



3D Industries Australia

3D Printer User Guide





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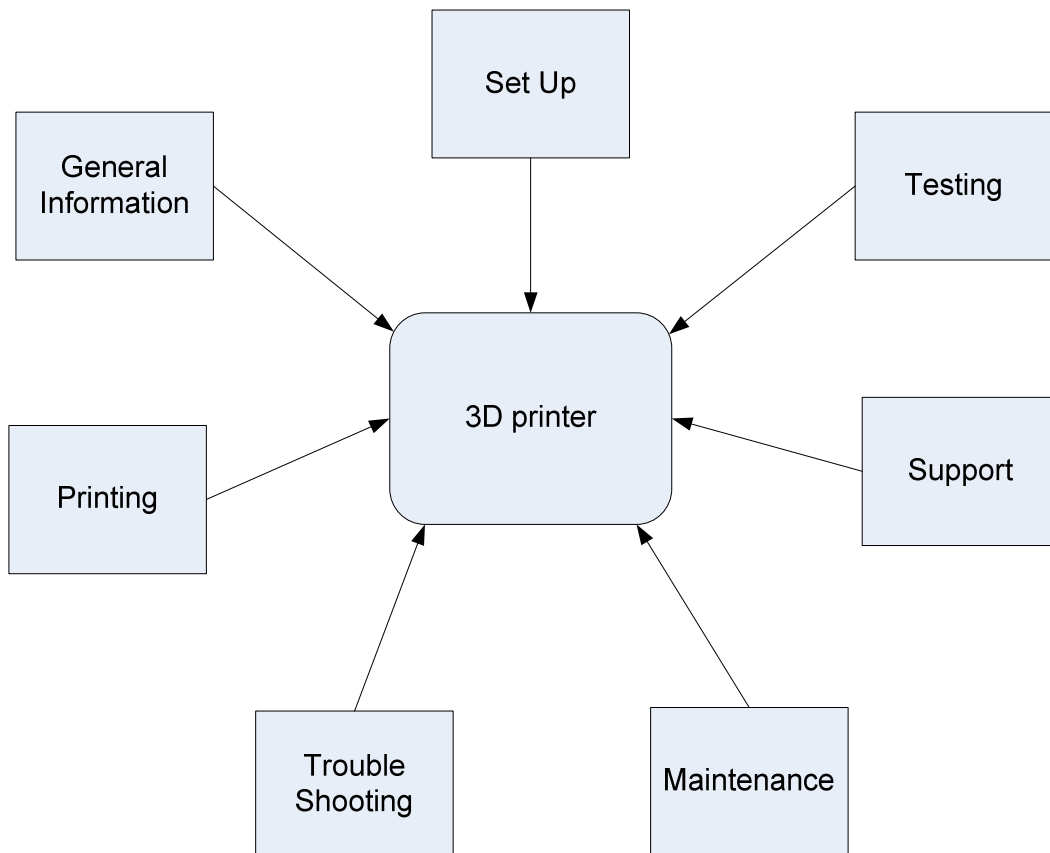
2 Preamble

The Series 5 3D Printers (Wombat, Joey and Possum) are manufactured in Australia by 3D Industries.

These printers are professional level printers that are scalable. The two printers the Wombat (larger) and the Possum (smaller) than the Joey demonstrate this. The printers feature:

- A welded Steel frame for robustness.
- A CoreXY mechanism that prints each layer on the X-Y axis, the object being printed descending into the printer for each layer printed.
- The printer is completely self contained and requires no connection to a PC to print.
- The Power supply is contained within the printer.
- The filament spool can be attached to different positions on the frame to suit.
- Objects to be printed are placed in gcode format on an SD card that is inserted into the LCD controller.
- The object to be printed is selected and printing initiated. The progress of the printing can be seen on the LCD display and adjustments made during the printing process.
- Many accessories are available.

3 Overview



The following sections refer.



4 Precautions

Power supply

The 200-240 volt power supply provides an isolated 19V to the printer. However before any work is done on the printer the power supply should be disconnected from the mains as a precaution.

Hot components

Certain parts of the printer can be very hot, typically:

- The heated build platform depending on the printer use can reach over 100 Centigrade.
- The Nozzle can reach a maximum temperature of 240 Centigrade.
- The extruded plastic filament can be at nozzle temperature until it cools.

Treat all printer components with respect and take precautions when operating.

Fans and cleaning

There are fans on the printer carriage and on the case of the electronics box. These need to be cleaned but this should only be done with the printer shut down and allowed to cool and the printer disconnected from the mains power. General printer cleaning should be by using a vacuum cleaner and possibly a paint brush to remove dust.

Environment

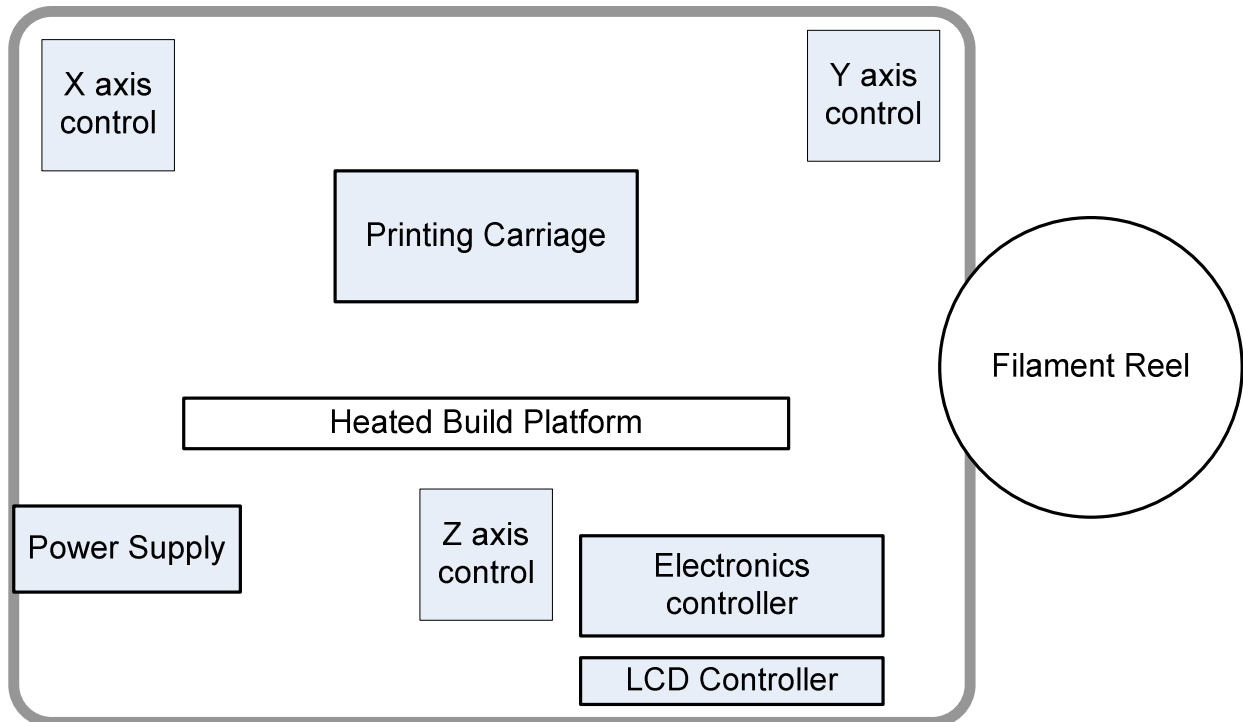
The printer should be operated on a bench or desk with no possibility of contact with any papers, curtains or other materials.

Unattended operation

The printer should not be left running unattended. If not printing the printer should be disconnected from the mains.

5 General Information

The instructions describe the printing of the objects using PLA filament on adhesive covered glass.



The frame is composed of 1.6 mm thick 20 mm square steel RHS for stability. The printer components are attached to the frame.



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The LCD Controller houses the removable SD card and is connected to and controls the Rumba electronics board.

The Power supply is a self contained sealed unit providing 19 Volts DC to the printer.

The build platform temperature is raised by means of heaters controlled by the Rumba board. The temperature of the build platform is measured by a thermistor connected to the Rumba board.

The stepper motors are controlled by the Rumba board. Motors control the X-Axis movement & Y-Axis movement of the printer carriage. The stepper motors also control the Z axis (vertical movement) and the movement of the filament into the hot end on the printer carriage.

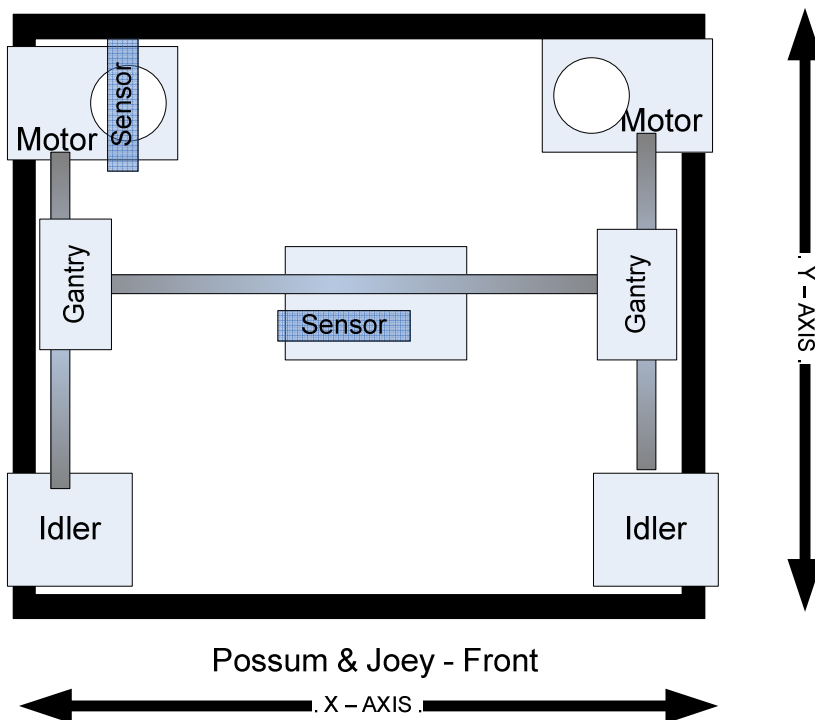
The plastic filament is pushed into the hot end by the extruder. The hot end is heated under control from the Rumba board; a thermistor on the hot end feeds the temperature back. The filament is melted and pushed out of the 0.4 mm hole because of the un-melted filament fed into the top of the hot end.

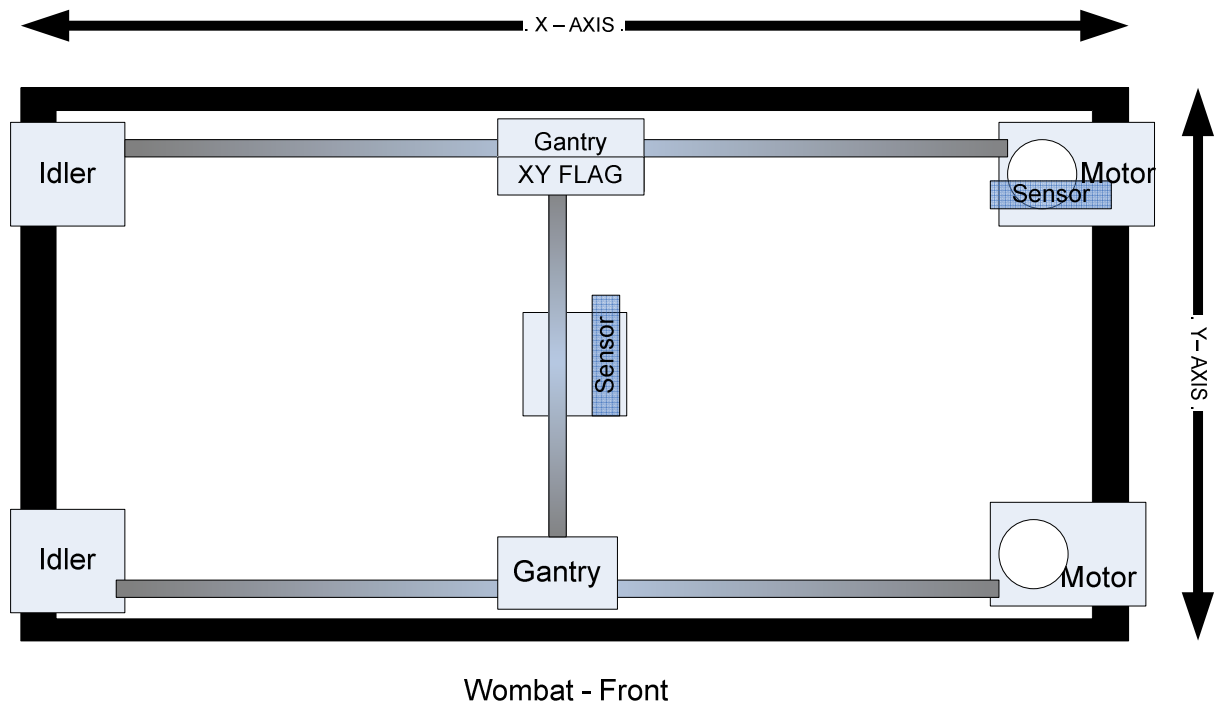
The extrusion of the melted plastic onto a position controlled by the movement of the X and Y stepper motors causes the object to be built up layer by layer.

The gap between the nozzle and the heated bed at the start of the printing is critical and typically sub millimeter although the best setting is determined by trial and error adjustment. This gap has to be consistent across the entire build table in both the X and Y Axis. Manual setting of this gap can be quite challenging but a calibration object is included. Printing of the calibration object enables the level of the build platform to be established very accurately. An easily accessible operator control knob is included to enable controlled setting of the A gap.

6 Wombat, Joey and Possum models

The models are very similar but the layout of the CoreXY mechanism differs in its orientation and therefore the position of the X and Y-Axis.





7 Set Up

If not delivered directly by 3D Industries or an agent, the printer is shipped in a heavy-duty cardboard box the frame is packed in Styrofoam.

On delivery the printer should be tested by printing the calibration objects and any required adjustments made.

7.1 Contents:

The shipment contains:

3D printer

Glass bed

Filament spool

Example prints

Fitted feet

Tools:

- Spatula
- Screwdriver with relevant bits
- Cutters/Pliers
- Brush

Spares

- Pre wired hot end assembly
- Hot end clamps
- Cable ties
- Clips

7.2 Unpacking

If shipped:

- The printer should be removed from the box.
- The white cable ties should be cut and removed.



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- The two shipping bars should be removed.

7.3 Testing

The 3D printer is a precision machine with sub millimeter tolerances. Therefore when starting a printing session particularly after relocation, it is wise to ensure the printer is properly set up. This is the suggested sequence:

1. Check that carriage moves freely
2. Turn the printer on
3. Ensure that the SD card is plugged in
4. On the LCD controller from the Menu select "Prepare"
5. Select "PLA" Then "PLA 1"
6. The controller will return to the info screen and the critical temperatures should be observed
7. Nozzle temp Actual /target e.g. (185/185)
8. Bed temp Actual / Target (e.g. 40/40)

Note the printer is operated from the LCD controller.

The LCD controller will return to the Info screen if there is no operator action within 20 seconds.

In the info screen position turning of the knob will adjust the speed of the printer, which is set to 100% by default.

To make further selections the knob is depressed revealing further options. The knob is turned in either direction to select the option or next menu and the item confirmed by depressing the knob.

8 Pre Printing

Note the instructions assume the recommended printing method of printing direct to glass using adhesive spray. When the bed and nozzle temperatures reach over 40 and 180 centigrade respectively:

1. Spray some adhesive on the build table glass.
2. Select "**Print from card**".
3. Select "**cube**" object.
4. The cube object will be printed.

9 Printing

An overview of the process end to end is as follows:

- The software used for design of the object to be printed is outside the scope of this manual. A common output format is a file with the extension ".stl".
- The design file is converted to gcode format recognized by the printer.
- 3D Industries recommends Slic3r to convert the file to the gcode file and can supply the recommended version, settings and configuration file for the printer. (Current version certified is 9.8).
- The gcode file is copied to the SD Card and inserted into the slot on the LCD Controller.
- The printer is heated up so the build table and the nozzle are at the correct temperature.
- Adhesive is sprayed onto the glass. Note different coatings can be applied to the glass. "Cedel Extra Firm" hairspray provides consistently good results.

Note: 3D Industries uses the procedure of printing direct to glass with an adhesive layer sprayed but other methods such as tape can be used.

Removal of the object from the glass

This can be done in several ways.

For small objects use the spatula to remove the object by removing the printed skirt and then sharply tapping the object-glass junction.

For other objects removal can be done by putting the glass aside to cool and removing the object in the same way.

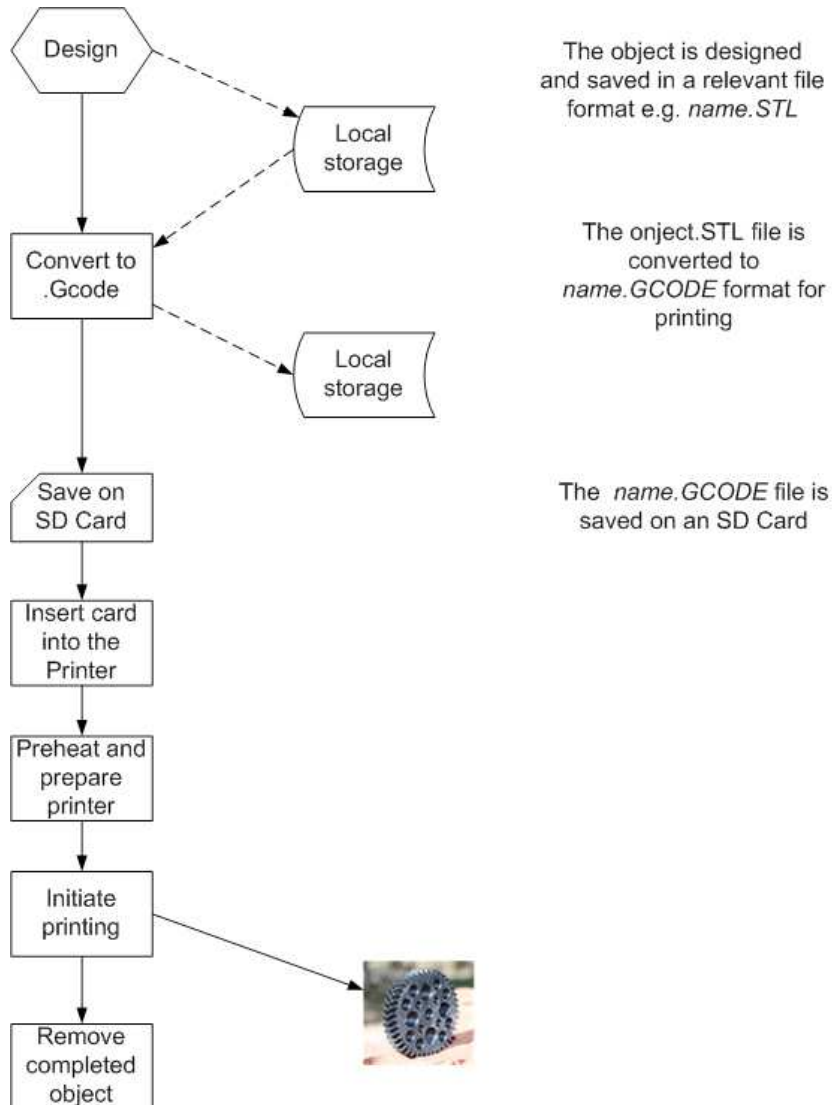
Large objects can be put into a freezer for no more than 15 minutes. Remove the glass and let stand for a minute or so.

The object may be loose and can be lifted off. If not look through the bottom of the glass to see where adhesion still exists. If pulling the object by hand levering from the non-adhered location does not work then use the spatula (gently) to nudge the object.



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The appearance of the base of the object can be improved if necessary by washing under warm water with a detergent and possibly using a small brush to remove any hairspray residue. Rinse and dry.



10 Maintenance

The printer is designed so that constant adjustment is not necessary to ensure quality prints. However the following points should be observed:

- Ensure the printer is clean and free from dust. The printers should be covered when not in use for a while.
- Pay particular attention to the electronics box cover and the fans. Use a brush and vacuum cleaner to remove dust.
- Do not allow dust to accumulate on the filament reel. Care should be taken to prevent dust entering the printer with the filament. While you cannot do anything about dust and impurities in the plastic itself (except to buy quality filament) you can prevent dust being carried into the printer by ensuring it cannot settle on the unused supply on the spool.
- Between sessions you can clean the build table glass. Between prints there is no need to clean the adhesive residue off the glass. Use the spatula to remove any traces of plastic or dust and spray a coating of hair spray. This will settle and provide a smooth base on which the first layer of plastic will be laid down.
- Regularly clean the nozzle (when it is hot). This can be done with a piece of cotton cloth.



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- Occasionally (once every few months) put a few drops of machine oil onto the smooth rods and wipe away the surplus.

10.1 Hot end replacement

The printer is supplied with a spare hot end.

If the nozzle is blocked or there are any other problems then the hot end should be removed and serviced (It should be returned to 3D Industries). The hot end is removed as follows:

1. Prepare the printer so that the hot end temperature is at 175 Centigrade or above (or 220 Centigrade for ABS).
2. First push and then pull the filament out of the extruder. Use both hands one to hold the extruder downwards and the other to pull out the filament.
3. Turn the printer off, disconnect the power lead and allow the hot end to cool down.
4. Move the extruder to the left.
5. Unplug the hot end wires from the extruder. Cut any cable ties that hold the wires to the extruder body. (Spare cable ties are provided with the printer.)
6. Unscrew and remove the clamp holding the heat sink of the hot end.
7. Catch hold of the hot end and pull it towards you.
8. Insert the new hot end and fix in place with the clamp.
9. Connect the hot end's heater and thermistor wires and secure with a cable tie.
10. Feed the filament into the extruder.

10.2 Replacement of the filament

It is important to understand how the feeding of the filament is performed.

Basically the filament is fed from the spool into the extruder and the extruder pushes the filament downwards into the hot end to the nozzle. While the hot end nozzle is hot, as filament is pushed into it a reservoir of melted plastic will be present. As more filament is pushed into the nozzle molten filament is ejected through the 0.4mm hole. As the nozzle is moved across the object under software control ejected plastic is laid down to form the current layer.

Sometimes as the nozzle is moved to another part of the object the filament will stop being forced into the nozzle and sometimes even there will be a temporary reversal.

Refer to the diagrams below:

The filament is fed from the spool through PTFE tubing to the top of the extruder.

The filament is fed down the hole in the extruder and passes between the cog wheel driven by the motor and the pressure bearing, into the PTFE below and down to the hot end.

The tension bolts enables the pressure bearing to press the filament up against the cog wheel. When the cog wheel is turned the filament is pushed downwards into the hot end through the lower PTFE tubing.

Prior to feeding the filament into the extruder a length of about 4 cm should be straightened and the end of the filament clipped as shown.

The filament is pushed down into the hole and some resistance will be felt as it is squeezed between the cog wheel and the pressure bearing.

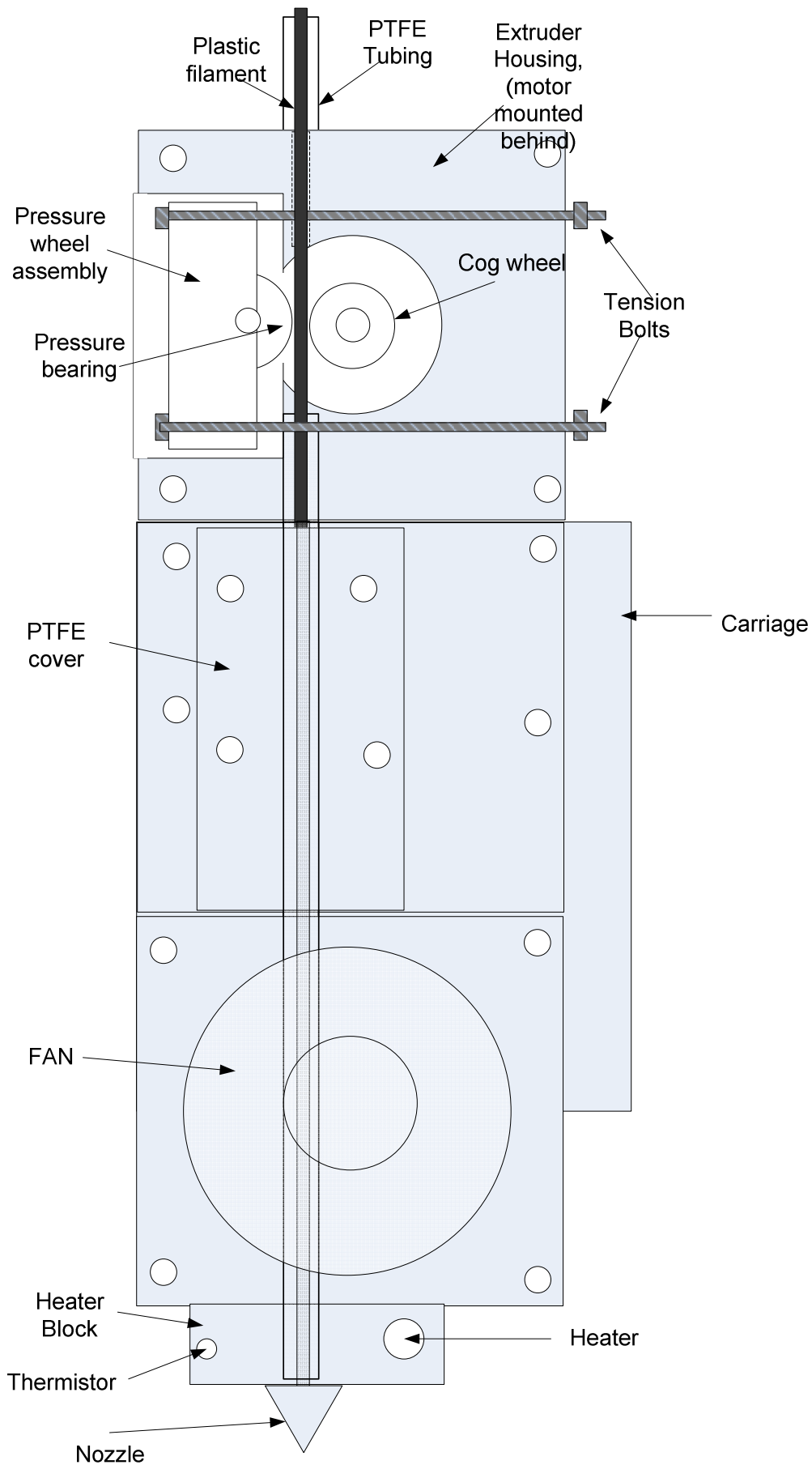
If the filament was straightened then there should be no problem with the end of the filament proceeding down the lower PTFE tube and into the hot end.

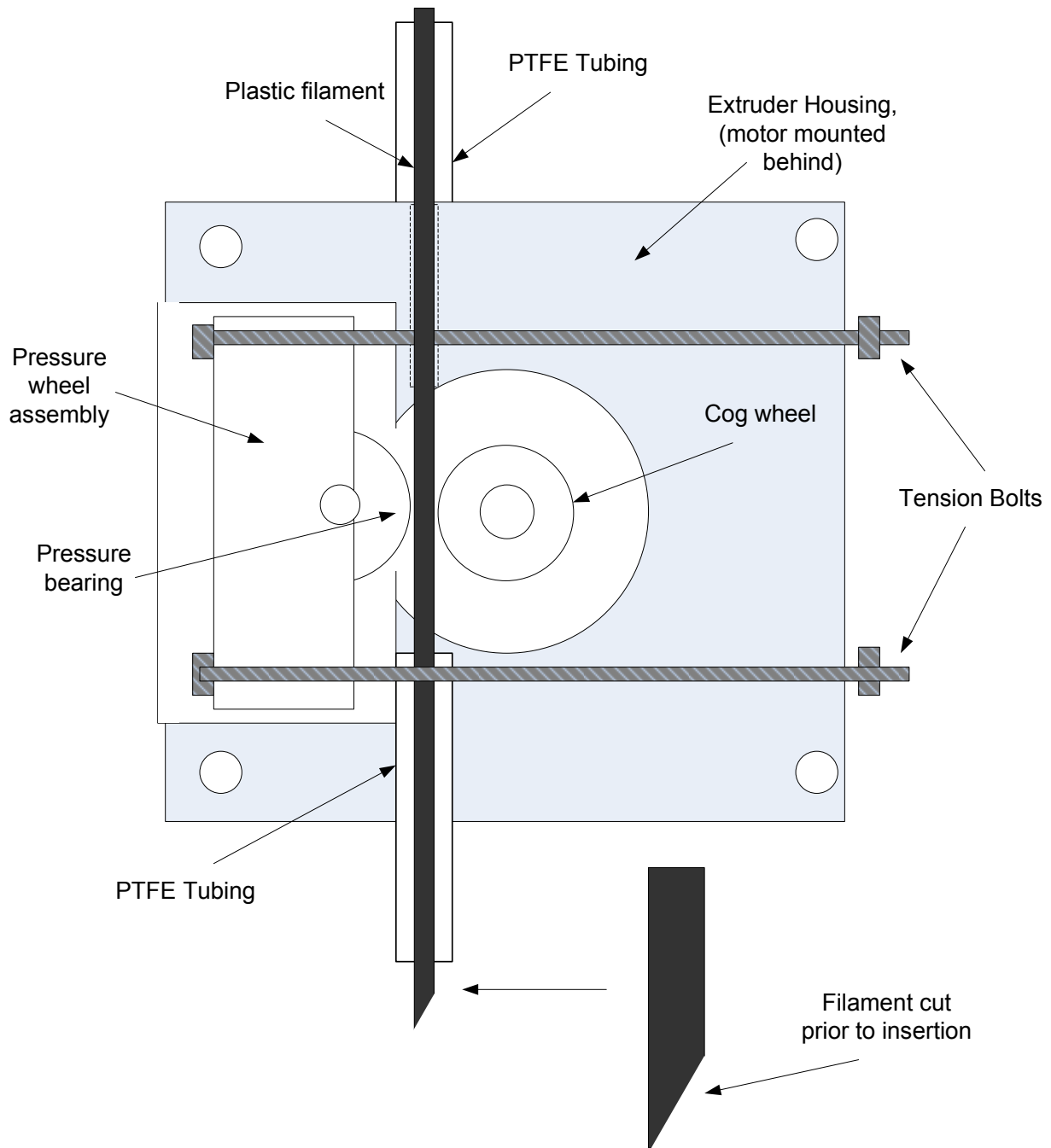
If the filament was not straight then it may miss the PTF tube and will not be able to be pushed further.

The position of the filament can be seen looking into the extruder – the same view as in the diagram.



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When a new spool of filament is to be inserted follow these steps:

1. Remove the Spool from the axle.
2. Replace the new spool.
3. Ensure that the hot end is at working temperature (above 180 degrees C) and using two hands pull out the filament from the extruder. If the filament ran out unexpectedly and is not visible see the section below.
4. Cut the new filament on a 45 degree angle (no kinks) and feed it through the guide and PTFE tube.
5. Ensure that the filament is straight and not curved (straighten if necessary) and push down into the extruder. This should be done when the hot end is at the working temperature.
6. Print a test cube. The filament may take a while to fill the reservoir so that not all of the skirt may be printed. If necessary reprint the test object.



If the filament ran out unexpectedly

If the filament ran out unexpectedly then the end of the filament may not be protruding above the extruder.

1. If the end of the filament can be seen from the front of the extruder it may be able to be removed by using pointed pliers or strong tweezers.
2. If this is not possible remove the PTFE cover (4 screws).
3. Undo the two screws holding the fan and hot end clamp
4. Using pliers to hold the hot end move the hot end away from the extruder so that there is better access to the filament. Pull this out.
5. Allow the hot end to cool down by switching off the printer and then put the hot end back into the extruder and tighten in place using a new clamp.
6. Turn on the printer and select “Prepare for PLA” and then follow instructions above.

11 The Z-Gap

The nozzle of the hot end is not in contact with the surface of the base on which the print is being produced. Instead there is a very small gap between the nozzle and the bed. The gap enables the plastic as it is ejected from the nozzle to be laid down on the bed (for the first layer) and the previous plastic layer as printing commences.

The Z-gap is critical:

- Too small a gap and the plastic is not properly laid down and may also be prevented from leaving the hole
- Too large a gap and the plastic may not properly adhere to the base or the previous layer.

The gap is set prior to soak testing before delivery using quality filament.

The position of the bed is sensed by the carriage prior to printing. An inductive sensor is used to home. The Z-Gap adjustment can be changed by turning the knob clockwise to decrease the gap anticlockwise to increase it.

If there are any problems in the plastic sticking to the bed first check:

- The bed is heated.
- The spray adhesive - or other means employed to cause the object to adhere to the bed, has been applied.
- The bed is level.

12 Printing an Object

It is assumed that the source CAD file has been sliced to produce the gcode file that has been copied onto the SD card.

Make sure the printer is turned on.

Select:

- Prepare
- Preheat PLA
- Preheat PLA 1

When the operating temperature of the bed and the nozzle is reached select:

- “Print from SD”.
- Rotate the knob until the selected object is located.
- Depress the knob.
- If the bed temperature is correct the print bed will descend and the X and Y homing will be performed by the carriage.
- If the bed is still heating then the printer will wait until the operating temperature is reached.
- If the nozzle temperature is correct then the printer carriage will move to a location on the print bed and perform the Z -Axis homing

When the temperatures are correct the printer will start to print a surrounding skirt.

Note that if the nozzle temperature is still heating the printer will wait until the operating temperature is reached.



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The printing of the skirt is to enable the molten plastic reservoir in the nozzle to be topped up and to ensure that the flow of plastic through the nozzle is working. The operator should check that the skirt is printing correctly, it could take several circles of the print head in printing the skirt before the plastic is flowing correctly.

After printing the skirt the carriage will move to the start position of the object and start to print the first layer. The first layer print is generally slow, after which subsequent layers are generally faster.

After each layer the bed with the object will descend slightly so that the next layer can be printed.

The progress of the print will be shown on the LCD screen.

- The first line will show the nozzle actual and target temperature and the bed actual and target temperature.
- The second line shows the position of the print head.
- The third line shows the speed the printer is working at, the percentage the object has printed and the elapsed time.
- The last line shows the last status, when finished it displays the time taken.



13 Trouble Shooting

13.1 General notes:

The use of high quality filament and dust control measures can go a long way to preventing any nozzle blockage problems.

Problem	Possible Causes	Action
Printer Dead	Not plugged in Power failure Printer problem	If there is power available and the LCD lights are not illuminated, then unplug the printer power lead wait for five minutes then plug it in again If the printer is still dead then place a support call.
Printer carriage moving but not printing	Filament finished Filament not being fed Blocked nozzle Idler not tight	Test the nozzle is not blocked by rebooting the printer and selecting the prepare PLA setting. When the nozzle temperature is reached access the UTILITIES folder in the SD card and print the "extrude. Gcode" file. If the filament is not being extruded pull out the filament cut it, straighten it and then reinsert manually pushing the filament down into the top of the extruder. Retry the extrude. If the nozzle is still blocked refer to the hot end removal section.
Object not sticking to the glass base	Incorrect gap setting If using adhesive then no, or not enough adhesive applied to the glass If using tape the gap may be incorrect or the tape surface not clean. Incorrect heated bed temperature.	Clean the nozzle and retry the test print. Check that the hair spray / adhesive was applied to the glass. If the glass has been recently cleaned then apply several layers in the first instance and retry the test print. Check the gap and correct if necessary Clean or replace the tape if necessary The temperature of the bed displayed is measured on the aluminum plate. Ensure the glass has been on the bed for a sufficient time to heat up.
Filament ran out and cannot be retrieved	A print job in unattended operation exhausts the available filament before it finished the object.	If the end of the filament can be seen protruding from the extruder roof then while the nozzle is at working temperature using pliers gently pull the filament out of the extruder. A new filament can now be inserted. If the end of the filament cannot be seen remove the four screws holding the PTFE cover The PTFE tubing, anchored at the top, can be pulled out revealing the end of the filament. Refer to the "Hot End Removal" section



13.2 The LCD Controller



The following are normal care and maintenance operations required from time to time. There are a lot of operations possible from the LCD controller. Not all of these refer to the Joey printer architecture.

Features of the LCD controller relevant to the Joey operation are.

- Info screen
- Preparation
- Control
- Printing

Note that there are many other options that can be selected, the ones described here refer to those that are generally used in normal printing. Some options are not operational in general printing usage and are used for testing and maintenance of the printer.

Info screen

As depicted above, this displays the temperature of the heated build table and the nozzle.

On the first line it displays:

- The current temperature and the target temperature of the nozzle
- The current temperature and the target temperature of the bed

On the second line it displays:

- The X axis,
- Y axis and
- Z axis position
of the extruder nozzle.

On the third line it displays:

- The speed of the printing (default 100% and this can be changed by turning the control knob).
- The presence of the SD card
- The percentage of the object printed and
- The time elapsed with the print so far

The last line is the status line and displays the last status / action.

During printing:

- The operator can turn the knob to increase or decrease the speed of the printing from the default value of 100%.
- The operator can depress the knob and select "**Pause Print**". The printing will stop. The operator can select "**Resume Print**" to continue.



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The following menus are accessible from the Info screen by depressing the control knob and then scrolling to the relevant section by turning the control knob and then depressing the current selection.

Preparation

"Prepare" lets the printer be set up for PLA or ABS printing. This raises the temperature of the bed and nozzle to the required value.

By selecting the options:

- "Prepare PLA" and then
- "Pre heat PLA" and then
- "Pre Heat PLA1"

The Nozzle temperature and the bed temperature target values are displayed and the bed and Nozzle are heated up to this value.

By Selecting:

- "Move Axis" then
- 0.1 mm or 1 mm then
- X axis, Y Axis Z Axis or E (extruder) the corresponding movement can be controlled by turning the knob.

The Auto home feature of the LCD menu should not be used. Instead there is a Gcode file on the SD card that can be "printed" and will perform the homing. (This is not generally required in normal operation).

Control

By Selecting:

- "Temperature" then "Nozzle" or "Bed" then
- Turning the knob to the desired temperature

The printer will start heating the bed or nozzle.

Print from card.

After selecting this item from the menu a list of objects resident on the SD card can be scrolled through and the desired object selected by depressing the knob. The printer will then start the print of the selected object.

13.3 Changing the filament spool

The filament spool should be changed before it runs out of filament. Control over this can be exercised by judging the amount left on the reel in regard to the object to be printed, or if the object has a known weight by weighing the spool. Smaller lengths of filament can be retained for printing smaller objects, testing the printers and so forth.

With the nozzle at the operating temperature (Around 185 degrees) move the carriage to a corner position and perform an extrude, then an extract. The filament should then be able to be pulled out.

Change the filament spool and feed the end of the filament into the guide and through the PTFE tubing. Cut off any troubled lengths and straighten about ten centimeters of filament. Remove the curve).

Push the filament down vertically into the extruder. It should be possible to push it 8 - 9 cm.

Print a test object. The first print may not print the skirt properly due to the reservoir in the nozzle being topped up. A second print should be perfect and the printer is ready to be used!

13.4 Removal of the hot end

Removal of the hot end requires the 3mm cap screw Allen key or an insert bit and a screwdriver.

- Turn the printer off and wait for the hot end to cool down.
- Unplug the hot end from the carriage mounted PCB.
- Unscrew the two 3mm cap screws holding the Fan and hot end heat sink and pull this away from the carriage.
- Holding the heater block from below gentle slide out and then put onto the heated bed the hot end assembly.
- The filament end will be protruding from the heat sink.
- With the hot end resting on the heated bed, plug the hot end back into the PCB and start the printer and using the LCD menu select "Prepare", "Preheat PLA" then "preheat PLA 1" .



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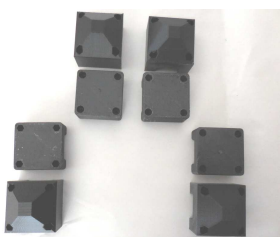
- When the temperature reaches over 175 Centigrade hold the heat sink, push the filament a little way into the hot end and then pull the filament completely out of the hot end.

Insertion of the hot end:

- Turn the printer off and wait for the hot end to cool down.
- Unplug the hot end from the carriage mounted connector.
- Offer up the hot end so that the heat sink fits into the extruder.
- Use a new clamp and the original screws to secure the hot end in place.
- Use cable ties to secure the wiring to the carriage as close as possible to the underside of the carriage.
- Turn on the printer and select "Prepare –Preheat PLA - Preheat PL 1" to heat up the nozzle and bed.
- Cut, straighten and then feed the filament into the top of the extruder.
- Cutoff any troubled lengths and straighten about ten centimeters of filament.
- Push the filament down vertically into the extruder. It should be possible to push it 8-9 centimeters.
- Perform a test print.

14 Accessories available

Feet



The printer is delivered with plastic feet, bolts that can be used as adjustable feet or the printer could be secured to a workbench or shelf.

Spatula

The most commonly used tool after every print is the spatula included in the tool box.

Printer Cover

A heavy duty cover with backing to prevent the accumulation and eventual ingress of dust is available from the web site.

15 3D Industries Support

If the printer problem cannot be resolved please advise 3D Industries by email with "**Support**" in the Subject line and include:

- Owner Name and printer location
- Printer number (On the Rumba box cover)
- Description of the problem
- Contact details

To the email address:

admin@3dIndustriesAustralia.com.au

To return the pre wired hot end assembly for servicing

Please call 3D Industries to advise and a replacement will be dispatched immediately.

Send the faulty unit with a covering note to:

3D Industries Australia
2/ 4 Matthews Street
Warwick, Queensland 4370
Tel: 07 32 001784



15.1 Software supplied

Test objects include .gcode

- Cube
- Solid cylinder

Calibration objects include .stl

- Cube
- Solid cylinder
- Bed level object

Slic3r 9.8 software (or latest certified version)
config.ini
