2.) Wiring your Duet

Written By: Filastruder
Step 1 — Board Diagram

- Take a moment to familiarize yourself with the wiring diagram. It may help to open the high resolution image in another window, or print it out.

- Note that the pictures are from an earlier version of the Duet however the wiring guide steps are still valid.
Step 2 — A Note on Fire Safety

⚠️ **WARNING:** it is imperative that you use the provided ferrule connectors for the power supply, hotend heaters, and bed heater.

⚠️ Failure to use the provided ferrules can result in wire creeping, causing the wires to come loose and can possibly create a short circuit, which could result in fire.

- The crimp tool shown in this photo is a basic and inexpensive tool available from any hardware store, electrical shop, etc.

- The method of crimp shown here is called an indent crimp. You should ensure that the tool you use provides a tight crimp to the ferrule.

- It is also best to use the include Molex connectors for all other connections as they ensure correct polarity and lock into place.
Step 3 — Powering the Duet Board

- Connect your power supply to the Power In terminal.

- Be sure to observe correct polarity when making the connections.

**WARNING:** It is HIGHLY recommended to use the included ferrules, by crimping them to the wires before putting the wires in the terminal block. Failure to do so could allow the wires to creep over time, become loose, and could possibly short circuit and start a fire.

- Do not tin (add solder to) these wires.

- Be sure not to twist the terminal block while tightening the screws. It can help to hold the terminal block while tightening.

- Check the screws after a few days/week of operation to ensure they are still snug.

**i** The gauge of wire should be appropriate to the current that the Duet will draw. This depends on a number of factors, however at its maximum this will be dominated by the 15A for the bed heater. The red and black ferrules provided are 1.0mm^2 and 1.5mm^2 respectively. This relates to 17 and 15 AWG respectively.
Step 4 — Communicating With the Duet Board

- Lets begin by ensuring there's a connection to the board. This can be over USB, wifi, or ethernet. Please refer to [Getting Connected to Your Duet](duet3d.dozuki.com/) for details.

- We'll be using Duet Web Control during this guide, though you can use your favorite host software over USB if a network connection is unavailable.

- If using USB, connect a USB cable at this time.
Step 5 — Reset button and erase button/jumper

- We'll start at the reset button, and work our way around the wiring diagram clockwise.
  - The reset button reboots the board, this is OK to press if a reboot is needed.

- The firmware is erased in one of two ways depending on the hardware PCB revision:
  - For revisions v1.04 and later it is a jumper which is bridged to erase the firmware.
  - For all versions prior to v1.04 it is through an erase switch.

- The erase jumper/button will erase the firmware that is stored on the main processor. The SD card does not hold the firmware, just some configuration files.

- Do not press the erase button unless you know what you are doing. There firmware does not need to be erased for normal upgrading. The process of reinstalling the firmware after it is erased is detailed in fallback procedure #3.
Step 6 — LED Indicators

- These indicators show the status of 3.3v power, 5v power, the Vin (power from your power supply) and the two extruder heaters.

- When the board is idle and connected to a power supply, expect the 3.3v, 5v, and Vin LEDs to be illuminated.

- When the board is powered only through an external 5v supply or through USB, expect only the 5v and 3.3v lights to be on.

- In this area you will also find indicators to show when an extruder heater is turned on.
Step 7 — Endstops

Endstops tell the printer when the travel limit has been reached on a particular axis. The Duet's connections are a little different than RAMPS style boards, so please review this step and your endstops carefully.

- X Endstop
- Y Endstop
- Z Endstop

From left to right on an endstop connector, the pins are signal, +3.3v, and GND.

- If using 2 wire microswitch endstops, connect one wire to GND and the other wire to signal (the outer two pins).

- If using other endstops, please refer to this link for details.

⚠️ Never connect your endstop wires from +3.3v to ground. This will create a short circuit and could damage the Duet.
Step 8 — Checking Endstops

It is important that you check that the Duet is receiving a signal from your endstops. Failure to do so could cause damage to your printer!

- You can see the live status of your endstops in the Machine Properties section of the web interface. Here's how to access it:
  - Navigate to "Settings"
  - Click the "Machine Properties" tab.
  - "Endstop Hit" shows an instantaneous status of each endstop.
  - The default endstop mapping is: X=0, Y=1 and Z=2.

The endstop status displayed might not be correct. If it is wrong, we will fix this in configuration.
Step 9 — Hotend Heaters

- Your hotend heaters should be connected here. From left to right, the connectors are E1 and E0.

- Polarity does not matter for hotend heaters.

WARNING: It is HIGHLY recommended to use the included ferrules, by crimping them to the wires before putting the wires in the terminal block. Failure to do so could allow the wires to creep over time, become loose, and could possibly short circuit and start a fire.

- Do not tin (add solder to) these wires.

- Be sure not to twist the terminal block while tightening the screws. It can help to hold the terminal block while tightening.

- Check the screws after a few days/week of operation to ensure they are still snug.
Step 10 — Motors

The Duet uses internal stepper drivers. In the event that you desire external drivers, consult the wiki.

Is your stepper motor spinning in the wrong direction? We will cover reversing the direction in firmware later on in the configuration guide.

- If you have two Z-Axis stepper motors, connect them to ZA and ZB.
- If you only have one Z-Axis stepper motor, plug it into the ZA connector and be sure that the supplied jumpers are installed on the ZB connector.

ZA and ZB are wired in series; without a second stepper motor or the jumpers in place on ZB, ZA will not function.

- If you use more than five stepper motors, you may use a Duex2 or Duex5 expansion board which offers 2 or 5 extra stepper motor outputs, respectively.
Step 11 — External 5V Input

EXT_5V is an optional 5v power input and is not required for operation.

The Duet has an on-board 5v regulator that gets its source from the 12-24v input.

- If you wish to provide external 5v power, or control an external ATX power supply, you may read more about it in the wiki.

- Unless you plan to provide an external 5v source, you should at this time check that there is a jumper on "INT 5V EN" and **NOT** on "EXT 5V EN".
  - INT 5V EN
  - EXT 5V EN
The Duet has three PWM controlled fan headers and two Always On fan headers.

A PWM (Pulse Width Modulation) fan connection is for fans you wish to control the speed of, for example a print cooling fan.

An always on fan is for something like an electronics fan - always on when the printer is on.

Some fans are more compatible with PWM control than others. If you have trouble varying the speed of a fan, check the [documentation](https://duet3d.dozuki.com/) for changing PWM frequency.
Step 13 — Bed Heater

The Duet is able to power a heated bed up to 18A. This should be well above the requirement for most heated beds.

If your heater has an integrated LED, then the polarity will matter as the LED will not light with reverse polarity. Otherwise, a heater's polarity doesn't matter.

- It is recommended to use the included ferrules, by crimping them to the wires before putting the wires in the terminal block.
- Do not tin (add solder to) these wires.
- Be sure not to twist the terminal block while tightening the screws. It can help to hold the terminal block while tightening.
- Check the screws after a few days/weeks of operation to ensure they are still snug.
**Step 14 — Bed Thermistor**

- Connect the bed thermistor to `BED_TEMP`.
- The polarity of a thermistor does not matter.

**Step 15 — CONN_SD and CONN_LCD**

- `CONN_SD` is used to connect the SD card reader on a PanelDue touchscreen display to the Duet.
- If you are using a PanelDue, this connection is optional and does not effect the function of the touchscreen monitor itself.
- The `CONN_LCD` header is reserved for future development at this time and should not be used.
Step 16 — Expansion

- The expansion header is to connect the Duet to a Duex 2 or Duex 5 expansion board.

   The Duex 2 and Duex 5 expansion is an available add-on which offers additional stepper motor drivers, heater outputs, fan headers, endstop inputs, additional thermistor inputs, support for additional Temperature Daughterboards, and more.

Step 17 — Temperature Daughterboard

- The Duet supports up to two MAX31865-based daughter boards. Each daughter board supports two PT100 temperature sensors or thermocouples.

   - A Temperature Daughterboard may be desired if, for example, you wish to print with materials which require greater than 290°C, which is the limit for a thermistor.

   - A Temperature Daughterboard allows the Duet to connect with a thermocouple or PT100 temperature sensor, which send a different type of signal than a thermistor.

   - If you plan to use PT100 temperature sensors, please read the wiki regarding the use of Temperature Daughterboards.
Step 18 — Z Probe

The Duet supports a Z-probe via this dedicated connector.

- Expand on this later
Step 19 — Panel Due

The PanelDue, an optional accessory sold separately, is a touchscreen display which gives a user the ability to control the Duet with an intuitive interface directly at the printer.

- The PanelDue can be connected in two ways:
  - A 4 wire cable that contains power and serial signals. This has a maximum recommended length of 1 meter
  - A 10 way flat cable which contains an external SD card signals with a maximum recommended length of 400mm

The wiki has more information on the types and sizes of PanelDue available. Also on connecting a PanelDue.
Step 20 — ESP Comms & JTAG

Note the ESP Comms and JTAG ports are removed from version 1.04a and later

- the ESP COMMS connection allowed a direct interface with the WiFi module. This was used during initial design but is no longer used so have been removed.

- The JTAG header was available for advanced debugging and programming but was never used so it has been removed.

Step 21 — Ethernet or WiFi Module

- The Ethernet or WiFi Module supports a connection over a web interface. It is responsible for a network connection as well as the web-based user interface.

- The WiFi module has a blue LED that flashes only when the firmware is being changed.

- The Ethernet module has two LEDs - Link, which is on when an ethernet connection is established, and Activity, which flashed whenever data is being actively transferred.
Step 22 — Hotend Thermistor(s)

- Connect your hotend thermistors here.
- The polarity of thermistors does not matter.

ℹ️ A thermistor can read up to 290°C. If you wish to print at a higher temperature than this, you should upgrade to a thermocouple or PT100 temperature sensor (See step 16). A PT100 also provides a more consistent reading between multiple sensors and resists noise interference in 4-wire mode.

Step 23 — Wiring Complete!

- Congratulations! Your Duet is wired and is ready to configure. Continue to 3.) Configuration (General Cartesian) to configure your Duet!