Troubleshooting

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Duet problems

Duet hardware problems

There have been a couple of issues with the construction of the Duet board.

- The Duet boards that were supplied with the first 220 red RS kits have a mistake in manufacture, which means that a USB cable needs to be attached to the board to supply 5V to the board logic all the time. The mistake is the resistors that allow 12V power to be fed to the 5V power regulator are incorrectly mounted. These are R60 (3k92) and R61 (750R), near the JP9 (5V_EN) pins, which have been soldered to the board at 90 degrees to where they should be. These resistors are next to capacitor C5; if they are the same orientation as C5, they are the wrong way around. The Duet schematics are HERE. If you feel confident in your abilities to remove and replace SMT components, please feel free to try. Otherwise, contact support for a warranty board exchange.
- The first 800 boards did not have their USB sockets soldered correctly. Looking at the USB socket, it has 4 pins that go through the board. All four of these should be soldered, to support the USB socket. Boards had only two soldered, or none, so inserting the USB cable can cause the fine connections to the board to break. Please solder up all four contacts, if you feel it is within your ability. Please contact support if you have intermittent or no USB connection for a warranty board exchange.

Power problems

When power is applied to the board, you should see at least one LED light. With USB, it should be the one next to the USB socket. With ATX PSU power, it should be the on below this; this is the LED for the MOSFET that controls the FAN0 output. It is on by default. You may also get the Y endstop LED. When powered by ATX PSU and with the USB connected, you should get all three LEDs switched on.

Problem

- No light turns on next to the USB socket on the Duet, when Duet plugged into USB
- No light when jumper JP9 (5V_EN) is enabled, and ATX PSU is turned on
- No USB or COM port appears on PC
- Duet is listed as a USB or COM port, but can't connect

Test voltage

Test the voltage of the 12V, 5V and 3.3V. Test 12V at the large green screw terminals; using a multimeter, put the probes on the two screw terminals. If connected by USB, you will get 0V here, otherwise 12V. Test the 5V by using the probes between ground (the top of the SD Card holder is useful for this) and pin 1 of the expansion header, then 3.3V on pin 3 – these are the pins closest to the heated bed connection, just under the 'SION' of 'EXPANSION'.

Solutions

1. If no light appears on the Duet next to the USB socket when plugged in via USB, check the cable, then check the USB socket. Some boards have loose sockets due to insufficient soldering of the socket, which may cause the board to get no power. See 'Duet hardware problems', above.
2. If the voltage is not as expected on 12V, 5V and 3.3V, contact support with your readings; your Duet board may have a fault with the 5V or 3.3V rectifier, or some other fault
3. If the voltage checks are correct, but no USB or COM port appears on your PC, check the USB socket soldering. It may be disconnected.

If a USB or COM port does appear on your PC, but you can't connect, this may be a hardware, firmware or software fault:

1. Hardware fault – the USB socket may be disconnected
2. Firmware fault – if you've tried flashing the firmware and the port still says 'bossac programming port', see below 'Firmware update problems'
3. Software fault – Particularly Windows 7 and 8, check the drivers have installed correctly , see below 'Check software installation'

Firmware update problems

Problem

- Can not update firmware
- After firmware update, Duet no longer visible
- Printer stops at the beginning of the print, even with the gcode supplied on the SD card

Solution

1. Check the instructions, and follow them carefully
2. If the ‘bossac’ command fails, make a note of the error, and contact support
3. If the error is to do with the port not being found, try sending the command without this part: ‘–port=COMxx -U true’
4. If the board is inaccessible following a firmware update, but then does reappear after the ‘erase’ and ‘reset’ buttons are pressed – we are testing a fix for this. When you send the bossac command, leave the ‘-R’ off the end. Once the flash has completed, wait for 10 seconds, then press ‘reset’ button on the board, and see if the board shows up correctly
5. ‘Printer stops at the beginning of the print’ – this problem has been solved with a firmware update.

Duet software connection problems

If you are having trouble communicating with your Duet board, follow this troubleshooting guide to narrow down where the problem is.

USB connection

Check software installation

1. Download Arduino IDE v1.5.5 BETA (with Arduino Due support) for your operating system from: http://arduino.cc/en/Main/Software
2. NOTE: if you are using a Windows PC, use the .zip file, NOT the ‘Windows Installer’. The ‘Windows Installer’ may not have the up to date ‘bossac’ command in it (to be confirmed)
3. Install Arduino IDE
4. Connect Duet via USB
5. On Windows computer, open the Device Manager. It should show up as ‘Arduino Due’. If it shows as ‘bossac programming port’, the firmware has been erased, and you will need to flash the firmware. Follow the instructions here: http://www.reprappro.com/documentation/RepRapPro_Firmware#Installation
6. NOTE: Windows 7 and 8 users – the Arduino device driver has to be installed manually. See the note under ‘First connection’ in the ‘Commissioning’ intructions

7. Open the Arduino IDE and go to Tools->Board menu and select ‘Arduino Due (Native USB)’ at the bottom of the list. If this is greyed out, check the device drivers have been installed.
8. Then go to Tools->Port menu and select the USB port for your Duet board; it’s usually named ‘Arduino Due (Native USB)’
9. Then go to Tools->Serial Monitor. Make sure the speed is set to 115200 (bottom right) and that Newline is selected (next to the speed).
10. Wait for 1 minute (this is normal when no ethernet is connected and the firmware is searching for the network), and following should show:

```
RepRapFirmware is up and running.
```

The above steps should diagnose that the Arduino driver is installed, the USB is functioning correctly.

Check Micro SD card is functioning correctly

Some customers have reported problems with the supplied SD cards and/or the SD card to USB adapter. If you can, try a different SD card, and writing files to it with a different adapter. SD cards come in a variety of sizes; we have tested cards up to 8GB. They should be a FAT32 formatted disk. It’s also possible you have a faulty Duet board, but please do the tests on this page before returning your Duet board for a warranty replacement; it will be quicker for you than a miss-diagnosed problem with the Duet board when the real problem is, for example, with the SD card.

- Test the SD Card as described in the Commissioning instructions HERE
- If it’s working at startup, it’s generally safe to assume it will work the rest of the time.
- If it isn’t working, update your firmware if it is an old version (we have improved the firmware to help with the problem of slow cards)
- If it STILL isn’t working, replace the supplied Micro SD Card with a better quality card

You should now be able to connect using Pronterface, as described in the main instructions.

Ethernet connection

Physical connection problems

If you get no green light on the ethernet connector, either there is no power to the Duet board (via USB or from the ATX PSU – it can’t be powered from the ethernet connection), or the ethernet cable is not making contact/isn’t working, or there is a problem with the Duet board. Check power and the ethernet cable.

Testing the connection

For testing, you can connect an ethernet lead directly from your computer to the Duet, so long as your computer’s ethernet port is setup with an ip address (eg 192.168.1.12) and netmask (eg 255.255.255.0) in the same range as the Duet.

Duet Firmware ip defaults – line 170-172, Platform.h, here: github.com

```
#define IP_ADDRESS {192, 168, 1, 10}
#define NET_MASK {255, 255, 255, 0}
#define GATE_WAY {192, 168, 1, 1}
```

Even without an SD card, you should be able to ping 192.168.1.10 and get a response from the Duet. However, you won't be able to access the printer web interface.

The following instructions assume you have a working SD card (see HERE). The standard SD card ip defaults – from sys/config, SD-Image here github.com are:

```
M552 P192.168.1.14; Set the IP address
M553 P255.255.255.0; Set netmask
M554 P192.168.1.1; Set the gateway
```

Edit the config.g on the SD card to suit your network, as described in the commissioning instructions HERE.

Establishing connection

1. Connect ethernet cable to router, then to the Duet.
2. Connect USB lead to Duet (this is needed for power, and can help with diagnosis), or turn on the ATX PSU, and check that JP9 has a jumper on it
3. The GREEN LED on the ethernet connection should light up on the Duet. The ORANGE LED is a indicator light for 10base-T connections – most ethernet hubs/routers/switches are 100base-T or gigabit, so it will stay switched off.
4. If you don't get a green light, check the Duet board is getting power (by USB or ATX PSU), check your ethernet cable is okay by testing it in a known working ethernet port. We have had a couple of reports of the ethernet not working at all on the Duet; contact support for a warranty replacement.
5. You should be able to ping the Duet, on the ip address you set.
6. If you ping 192.168.1.10 and get a response, this is the firmware default; the network settings are not being loading at startup, and the web interface will not respond correctly. Check the Duet is loading config.g at start up; see HERE
7. You should then be able to connect to the web interface, using Google Chrome, by typing the ip address you set in the address bar.

If you are having problems during connection, you could try the version of the web interface that has been developed by Ormerod owner Matt Burnett; see http://forums.reprap.org/read.php?340,290811,301393#msg-301393 and https://github.com/iamburny/OrmerodWebControl

This doesn't use password control, so is perhaps more reliable at connecting, if more insecure.

Random disconnections during printing

If the printer is resetting, and stopping mid-print, the cause is likely to be related to power to the printer. Double-check that the 12V power input wires and the heated bed power wires are well-seated in the screw terminals; they should be really solid. They have to carry a lot of current, and a loose connection here will generate heat, and

possibly cause a disconnection/reset if the contact is poor. Once you are satisfied with this, check that you are getting 12V from the power supply when under load. Test at the 12V power input screw terminals, turn on the bed, and see if the voltage drops. A small voltage drop of 0.5 to 1V is to be expected, but more than that can cause a problem.

If the printer is loosing the USB connection, check the soldering on the USB connector. See ‘Duet hardware problems’ above.

If the printer is loosing the USB connection and the soldering is okay, there can be a variety of causes. USB is quite prone to Electro Magnetic Interference (EMI), via the power line. Large motors (in air conditioning, fridges, fans, drills and other hand tools etc) starting and stopping on the same ring main can cause power spikes, while other high current devices, unstable mains supply, or poor USB power connectivity on the host PC can knock out the USB connection. If the printer seems to continue working without resetting (for example, if you are printing from SD card, it continues to print), this is the most likely source of the problem. Check that the USB cable is connected properly, and for any damage – a poor connection will be more susceptible. Customers have found that adding a surge suppressors, power conditioners and/or UPSs to smooth the mains supply, and/or using a USB cable with a ferrite core, can help.

Proximity sensor problems

Problem

- Homing of X and Z axis does not work properly
- Response from G31 is inaccurate, or varies, or doesn’t change

Solution

1. Check your wiring of the proximity sensor, at the sensor end and the Duet end. See: http://www.reprappro.com/documentation/ormerod/wiring/
2. Updated your firmware, and update the files on your SD card, with the files from ‘SD-Image’ in the firmware folder. These should be kept on the same version. This should update any firmware behaviour that may be causing homing problems. See: http://www.reprappro.com/documentation/RepRapPro_Firmware#Installation
3. Check that your SD card is working AT STARTUP. This is crucial, because it effects the behaviour of the proximity sensor: http://www.reprappro.com/documentation/ormerod/commissioning/#Is_the_SD_card_being_read_AT_STARTUP
4. Check that there is no big Infra Red source near the printer, this will upset the proximity sensor. See the noted below the picture here: http://www.reprappro.com/documentation/ormerod/axis-compensation/#Setting_the_Z_Probe

5. Check the values you get from the probe. With axis a long way from the bed, send G31. The result should be a low number, like 10. Put a piece of white paper under the sensor, very close, and send G31. The result should be a very high number, like 950. This is the normal range for the sensor.
6. If you get a constant value from G31, the board may be damaged. If you get 1023 from G31, check your wiring.

If the homing seems inaccurate after all of the above, check that the Z axis is moving correctly; there could be backlash that is causing problems. Check:

- look for binding or stalling in the z-gears
- stiff movement of the Z axis up and down
- If you have an adjustable z-runner-mount, it should only be lightly gripping the extrusion, or that will cause problems for the Z axis movement

Printing problems

Poor or no extrusion

Problem

This could be due to a number of reasons:

- Initial construction problems (if the nozzle has never successfully extruded)
- The nozzle is partially or fully blocked
- Extruder motor does not move much but makes a squeaking noise.
- Extruder motor rotates, but the gears do not.
- Extruder drive motor and gears rotate, but the filament does not feed.
- The extruder gears squeak, rub and/or get stuck as the big gear turns.
- The Bowden tube comes out of the brass unions

Solutions

Construction problems

- Hot end cooling: Check that the hot end fan is on ALL THE TIME. If the hot end fan turns off, heat can travel higher up the nozzle, and the force of extrusion increases, eventually stopping extrusion. The hot end fan MUST run all the time (it should be wired to the +12V directly), and there should be good contact of the heatsink to the heatsink block.
- Hot end cooling: Make sure the heatsink is installed so that the fan can blow air through it!
- Hot end construction: Check that the brass tapered nut is tight against the heater block on the nozzle. Tighten with spanners – more than finger tight! This will ensure the threads make good contact with the nozzle, and heat transfers well.

- Hot end construction: If the ptfe nozzle liner is not cut square, or cut too short, and there is sufficient gap that fills with molten filament, again the force of extrusion increases. Cut a new piece of ptfe tube, 8mm long, with square ends.
- Bowden tube: If the Bowden tube is tight into the brass unions, and the filament has difficulty moving through the tube, this increases the force needed for extrusion. The tube should be 10mm into the brass unions, then run a 2mm drill into the ends to clear them. Push a piece of filament through to check it is smooth, and to clear out any debris.
- Extruder: If the teeth of the hobbed insert has slipped on the filament, there may be pieces of plastic in the teeth, which the filament will slip on. Remove the filament, take out the big gear with the hobbed insert, then check and clean the teeth of the hobbed insert – a small wire brush is good for this.
- Extruder: Check the idler bearing has a washer on it between the bearing and the motor, or the bearing will have difficulty turning

Nozzle blockage (also for changing filament)

To ensure the nozzle and melt zone are free from contamination, follow these steps:

1. Heat nozzle to operating temperature (200C for PLA)
2. Extrude a little filament, like 10mm (if possible) by hand or via Pronterface, then set temperature to 100C
3. Wait for the temperature to drop to 100C, then reverse filament until it comes out of the extruder drive (about 380mm). You can do this at 600mm/min, or by hand if you wish.
4. This should pull out the filament from the melt chamber, hopefully down to the nozzle, along with any contamination.
5. Cut the contaminated end from the filament, and drive or feed the filament to just before the hot end.
6. Set temperature to operating temperature
7. Command the filament to extrude short lengths, 5mm at 200mm/min, until it squirts out of the nozzle.
8. Only in the worst case will you need to disassemble and clean the hot end.

Extruder problems

If the extruder motor does not move as expected, but makes a squeaking noise or just vibrates, it may mean it does not have enough torque to drive the extruder feed mechanism, because it is stuck or jammed.

1. Check that the nozzle is not blocked (see solution above)
2. Check that the idler bearing can rotate freely (there should be an M3 washer between the bearing and the motor)
3. Check the diameter of your filament is not too wide (over 2mm in diameter will not feed through the extruder)
4. If the motor vibrates rather than turning, even with no load on it, the stepper driver chip may be damaged

Extruder gear rotates, gears do not

1. It is unlikely the small gear will rotate on the motor shaft. If it does, contact RepRapPro support for a replacement.
2. On the big gear, check that the hex head bolt is not rotating in the hex hole. If it is, again, you will need a replacement. As a temporary fix, you may be able to use epoxy glue or superglue to get the hex head to hold again.

Extruder drive motor and gears rotate, but the filament does not feed. There are a number of potential reasons for this:

1. The teeth of the hobbed insert have plastic in them. This will cause the teeth to slip on the filament. Clean the teeth with a pointy tool.
2. The nyloc nut on the back of the large gear has come loose, and the hobbed insert is unwinding
3. The filament may be to thin, or it is trying to grip on a section where filament has been worn away. Remove filament and check diameter.

The extruder gears squeak, rub and/or get stuck as the big gear turns:

1. There may be printing artefacts on the large and small gear, or they have been printed too ‘full’, so that they mesh very tightly. You can use sandpaper to improve the fit, or contact support to send you new gears.
2. There is no other adjustment available

The Bowden tube comes out of the brass unions

1. If the ptfe tube pushes out of the brass union, it is probably not screwed in far enough into the union. It should have about 10mm of thread. Remember to drill, with a 2mm drill, into the brass union with the ptfe in place, or there may be a tight spot that the filament can’t push past.

Filament doesn’t stick or parts warp

Problem

- If the first layer does not adhere well enough to the heatbed, there is a chance the component(s) will warp during printing.

Solutions

Bed surface: Some people are lucky, and seem to be able to print directly onto the glass bed, and the PLA sticks. Most, it seems are not so lucky; for them we provide a roll of Kapton tape. Kapton can be applied to the glass surface in strips – try to keep the air bubbles out, and put the strips as close together as possible. Kapton is durable: we use it in the production of kits, and will last at least a couple of months of 24/7 printing. Usually it peels up before the PLA won’t stick to it. Blue painter’s tape can also be used. PLA doesn’t stick as strongly to it, and the surface isn’t as flat or durable as Kapton, but it is more widely available, and often in wider widths.

Cleanliness of build surface: The bed surface needs to be completely free of all oil and grease (including finger marks), otherwise your prints won't stick to it. Set the heatbed to a temperature of 45C and wait for it to settle there. Clean the surface with nail polish remover (containing acetone, glycerine, and as few other ingredients as possible, and definitely "'not"' lanolin or any other oil or grease) using a lint free cloth. Set your heatbed to your print temperature ready for printing. Other products that also work include pure Acetone, Isopropyl Alcohol, White Methylated Spirits, White Vinegar. All of these are acidic, and dissolve oil and grease before evaporating. Don't use Windex/Windowlene or polish; they often have a non-stick component!

Setting Z zero: At the Z 'home' position, where Z=0, the nozzle should be just touching the bed. Follow the instructions laid out in the Commissioning and Axis Compensation instructions

Bed temperature: For PLA, try a setting of 50-60C. If you go too hot, the PLA will stay liquid and can be pulled away from the bed by the cooling of subsequent layers. Too cold, and it won't stick. For ABS, the bed temperature needs to be much higher, at around 100C. See the ABS printing guide later.

Hot end parts hit print and bed fold-back clips

Problem

- Fan/nozzle duct is closer to the bed than nozzle
- Proximity sensor is closer to the bed than nozzle
- Parts that are being printed are knocked off the bed

Solution

This can have a number of causes, in construction, and set up/adjustment. The bottom of the cooling nozzles and the proximity sensor should be about 1mm ABOVE the tip of the nozzle. To achieve this, a number of things need to be set correctly.

1. When constructing the hot end, the brass Bowden tube union that screws into the aluminium cooling block needs to screw ALL THE WAY IN. If it is not, the nozzle will be lifted slightly, in relation to the sensor and the fan duct.
2. The hot end need to sit on the x-carriage so it is vertical. If it leans forward, the fan duct will be lower. Change this angle by adjusting the bearing on the back of the x-carriage. If there is not enough adjustment, you can elongate the adjustment slot that the bearing sits in, or replace the bearing with a larger one (the standard is a 9mm bearing, replace with a 10mm 623 bearing if available), or put a 'runner' on the back of the x-axis plate for the bearing to run on – some people have used a hacksaw blade.
3. If the hot end changes angle as it moves along the X axis, the x-axis-plate may be twisted, so the whole x axis arm has a twist along it's length. Look along the arm, and rotate it until it is straight. Tighten the 8 screws in the x-motor-mount, and the screw in the x-idler to hold it in position.

4. If the proximity sensor is too low, check that the mdf spacer is inserted between the nozzle-mount and aluminium cooling block. You can add an extra couple of washers if you need more clearance.
5. It's also possible that the y carriage bed is a long way out of level with the x-axis. You may need to adjust the corner screws of the heated bed to get it more level with the x-axis.

Axis sticking problems

Problem

- Axis doesn't move smoothly
- Motor stalls when moving (sometimes okay at low speed, doesn't move far enough at high speed)

Solution

1. Make sure rods are clean and linear bearings run smoothly. A little light oil (like 3-in-1 oil) will help lubricate the bearing seals. Smooth rods can be cleaned with wire wool or kitchen scourer to remove stubborn lumps
2. Check stepper motor voltage is not set too low in config.g. As standard this is set to 800 milliamps by this line:

   ```
   M906 X800 Y800 Z800 E800 ; Motor currents (mA)
   ```

3. Check that belt alignment is correct, and the belt is not rubbing unduly on belt guides or anything else.
4. Check there is no mechanical obstruction to the movement of the belt, or bearings on the smooth rods.

Wobbly Z walls and non-circular circles

Problem

- Vertical walls are not accurately printed on top of each other
- Variability in layer height causes vertical walls not to be smooth
- Circular objects print out square

Solution

Generally we lump these problems together under the term '[backlash]'. This can happen on any of the axes, or a combination of them.

1. Check belts are tight enough. On the longest free length, ie the side not attached to the carriage, pluck the belt. It should make a just audible, low pitch, twang. Tighten or loosen as needed.
2. Check pulleys are not loose on stepper motor shafts (X and Y axis) – hold the motor shaft with pliers, then try moving the carriage, while looking at the pulley
3. Check that the axes are moving freely: see ‘Axis sticking problems’ above
4. Check extrusion is consistent: see ‘Poor or no extrusion’ above

Stepped layers

Problem

Partway through a print, the next layer appears to have slipped by a millimetre or two (or much more) causing a step which should not be there. This can be caused by:

- Axis belt slipping where it is attached to the carriage.
- Print head snags on part of the print, usually the print curling up or lifting off the bed. This can cause the belt to skip on the pulley, or the motor to stall.
- Axis snags on something. For example, the wiring catching/getting in the way of movement. This can cause the belt to skip on the pulley, or the motor to stall.
- Stepper driver overheats and temporarily shuts down.

Solution

Belt slipping in carriage

1. This usually happens on the y-carriage. To test, hold the motor pulley tight and try and move the carriage. If it slips, secure it in place more positively. The quickest fix is to put a cable tie around the two ends of the belt, on the left side of the y-rib, push it up against the y-rib, and tighten it.

Nozzle hitting printed part

1. The printer should generally have the power to overcome hitting a part while printing, and the hot end can flip up a little. However, if printed parts are curling up, particularly on overhangs or bridging, reducing the extrusion temperature 5°C at a time will usually help.
2. If the parts are curling up from the first layer, see ‘Filament doesn’t stick or parts warp’ section above

Belt skipping on pulley

1. Check belts are tight enough. The actual tension required comes with experience, but should be at least tight enough to produce a low frequency,

just audible ‘twang’ on the longest section of belt. Over-tensioning the belts can also be detrimental, as the motors will have to work harder.
2. Check that the belt is running smoothly and in line, and the edge of the belt is not snagging on the motor and idler ends. With the motors off, check the axis moves smoothly – if not, see the ‘Axis sticking problems’ section above.
3. Check all wires, pulleys and belts whilst printing and reposition/realign anything impeding the smooth movement on all axes.

Stepper motor stalling

This is a result of the motor not having enough torque to move the axis (temporarily, since the print continues at the new position).

1. Check that the motors are being supplied with sufficient current to meet the demand; check the setting in config.g
2. Use secondary cooling fan to cool the electronics if they are getting too hot.

Printing ABS

Problem

- Concerns about printing ABS
- Heated bed takes a long time to get up to 100C, or never reaches it
- ABS doesn’t stick

Advice

Important: all the supplied printer parts are made from PLA. Long term exposure to the heat of ABS printing will cause some of them to fail. If you plan to print a lot of ABS, you should first remake some of the parts from ABS, specifically (and in this order) the x-carriage, z-runner-mount, extruder-body and the rest of the extruder parts, nozzle-duct, fan-duct.

When printing ABS without upgraded parts, at the start of the print leave the x-axis high above the bed (at least 100mm) so that it is not getting hot while the bed heats up.

Heated bed

Check the voltage of the power supply, particularly under load. Ormerod PSUs should supply around 12V, but may be supplying a voltage below this. Some customers have replaced the supplied PSU with ones that can supply 13V, which allows the heated bed to heat up quicker and get to a higher temperature. However, don’t go beyond 13.5V, or the heated bed will draw too much current.

The heated bed can max out at around 100C, due to the thermal mass of the aluminium and glass. This is a designed limit, and is generally okay for the ABS we

have tested. You can increase this to around 110C by covering the bed with an insulator while it heats up. In the past, we've used a foil-fronted piece of MDF, which reflected heat back onto the bed, but was held off the surface by the clips, so didn't heat up. Remove it to start printing; the first layer will then be a bit hotter, so should stick better if it's being difficult, and the temperature will drop during printing to hold at around 100C. Another improvement suggested by a customer is to put aluminium/kitchen foil between the heatbed PCB and MDF insulator. This also decreased warm up time. Be VERY careful not to short the main power connections through the silver foil! ABS shouldn't need heating to more than 110C anyway, as this is beyond it's glass transition temperature; it's like printing PLA onto a bed at 80 degrees – the PLA stays so soft it gets pulled off the bed. ABS generally does this above 110C.

Other considerations

Also, keep draughts to a minimum, and try to keep the area around the printer at a reasonable temperature – above 25C minimum. This should help to prevent the part warping as it prints. You can build a small 'greenhouse' to cover the printer, but be careful it doesn't get so hot (over 45C) that the PLA parts of the printer melt!

It should be noted there are plenty of other problems getting ABS to stick at any temperature, and there are quite a few workarounds; the favourite around here are super strength hold hairspray (it can contain both PVA and acrylic) or making a slurry of some ABS dissolved in Acetone, applied to the bed at 50C, and wait for it to dry before printing. Joseph Prusa shows how he does it HERE (follow the pictures in the 'Older' direction). And then some people have no problem with ABS at all! It's a bit of a dark art, but probably depends on the quality of your ABS filament.