The ‘zbit:connect’ family guide

zbit:connect is a family of add-on boards for the **BBC micro:bit** brought to you by ***i*nnovations in *e*ducation**.

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 promote an **understanding of software programming** by encouraging the **writing of code** to **control external electronics**.

The **zbit:connect** family is designed to promote an **understanding of electronics** by encouraging ‘***positive hacking***’ such as modifying the **zbit:connect** boards to change or enhance their capabilities and/or **attaching your own electronics design**s to the **BBC micro:bit**.

And above all the **zbit:connect** family is designed for you to ***‘Have Fun while you Learn!’***

www.zbit-connect.co.uk

zbit:connect family features

Central to the **zbit:connect** family is the ***zbit:connector***. This ***unique custom connector*** designed by ***i*nnovations in *e*ducation** is small and light weight allowing **zbit:connect** boards to be simply bolted on to your **BBC micro:bit** without the bulk and weight of a traditional edge connector.

The **zbit:connector** uses advanced elastomeric technology to electrically connect the small edge connector pads on your **micro:bit** to the small pads at the top the **zbit:connect** board. The **zbit:connector** is not soldered. Instead it is held in place by 5 x M3 screws with a further 5 x M3 screws to bolt the **micro:bit** to the **zbit:connect** board, providing mechanical fixing plus electrical connection to the **micro:bit’s** large pads, P0, P1, P2, 3V & GND.

The **BBC micro:bit** compatible **Edge Connector** at the bottom of the **zbit:connect** boards allows you to add additional **zbit:connect** boards (or other **micro:bit** compatible boards) in the **y-axis**.

The **‘z’ screws** together with the **Top and Bottom Row Headers** allows you to add other **zbit:connect** boards in the **x and/or z-axis**. (Requires additional components).

The **‘x’ and ‘y’ screw holes** provide mechanical fixing points and allow you to feed **external power rails** onto your **zbit:connect** board to power motors and sensors that require a higher voltage than the 3.3V supplied by the **micro:bit** or can be used to connect **auxiliary signals** between boards.

The 20 way ‘**Top Row Header’** provides access to GPIO P0, P1 & P2, I2C, 3V and GND plus X & Y auxiliary signals/power rails. It can be used for local access to these GPIO or to attach **‘zbit:toolkit’** boards. P0, P1 & P2 have adjacent GND & 3V pins allowing many 3 pin sensors, servos, etc to plug in. I2C signals ‘D’ (SDA GPIO P20) and ‘C’ (SCL GPIO P19) have adjacent GND & 3V pins making a **4 pin I2C connector**.

The 20 way ‘**Bottom Row Header’** provides access to GPIO P3-P20, 3V & GND presenting P19, P20, GND and 3V as an auxiliary **4 pin I2C connector** and P13-P16, GND & 3V as a **6 pin SPI connector**.

The **I2C Connectors** allows you to connect to a vast range of **I2C Boards.** You could also **design your *own* I2C board!** I2C Boards available from manufacturers such as **Adafruit** and **SparkFun** include **Seven Segment Displays**, **Dot Matrix Displays**, **Bargraph Displays**, **Digital-to-Analog Converters**, **Analog-to-Digital Converters**, **Real Time Clock Modules**, **Light Sensors**, **Proximity Sensors**, **Gyro Sensors**, etc.
(***Note – These I2C boards don’t always have the I2C signal and power pins in the same order as the zbit:connect board’s I2C Connectors hence some rewiring may be required***)

Version 0.1 (Preliminary, subject to change)

The zbit:connect family of boards

There are numerous boards in the **zbit:connect family** but they can be subdivided into 4 categories

1) Full size zbit:connect boards

Features:-
- **52x55mm** PCB's
- **zbit:connector compatible** edge connector at the top
- **micro:bit compatible** edge connector at the bottom
- **Top Row Header** for connection to P0, P1, P2, I2C, 3V, GND, X & Y
- **Bottom Row Header** for connection to P3-20, 3V & GND
- **Z0, Z1, Z2, Z3V & ZGND** fixing holes
- **X & Y** fixing holes
- Can be connected to other **full size *or half size* zbit:connect boards** in **X, Y or Z axis**.
- Can be plugged into **micro:bit accessories from other companies**

Full size zbit:connect boards include:-
- **zbit:speaker**
- **zbit:builder**
- **zbit:breadboard**
- **zbit:motor**
- **zbit:Trol**
- **zbit:expander**

2) Half size zbit:connect boards

Features:-
- **52x33mm** PCB's
- **zbit:connector compatible** edge connector at the top*
- **micro:bit compatible** edge connector at the bottom
- **Top Row Header** for connection to P0, P1, P2, I2C, 3V, GND, X & Y**
- **Bottom Row Header** for connection to P3-20, 3V & GND**
- Top and Bottom Row Headers are adjacent hence a 2 row, **40 pin connector** can be fitted
- **Z0, Z1, Z2, Z3V & ZGND** fixing holes
- Can be connected to other **half size *or full size* zbit:connect boards** in **X, Y or Z axis**
- (***Two* half size zbit:connect boards** bolted together are exactly the **same size as a full size board**)
- Can be plugged into **micro:bit accessories from other companies**

Half size zbit:connect boards include:-
- **zbit:toolbelt**
- **zbit:PiDapter** (****40 pin connector** pinout is **compatible with the *Raspberry Pi***. It is ***not*** compatible with the Top and Bottom Row Header pinout other zbit:connect boards)
- **zbit:kwikconnect:0:180** (*uses conventional **edge connector socket**, rather than zbit:connector)

3) zbit:tool*kit* boards

Small boards primarily for use with **zbit:toolbelt** or **zbit:kwikconnect:0:180** which plug into the top and/or bottom row header connectors. Most are also compatible with the Top and Bottom Row Headers of full size **zbit:connect** boards.

zbit:tool*kit* boards include:-
- **zbit:headphones**
- **zbit:shaker**
- **zbit:power:usb**
- **zbit:logic:probe**

4) **Auxiliary boards**
   Small boards to help mechanically and electrically interconnect the zbit:connect boards. These are normally supplied with the zbit:connect boards as **'snap-off' boards** but may also be available to buy as optional extras.

   Auxiliary boards include:-
   - **spacer board**
   - **clip board**
   - **xspacer board**
   - **xy board**
   - **zbit:pwr:bar**

zbit:connector specification

The **zbit:connector** is an elastomeric connector consisting of fine layers of conductive carbon with adjacent insulating layers. The conductive layers electrically connect the small edge connector pads on your **micro:bit** to the small pads at the top the **zbit:connect** boards. Since the conductive layers are made of carbon the connector introduces a small electrical resistance of about 50 ohms (typical). In most applications this resistance is negligible compared to the input impedance of the micro:bit GPIO.

The **zbit:connector** is not soldered. Instead it is held in place by 5 x M3 screws with a further 5 x M3 screws to bolt the **micro:bit** to the **zbit:connect** board, providing mechanical fixing plus electrical connection to the **micro:bit's** large pads, P0, P1, P2, 3V & GND. To ensure a good electrical connection the 10 M3 screws must be screwed tight – ***but do not over tighten!***

Why are zbit:connectors sold separately?

Not all applications require a zbit:connector and since the zbit:connector is a significant cost item the zbit:connect board may be supplied ***without*** a zbit:connector but with the zbit:connector available as an optional extra (***when ordering boards check if the zbit:connector is included or is an optional extras***). Also, since the zbit:connector is not soldered, it can be moved from board-to-board. Hence if you have two zbit:connect boards that need a zbit:connector but you only use one board at a time, then you only need one zbit:connector which can be switched between boards, saving you the cost of a 2nd zbit:connector.

Does my application require a zbit:connector?

A zbit:connector is not essential if the attached board only connects to GPIO P0, P1 and/or P2 as these signals, along with **3V** and **GND**, are electrically connected by the M3 screws. So, for instance **zbit:speaker** which just connects to P0, 3V and GND **does *not* need a zbit:connector**. However if another board that uses GPIO **P3-20** is attached to **zbit:speaker's *bottom edge*** connector, **zbit:speaker *would* need a zbit:connector**.

Why are the Top and Bottom Row Header connectors supplied separately?

Many applications don't require the Top and Bottom Row Header connectors to be fitted. Furthermore, there are various different header connectors that could be fitted (male header pin, female sockets pins, extended tail versions, single row versions, dual row version, etc) hence these connectors may be supplied separately so that you can order the header needed for your application (***when ordering boards check if a Top and/or Bottom Row Header connector is included or is an optional extras***)

Do the boards need soldering?

Most **full size zbit:connect boards** come fully soldered and ready to use but some may require header connectors, etc to be soldered. (***when ordering boards check if header connectors, etc need soldering***). Also, some advanced features of the boards may require soldering extra wires or components. For example, **zbit:speaker** is supplied fully soldered and **connected to GPIO P0**, the normal GPIO used to generate sound

effects. If however you wish to generate sound effects using **P1** or **P2** it would be necessary to cut a track and solder a link.

Most **half size zbit:connect boards** come ***without the 40 way header connector fitted***. If this header connector is required, it will need to be soldered.

The **zbit:tool*kit* boards** come with all main components soldered. The header pins however are supplied unsoldered, so require soldering. This is to give you the option of either fitting the supplied header or fitting a different connector to suit your application.

The auxiliary boards have no components however for some advanced applications, for instance distributing auxiliary power and signals between boards, soldering wire links may be required.

What tools are needed?

The basic tools needed to assemble a zbit:connect board are:-

- Pozidrive Screwdriver
- Pliers
- Small File

The Screw Driver is needed to tighten the screws attaching the zbit:connect board to your micro:bit.
The Pliers are needed to tighten the nuts and snap-off the auxiliary boards from the main zbit:connect board.
The File is needed to file down the PCB's rough edges where the auxiliary boards snap-off.

Boards with connectors, etc to solder will require:-

- Soldering Iron
- Solder

Whilst not essential, other tools which could be useful are:-

- Wire Cutters
- Scalpel
- De-soldering braid
- Multimeter

A multimeter is particularly useful to check signals are connected and not shorted and to check voltages are correct.

Why is the family of boards called 'z' bit?

There are 3 reasons why these boards are called 'z' bit.

Firstly, the elastomeric **zbit:connector** is known as a ***'z-axis'* connector** as it connects together edge connector pads in the z-axis.

Secondly, whilst in binary a 'bit' can be a '0' or a '1'. In electronics, a GPIO can be set to 3 different states. When configured as an output it can be set to drive 'low' indicating a binary '0', or drive 'high' indicating a binary '1'. However, when configured as an *input* it is set to 'high impedance', often represented by the letter 'Z'. So **in *electronics* a 'bit' can be a '0', '1' or 'Z'**.

And **thirdly**, just as...
"k" stands for "kilo" (10^3) - so a kilobit or kbit means 1,000 bits, and...
"M" stands for "Mega" (10^6) - so a Megabit or Mbit means 1,000,000 bits, and...
"G" stands for "Giga" (10^9) - so a Gigabit or Gbit means 1,000,000,000 bits.
"Z" stands for "Zetta" (10^{21}) - so a Zettabit or **Zbit is 1,000,000,000,000,000,000,000 bits!**
...which is hopefully the number of micro:bits that are eventually made to help get the whole world coding!!!