0',** and **'GND'** fitted)

zbit:connector assembly diagram

BBC micro:bit

(Front)

M3 Nut

M3 Countersunk Head

M3 Pan Head

M3 Nut

clip board

spacer board

zbit:connector

zbit:speaker board

(Front)

zbit:speaker designer's guide

Here are a collection of examples to show the versatility and advanced features of **zbit:speaker**.

1) Reverse mounted zbit:speaker

zbit:speaker can be mounted on the back of the micro:bit using 3 x M3x10mm Threaded Spacers & 3 x M3x6mm Countersunk Screws.

To control the potentiometer the **Volume Spindle** can be inserted from the back as shown

2) Plugging zbit:speaker into other accessories

Since **zbit:speaker** has a **micro:bit** compatible edge connector it can be plugged into other **micro:bit** accessories. In this example it is plugged into the **Kitronik Motor Driver Board**.

Note that if the accessory connects to GPIO P3-20 a **zbit:connector** will need to be fitted to **zbit:speaker**

3) Connecting Crocodile Clips or Banana Plugs onto zbit:speaker

Since **zbit:speaker** has a **micro:bit** compatible edge connector, Crocodile Clips or Banana Plugs can be attached as shown.

4) Fitting Bluetooth Transmitter to zbit:speaker

The Aukey BT-C1 Bluetooth transmitter can be attached to the back of **zbit:speaker** using self adhesive velcro pads or Blu-Tak with the transmitter plugged into the headphones jack. It can be used to transmit sound effects, wirelessly to a Bluetooth speaker.

If there is no space to have a headphones plug sticking out the side (for instance if the **micro:bit** is to be fitted in a mobile phone arm band) the Headphones Jack can be de-soldered and rotated 180 degrees. (Note - the front pin of the headphones jack must be cut off for it to fit when rotated)

5) Fitting Top and/or Bottom SIL sockets

Soldering 20 way SIL socket to the Top and/or Bottom Row Headers pins gives access to all the micro:bit's GPIO. e.g. plug in LED's as shown. The Red LED plugged into P0 and GND will illuminate when you generate sound effects. The Amber and Green LED's can be controlled via P1 and P2.

6) Fitting zbit:thumb

With a 20 way SIL socket fitted to the Top Row Header of **zbit:speaker**, **zbit:thumb** can be attached allowing the **micro:bit** to be controlled from an analog Thumb Joystick via GPIO P1 and P2. See **zbit:thumb** for details
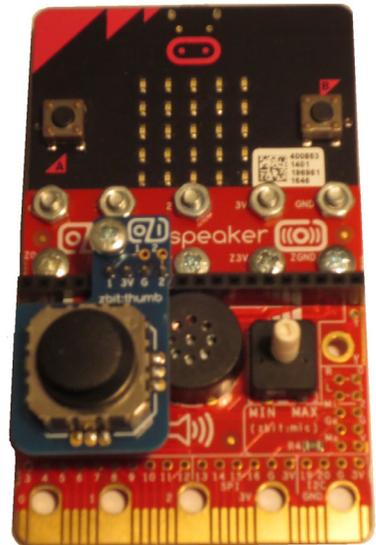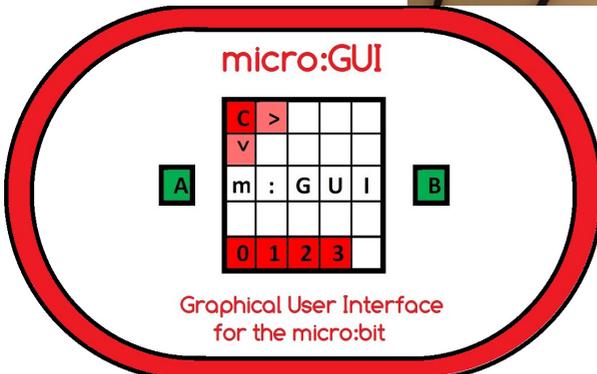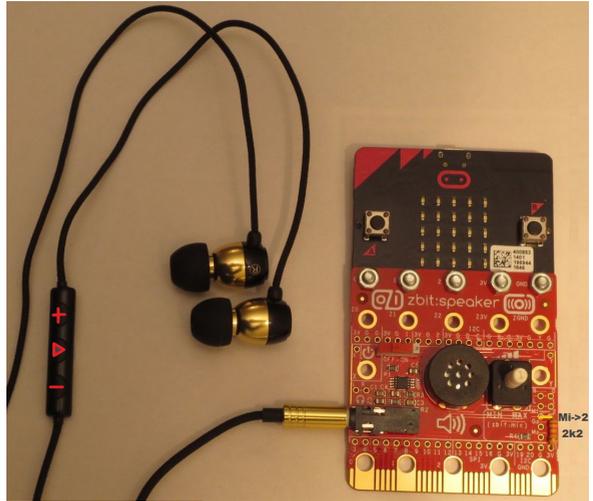
7) zbit:stereo

zbit:speaker can be modified to generate *stereo* sound effects via the Headphones Jack using GPIO P0 for right audio and GPIO P1 for left audio. (See separate Worksheet for full details)

8) Headphone [+ > -] Button Control
By adding a resistor and wire link to **zbit:speaker** the **micro:bit** can be controlled by the 3 pushbuttons [+ > -]on some sets of headphones

9) Use zbit:stereo with Headphone [+ > -] Buttons to control micro:GUI
The **micro:GUI** specification shows how **zbit:stereo** can be used for an 'audio:GUI' which could be controlled by the 3 Headphone Buttons

10) micro:bit 'Voice Recognition'

By connecting an Adafruit microphone plus 3 additional components to **zbit:speaker** it is possible to write the code control the **micro:bit** using voice commands. (See separate Worksheet gives full details)

11) Attaching other zbit:connect boards

Other **zbit:connect** boards can be attached in the x,y ot z axis. See **zbit:builder** instructions for further details.

12) Using xspacer and xy boards

These additional boards can be useful! See **zbit:builder** and **zbit:toolbelt** instructions for further details.

13) Fitting zbit:tool*kit* boards

Boards such as **zbit:shaker, zbit:Trol** and **zbit:power** can be plugged into **zbit:speaker's** Top Row and/or Bottom Row Headers in a similar way to **zbit:thumb**.

14) Driving speaker from GPIO P1 or P2

Most micro:bit programming languages generate sound effects on GPIO **P0**, so **zbit:speaker** is wired to this GPIO. However by cutting a track and adding a solder link wire, **zbit:speaker** can use GPIO **P1** or **P2** instead. This can be useful when using zbit:speaker with, for example, the Kitronik Motor Driver Board which uses **P0** to control the Motor.

13) Cardboard Megaphone

Print out the Cardboard 'Megaphone' and attach it to the speaker to increase the volume of **zbit:speaker**. It is surprising how this increases the volume considerably!