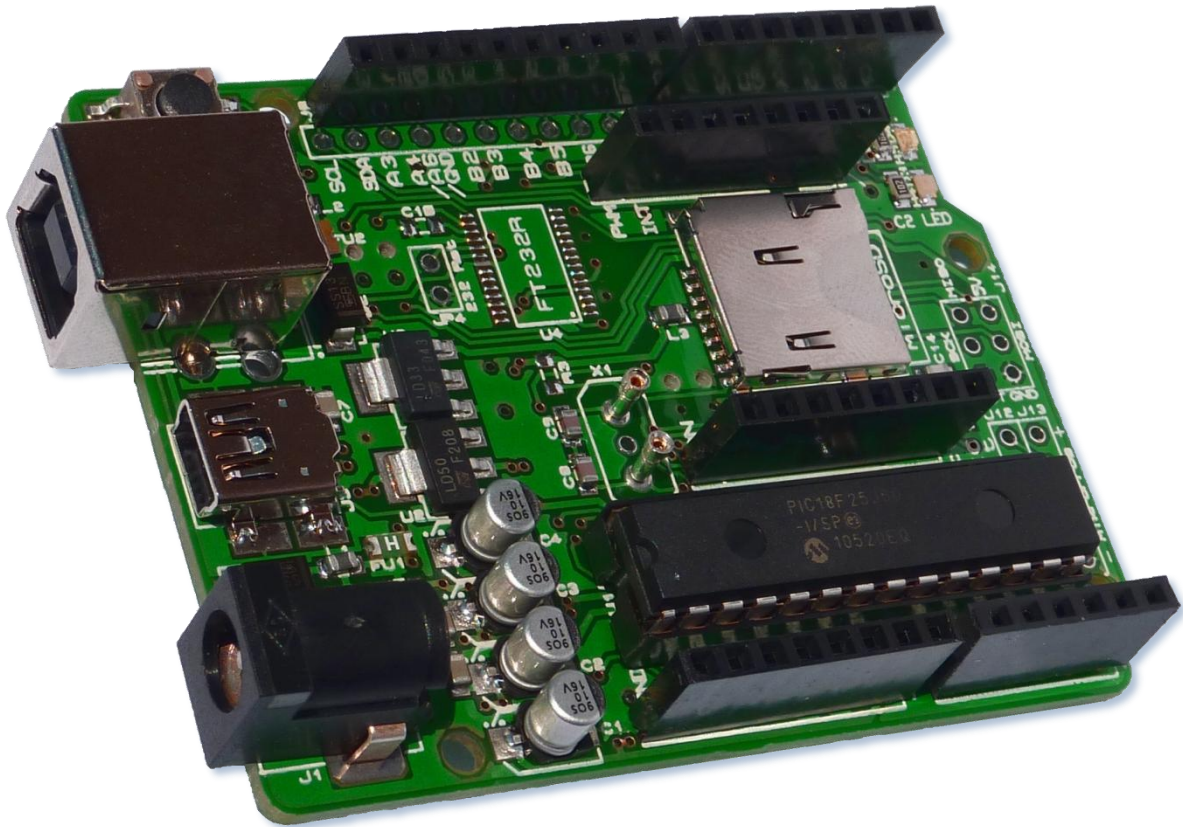


# Breeze Board

Type B



User Manual

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# Introduction

The Breeze is a compact and cost-effective microcontroller platform, drawing inspiration from the Arduino ([www.arduino.cc](http://www.arduino.cc)) and Amicus ([www.myamicus.co.uk](http://www.myamicus.co.uk)) microcontroller platforms. It also features a mikroElektronika ([www.mikroe.com](http://www.mikroe.com)) mikroBus socket.

At the most basic level, the Breeze board takes care of providing power to the microcontroller and conveniently exposing its I/O (input/output) pins. It also provides a socket for connecting an external crystal oscillator, includes a convenient reset button, and provides connections for two different types of external programmers – the mikroProg and the PICkit (programmers are not needed to use the board however, as the microcontroller comes pre-loaded with a bootloader – more on that later). The board also includes a power LED, so that you can easily see when the board is powered or not.

Besides for the above-mentioned basic features, the Breeze also includes a USB connection, a microSD socket for storing data, a mikroBus socket for easily connecting a variety of accessory boards and a LED connected to one of the PIC's I/O pins. The Breeze is also the same size and shape as the Arduino, and every effort has been made to match the pinout of the Arduino as closely as possible, which means that the board is compatible with most Arduino shields/enclosures/etc.

The microcontroller used on the Breeze B is the PIC18F25J50, which features full-speed USB.

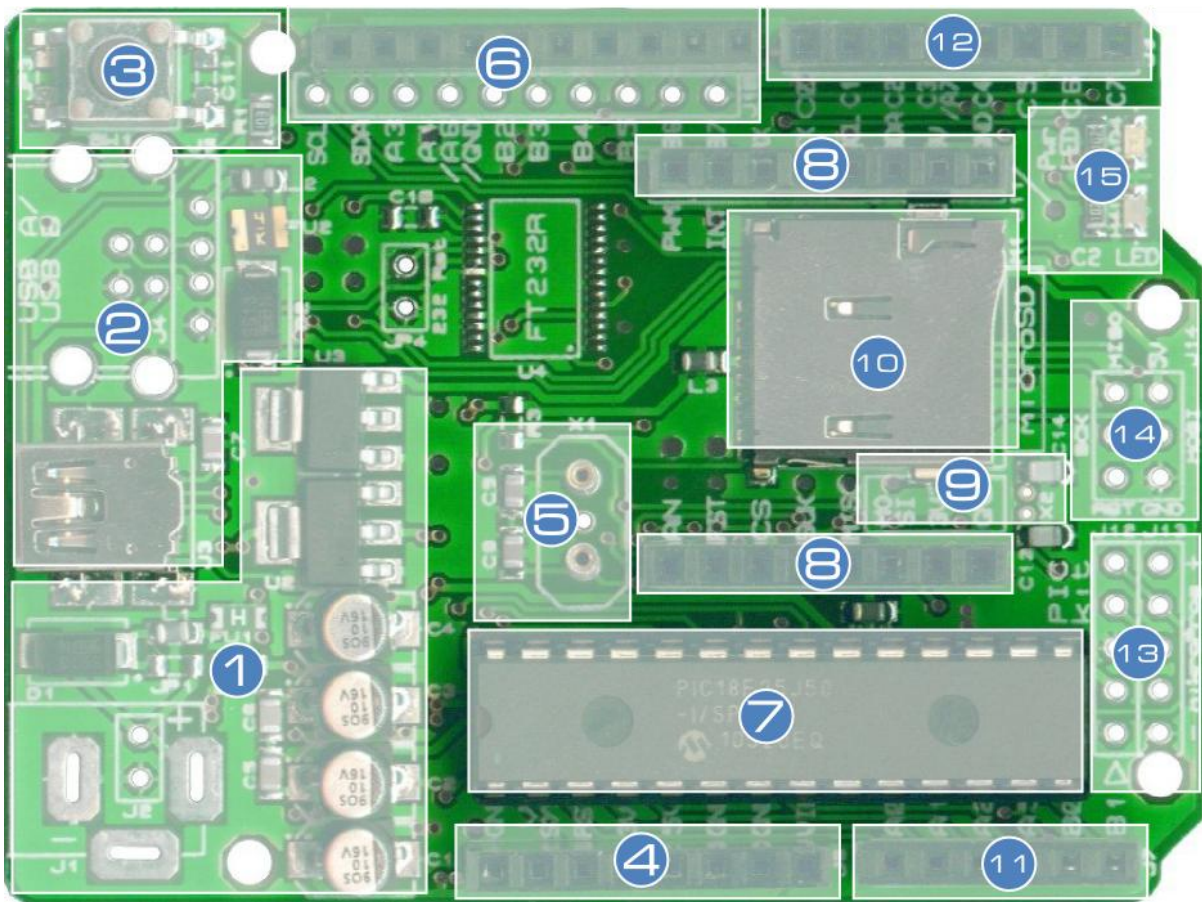
The mikroBus socket allows “click” boards from mikroElektronika to be easily plugged into the system. This means that the functionality of the system can be easily extended with features such as Ethernet, WiFi, an MP3 decoder, GPS, and much, much more. There are currently over 30 “click” boards, and counting.

The LED, connected to PortC.2 of the PIC, is extremely useful for debugging, or whatever else you may need it for.

Finally, the PIC microcontroller comes pre-programmed with a USB-HID bootloader, meaning that no external programmer is needed to program the board.

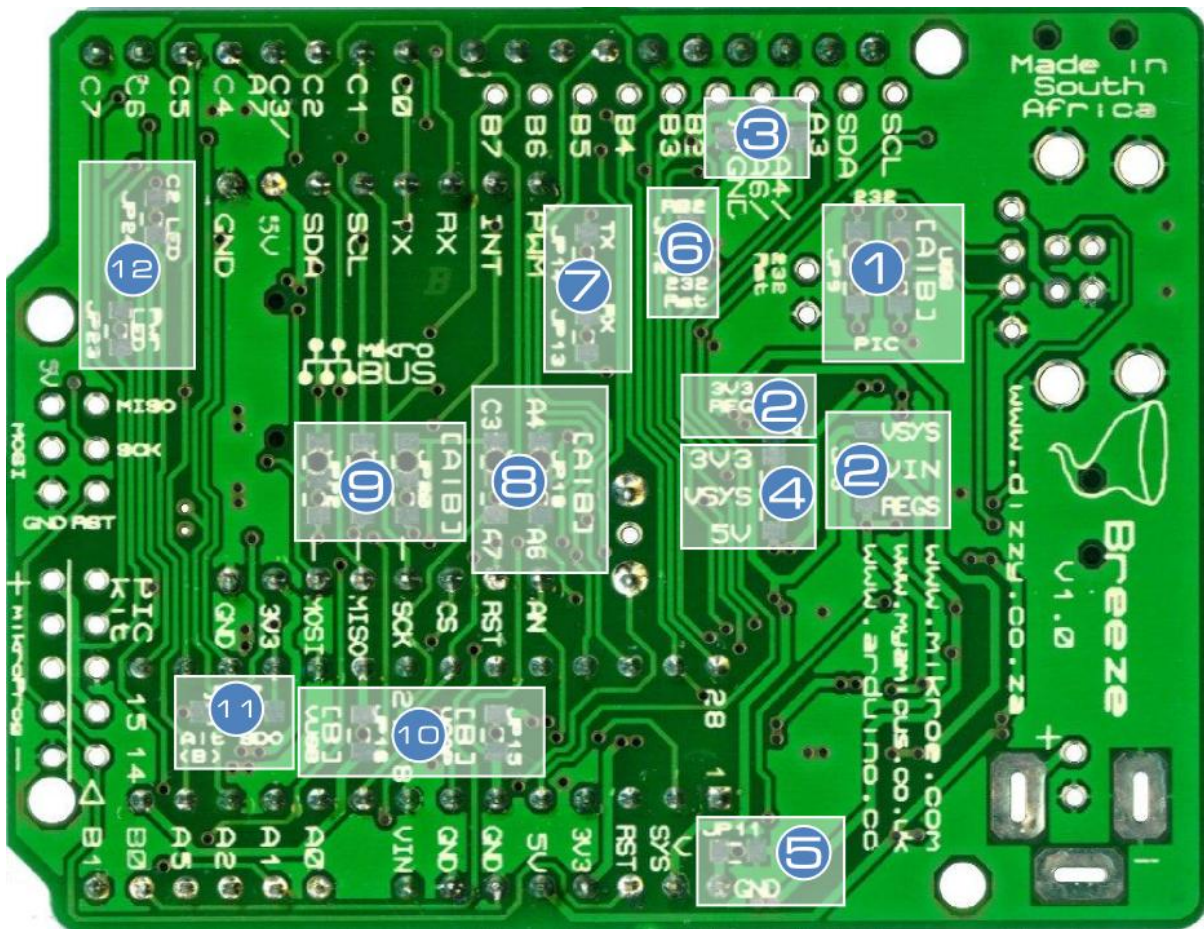
Whether you're a beginner who is just getting started with microcontrollers, or a pro that has been using them for ages, we hope that the Breeze will be exactly what you need to continue your journey.

## Overview – Top



1. Power-supply circuitry.
2. USB.
3. Reset button.
4. Power socket (3.3V, 5V, Ground, VIN, VSYS).
5. Oscillator socket.
6. PortB socket (inputs and outputs).
7. PIC18F25J50 microcontroller.
8. mikroBus socket.
9. Connections for 32.768kHz oscillator.
10. microSD socket.
11. PortA/analogue socket (inputs and outputs).
12. PortC socket (inputs and outputs).
13. Programmer connectors (mikroProg/PICkit).
14. Arduino compatibility "ISP" connections.
15. Power and PortC.2 LEDs.

## Overview – Bottom



Although there are many jumpers on the Breeze, most (if not all) of them can be ignored – so if you're a beginner then don't feel overwhelmed, you really don't need to pay any attention to any of these!

The most relevant jumpers are the VSYS jumper (4), which is necessary if you wish to use a 5V microcontroller with the system, and the Arduino compatibility jumpers (3) and (5), which may be necessary if you wish to use an Arduino shield with the system.

1. [Advanced users only] Breeze type A/B USB-UART/direct-USB jumpers.
2. [Advanced users only] Power circuitry reconfiguration.
3. PortA.4/Ground jumper: For compatibility with Arduino shields, this jumper can be placed in the "GND" position.
4. VSYS jumper: This jumper is used to select whether VSYS (which is used to power the microcontroller) is connected to 3.3V or 5V. I.e. if you wish to use a 5V microcontroller with the system, then place this jumper in the 5V position (also make sure that the 3.3V jumper has been disconnected).
5. For maximum compatibility with Arduino shields, this jumper can be disconnected (this connection is currently unused on the Arduino).

6. [Breeze type A only] USB-UART (FT232R) / PortB.2 jumper: This jumper can be used to connect PortB.2 of the PIC to the FT232R's reset connection, enabling you to disable the FT232R from the PIC if desired.
7. [Breeze type A only] USB-UART (FT232R) Rx/Tx jumpers: These jumpers can be used to disconnect the FT232R from the PIC's Rx and Tx connections.
8. [Advanced users only] Breeze type A/B PortA.4/PortA.6 and PortC.3/PortA.7 selection jumpers.
9. [Advanced users only] Breeze type A/B SPI/I<sup>2</sup>C connection selection jumpers.
10. [Advanced users only] Breeze type B VCAP and VUSB connection jumpers.
11. Alternative SDO connection jumper: This jumper can be used to connect the board's SDO line to PortB.6 instead of PortC.7 (PortC.7 is also the board's RX line).
12. LED disconnect jumpers: These jumpers can be used to easily disconnect the LEDs.

## Getting Started (USB Bootloader)

This quick-start guide is designed to get you up-and-running with your Breeze board as quickly as possible.

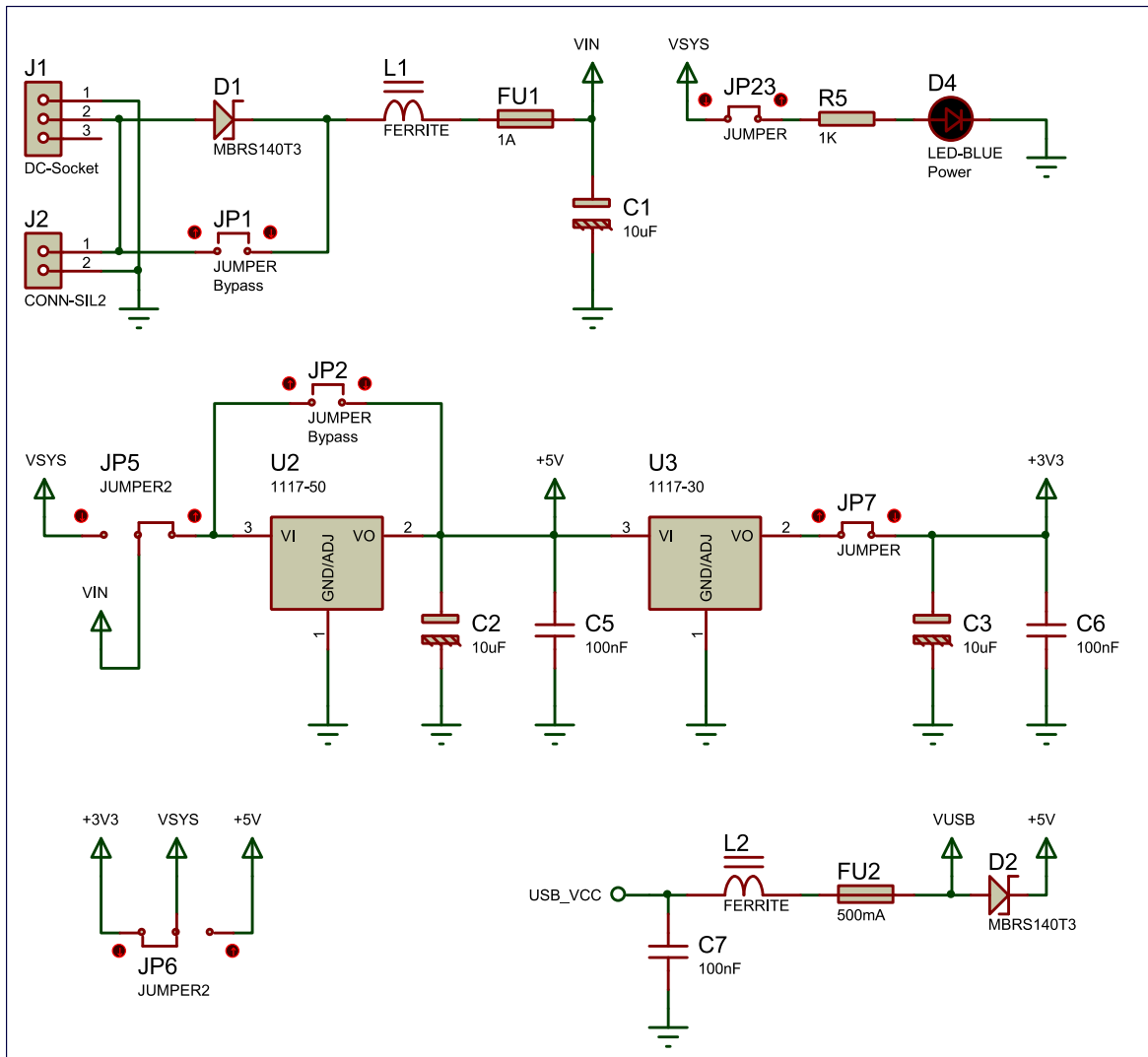
1. Download and install your preference of one of mikroElektronika's PIC compilers (mikroC, mikroBasic or mikroPascal) from [www.mikroe.com](http://www.mikroe.com). If you're not sure which one to use then we'd say that BASIC is easier to understand, but we would recommend that you go with C. These compilers are free up to a 4KB of code.
2. Download the Breeze B example projects from [www.dizzy.co.za](http://www.dizzy.co.za).
3. Start up your compiler and open our "Blink" example project (click "Open Project..." on the Start Page – if the Start Page is not visible then click "View" -> "Start Page").
4. Compile the project ("Build" -> "Build").
5. Start the USB-HID Bootloader application by clicking "Tools" -> "USB HID Bootloader".
6. Connect your Breeze board to the computer via a USB cable, and check that the power LED on the Breeze board lights.
7. When you connect the board there is a 5 second window during which the USB symbol next to the "1. Wait for USB link" text in the bootloader application will turn red – click the "Connect" button within this time period. If you miss it don't worry – simply press the reset button on the Breeze board and try again.
8. Click the "Browse for Hex" button, and locate the "Blink.hex" file in the same directory as the "Blink" example project.
9. Click the "Begin uploading" button.

That's it! The LED connected to PortC.2 of the PIC on your Breeze board should now be flashing at 1 second intervals.

*Note: You can still use the mikroBootloader application even if you don't wish to use one of mikroElektronika's compilers – simply download it [from our website](http://www.dizzy.co.za).*

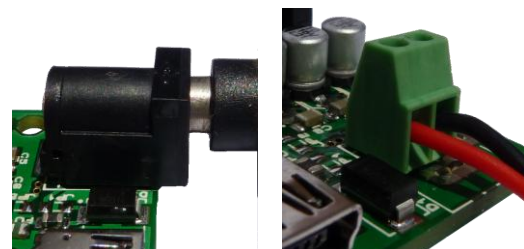
# Power Circuitry

The schematic for the Breeze's power circuitry is detailed below:



The main points are:

- DC socket or terminal-block power-input connectors.
- Reverse-polarity protection diode.
- Fuse.
- 5V and 3.3V regulators.
- USB power-source option, with fuse and reverse-current protection diode.
- VSYS selection jumper, between 3.3V and 5V (change this to 5V if you plan to use a 5V PIC with the system).
- Power LED.



DC socket

Terminal Block

For advanced users, the power circuitry can be reconfigured:

- JP1 can be used to bypass the polarity protection diode, thus eliminating the voltage drop caused by the diode.
- JP2 can be used to bypass the 5V regulator (if, for example, a 5V power supply is used).
- JP5 can be used to bypass both regulators. This is intended to be used when the system is powered by a 3.6V lithium battery. Either JP7 or JP6 should also be disconnected if this is used.

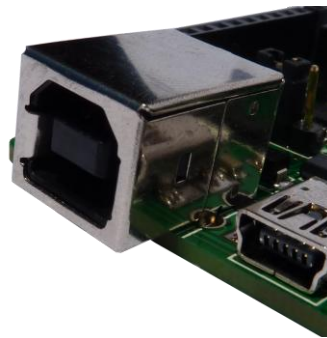
For more information on the power socket, please see the “Inputs and Outputs” section of this manual.

## USB

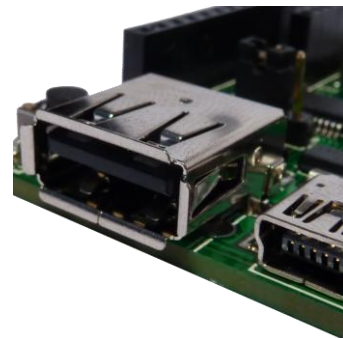
The Breeze comes with a miniUSB connector, and has the option to install a USB-B or USB-A connector as well.



miniUSB Connector



USB-B Connector



USB-A Connector

The USB connector's D- line is connected to PortC.4 of the PIC, and its D+ line is connected to PortC.5.

## Microcontroller

The microcontroller used in the Breeze B is the PIC18F25J50.

The PIC18F25J20 features:

- Operating voltage range from 2.0V to 3.6V.
- 32KB of program memory and 3776B of SRAM.  
(Approximately 6800B of program memory are used by the USB-HID bootloader).
- Operating frequency up to 48MHz (12MIPS).

For more information on the PIC18F25J50 please download its datasheet from

<http://www.microchip.com/wwwproducts/Devices.aspx?dDocName=en534040>



It is of course possible to replace the PIC18F25J50 with almost any other 28-pin 8-bit PIC microcontroller (adjustment of some jumpers on the board may be necessary).

## Oscillator Socket

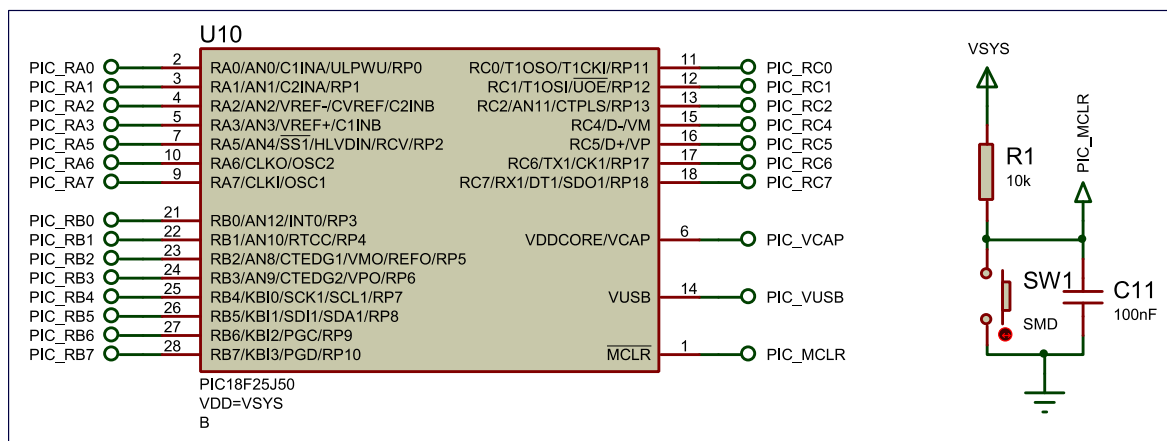
The Breeze comes programmed to run from the PIC's internal oscillator. An oscillator socket (X1), with 22pF capacitors, is however provided should you wish to connect an external oscillator. The oscillator socket is connected the PIC's PortA.6 (CLKO) and PortA.7 (CLKI) pins.

## Reset Button

A tactile switch (SW1) is connected to the MCLR pin of the microcontroller. Depressing this button will pull the MCLR pin low and place the microcontroller in a state of reset. Releasing the button will allow the R1 resistor to pull the MCLR pin high again, and program execution will restart from the beginning. (Note: The reset button will not work if the MCLR function has been disabled on the PIC by programming it with the relevant configuration setting).

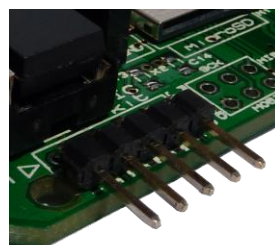
## Schematic

The schematic for the microcontroller and reset button is detailed below:

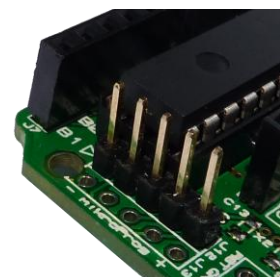


## Programming

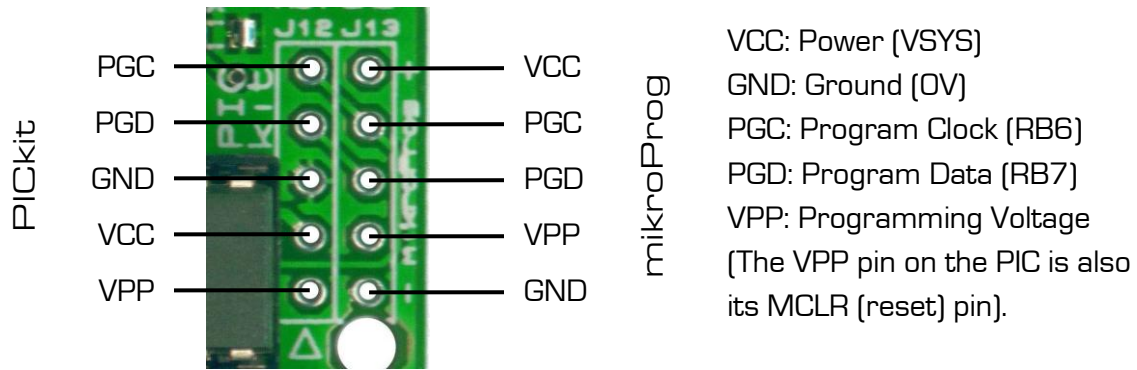
The Breeze B comes pre-loaded with a USB-HID bootloader, meaning that no external programmer is needed in order to use the board. It is however possible to use an external programmer if desired, with connectors provided for both the mikroProg and PICkit programmers.



Right-Angle Connector  
(in PICkit socket)



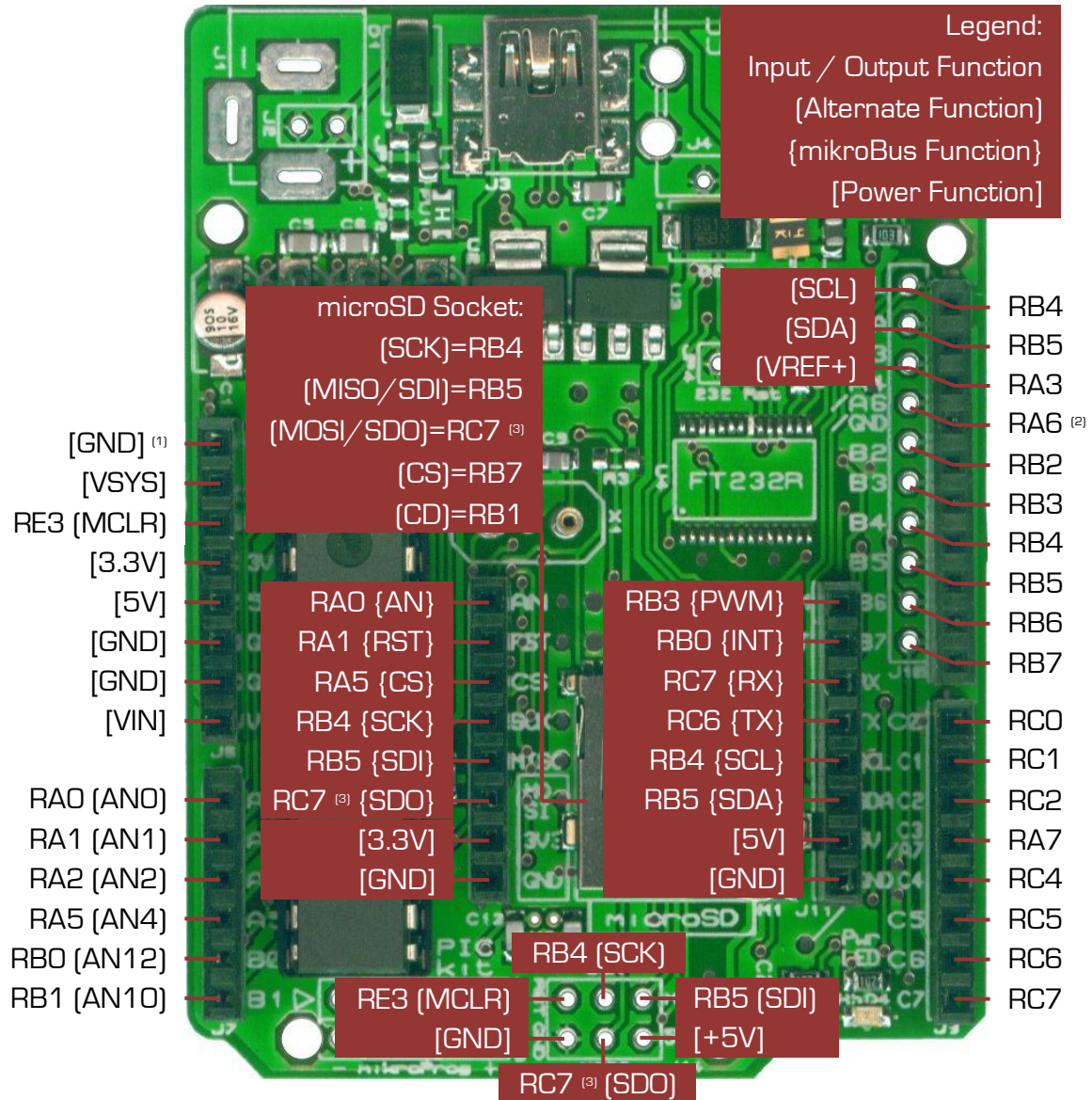
Straight Connector  
(in PICkit socket)



For a quick guide on how to program the board using the bootloader, please see the “Getting Started” section of this manual.

## Inputs and Outputs

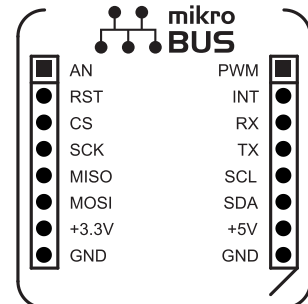
The inputs and outputs of the Breeze B board are detailed in the following diagram:



- (1) Can be disconnected using jumper JP11
- (2) Can be connected to ground instead using jumper JP10
- (3) Please see the “USB” section of this manual for more information

## mikroBus Socket

The mikroBus socket allows a huge variety of mikroElektronika ([www.mikroe.com](http://www.mikroe.com)) “click” add-on accessory boards to be connected to the system. There are currently over 30 “click” boards and counting, performing a vast variety of functions such as communication, storage, audio, etc.



“ETH click” Ethernet board connected



“WiFi PLUS click” WiFi board connected

The mikroBus connections are explained in greater detail below:

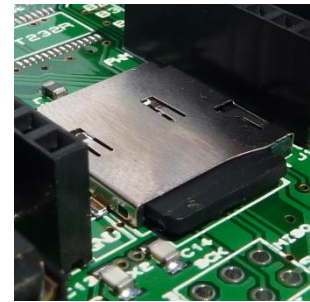
AN	Analogue	Pulse Width Modulation	PWM
RST	Reset (different from the PIC's reset)	Interrupt	INT
CS	SPI Chip Select	UART (Serial) Receive	RX
SCK	SPI* Serial Clock	UART (Serial) Transmit	TX
MISO	SPI* Master-Out Slave-In (SDI on the PIC)	I <sup>2</sup> C** Serial Clock	SCL
MOSI	SPI* Master-In Slave-Out (SDO on the PIC)	I <sup>2</sup> C** Serial Data	SDA
+3.3V	3.3V Power Supply	5V Power Supply	+5V
GND	Ground (0V Power Supply)	Ground (0V Power Supply)	GND

\*Serial Peripheral Interface (communication interface)

\*\* Inter-Integrated Circuit (communication interface)

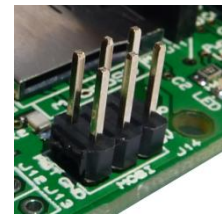
## microSD Socket

A microSD socket is included on the Breeze board. It is connected to the standard SPI pins on the board, with the CS (chip select) pin being connected to PortB.7 and the CD (card detect) pin being connected to PortB.1. The card detect function is intended to be used with the internal “weak pull-up” available on the PIC’s PortB.1 pin, however an external pull-up resistor (R3) can also be connected if desired.



## “ISP” Header

“ISP” connections are included on the Breeze board for maximum compatibility with Arduino shields. “ISP” is the programming standard for Atmel AVR ATmega microcontrollers, which the Arduino uses. Note that soldering this header onto the board will block access to the microSD socket.



## PortC.2 LED

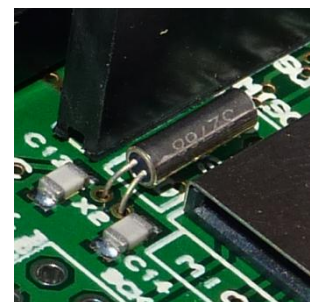
An LED is connected to PortC.2 of the PIC, and is very useful for debugging, or whatever other purpose you may find for it. It can be easily disconnected if desired using jumper JP24.

## Offset PortB Socket

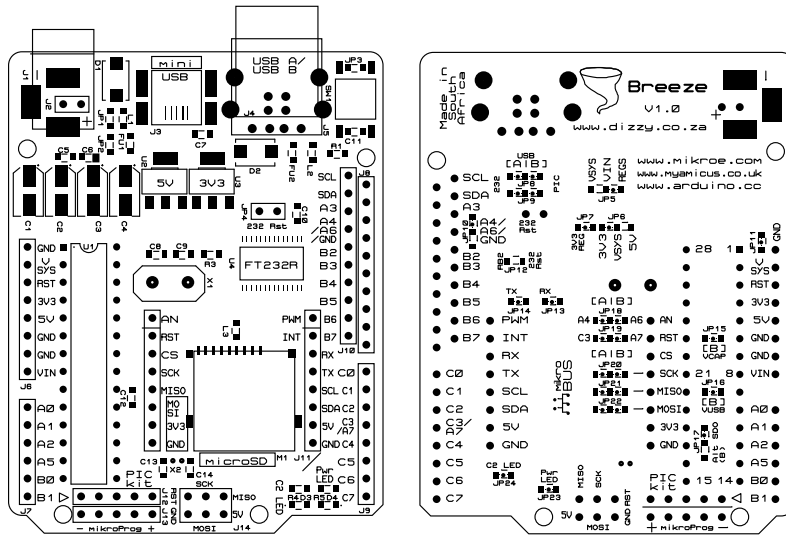
An offset PortB socket is provided on the Breeze board. This was done so that all connections on the board are exposed in a 2.54mm (0.1in) grid format, making the board compatible with various prototyping tools such as veroboard.

# RTCC (Real-Time Calendar and Clock)

The PIC18F25J50 features a built-in RTCC (real-time calendar and clock). The Breeze board has a facility for connecting a 32.768kHz crystal (X2) to the PIC’s PortC.0 (T1OSCO) and PortC.1 (T1OSCI) pins, in order to run the RTCC. Two 12pF capacitors are also connected between ground and these lines in order to facilitate proper operation of the oscillator.



# Drawing



For more information please see the “Arduino Template” file, available from the [Breeze page on our website](#).

# Microcontroller I/O Map

RA0	mB AN	RP0	RB0	mB INT	RP3	RC0	(T1OSCO)	RP11
RA1	mB RST	RP1	RB1	(SD CD <sup>1</sup> )	RP4	RC1	(T1OSCI)	RP12
RA2			RB2		RP5	RC2	LED	RP13
RA3			RB3	mB PWM	RP6			
			RB4	SCK/SCL	RP7	RC4	USB D-	
RA5	mB CS	RP2	RB5	SDI/SDA	RP8	RC5	USB D+	
RA6	(OSC2)		RB6	(Alt. SDO <sup>2</sup> ) (PGC)	RP9	RC6	mB RX	RP17
RA7	(OSC1)		RB7	(SD CS <sup>1</sup> ) (PGD)	RP10	RC7	SDO <sup>2</sup> mB TX	RP18

- 1) Only applicable if an SD card is inserted. SD Card Detect switch is normally open – R3 can be used to pull-up the input, if the PIC's internal weak pull-up is not used.
- 2) JP17 can be used to switch SDO to RB6.

# Links

The Breeze B board:

- Is designed by Dizzy Enterprises ([www.dizzy.co.za](http://www.dizzy.co.za)).
- Is designed in the Proteus Design Suite ([www.labcenter.com](http://www.labcenter.com)).
- Features a mikroBus socket ([www.mikroe.com](http://www.mikroe.com)).
- Is compatible with (most shields), and draws inspiration from, the Arduino ([www.arduino.cc](http://www.arduino.cc)).
- Draws inspiration from, the Amicus ([www.myamicus.co.uk](http://www.myamicus.co.uk)).

## Disclaimer

This part says that you cannot sue us because we accept no responsibility for any damages whatsoever that may be caused in connection with our products. We've designed them the best we can, but please, use your common sense.

## Errata

### 32.768kHz Crystal Pads

Due to an error in production the 32.768kHz crystal connection pads have been covered in solder-resist and will not solder easily. This problem is however easily solvable by gently scraping the solder-resist from the pads with a knife or similar sharp object. Note that the colour of the pads once the solder-resist has been removed will be copper and not silver.