MBot Cube Duo
3D Printer

User Manual

Revision 1.1

16 May 2017

Sailfish firmware version 7.5

MPrint® software version 1.3.0.6

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This manual describes the operation of an assembled MBot Cube Duo 3D Printer. For assembly instructions consult the 3D Printer Assembly Instructions manual that is available for download from http://www.mbot3d.com/product-3d-printer/mbot-cube.

Revision History

Revision	Date	Description
1.0	27 April 2017	First release
1.1	16 May 2017	Updates after review by UA

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1.   Introduction

The MBot Cube Duo 3D Printer is a Fused Deposition Modelling (FDM) printer manufactured by MagicFirm, LLC. It builds plastic three dimensional (3D) objects by depositing successive layers of molten plastic.

It is a Cartesian printer – it moves its print head on the xy-plane. The print bed is moved up and down along the z-axis.
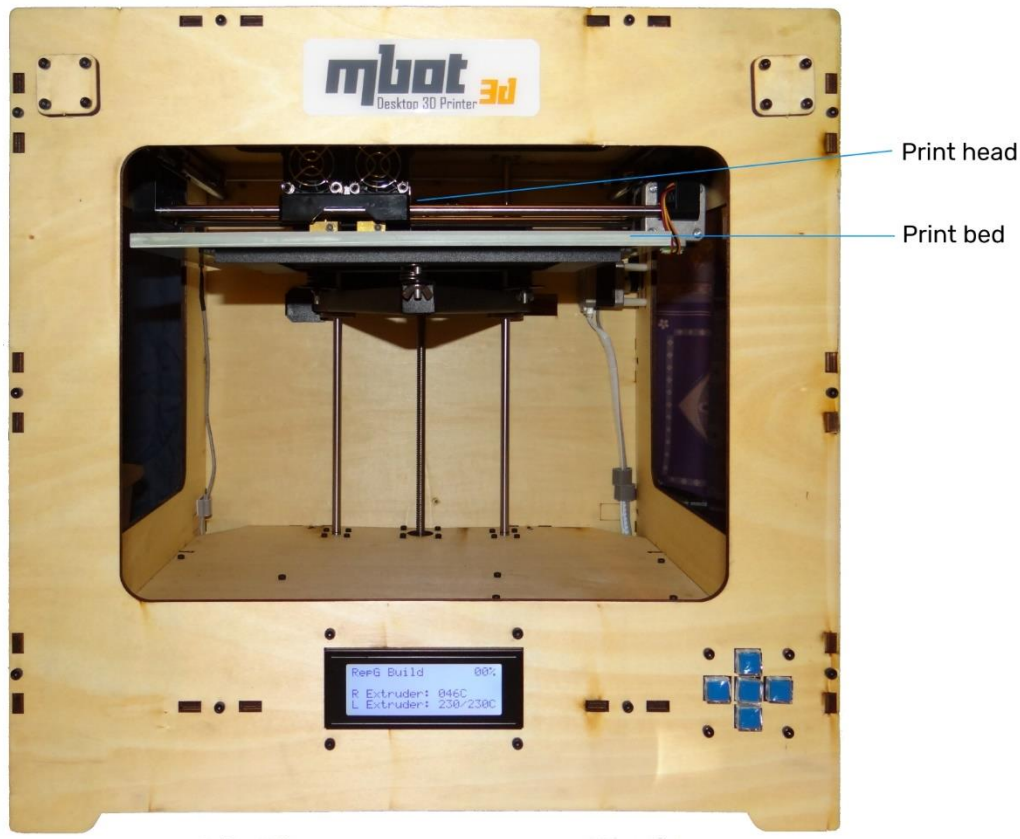
Figure 1 : Important Components of the MBot Cube Duo 3D Printer

The MBot Cube Duo is a dual head printer. Two materials can be used at the same time in one print.

This manual describes how to operate the printer from the front panel, and how to use the MPrint® software. Note that a Secure Digital (SD) card reader is required to transfer files to the supplied SD card.

An installation of ReplicatorG with printer profiles for MBot printers is also available for download. The use of ReplicatorG is, however, beyond the scope of this manual.

2.　Printer Specifications

Table 1 : Printer Specifications[1]

Operational Parameters	
Build Resolution	0.1 mm (0.004")
Layer Resolution	0.1 - 0.3 mm (0.004 – 0.012")
Build Speed	50 – 120 mm/s (1.96 – 4.72"/s)
Extruder Temperature	190 – 260 °C (374 – 500 °F)
Data Input	SD card offline operation
Build Volume	220 mm x 220 mm x 180 mm (8.6" x 8.6" x 7")
Print Bed	Not heated
Physical Dimensions	
Printer Size	405 mm x 405 mm x 410 mm (15.9" x 15.9" x 16.1")
Shipping Box Size	520 mm x 520 mm x 580 mm (20.5" x 20.5" x 22.8")
Shipping Weight	15 kg (33 lb)
Power Supply	
Input	110 – 220 V AC, 50 – 60 Hz
Output	24 V DC, 6 A 5 V DC, 2 A
Filament	
Materials	ABS PLA
Material Thickness	1.75 mm
Software	
Printer Software	MPrint® ReplicatorG
Supported File Types	STL
Supported Operating Systems	Windows 7/XP/Vista Ubuntu Linux 10.4+ Mac OS X 10.6+
Regulatory Conformance	
Markings	CE, CAS

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[1] From http://www.mbot3d.com/product-3d-printer/mbot-cube#specifications

3. Software Installation

Download the MPrint® software installer from the MBot3D website at http://www.mbot3d.com/software.

The installation steps below are for a 64-bit Windows operating system. The default install folder will be C:\Program Files\MPrint on a 32-bit operating system.

To install MPrint® on Microsoft™ Windows™ Vista or later:

1. Run the downloaded file MPrintInstaller1.3.0.6.exe to display the Welcome to the MPrint Setup Wizard screen.
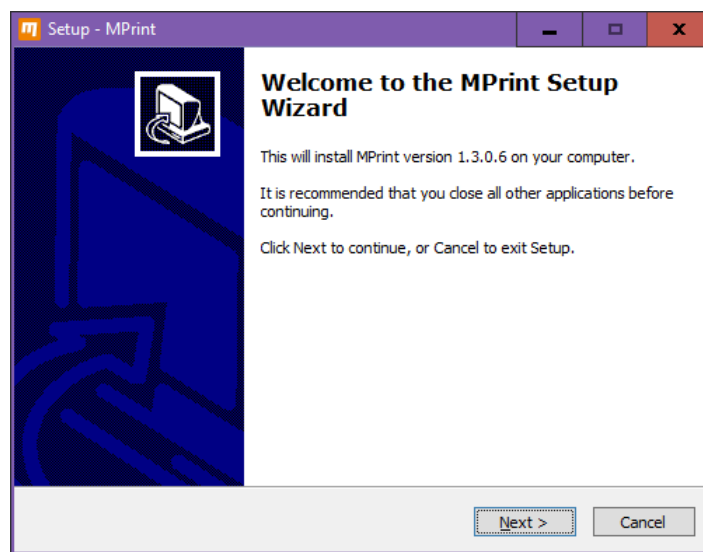

Figure 2 : Welcome to the MPrint Setup Wizard screen

2. Click **Next** to display the Select Destination Location screen.
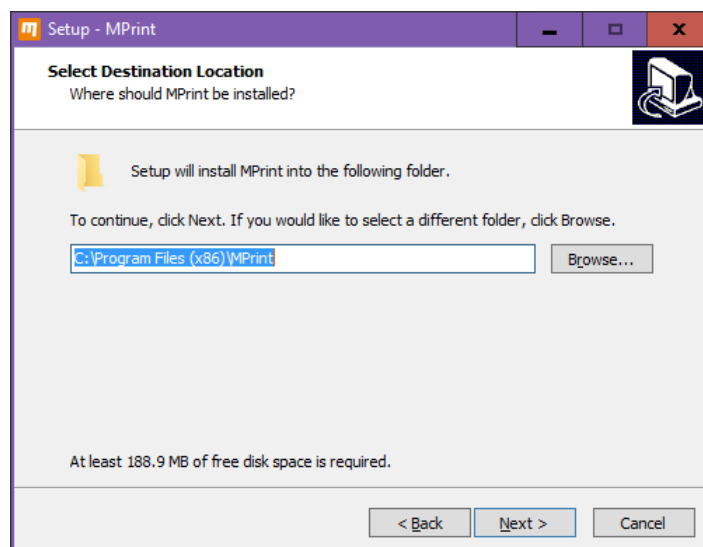

Figure 3 : Select Destination Location screen

3. Click **Browse** to choose a different install location if desired.

4. Click **Next** to display the Select Start Menu Folder screen.
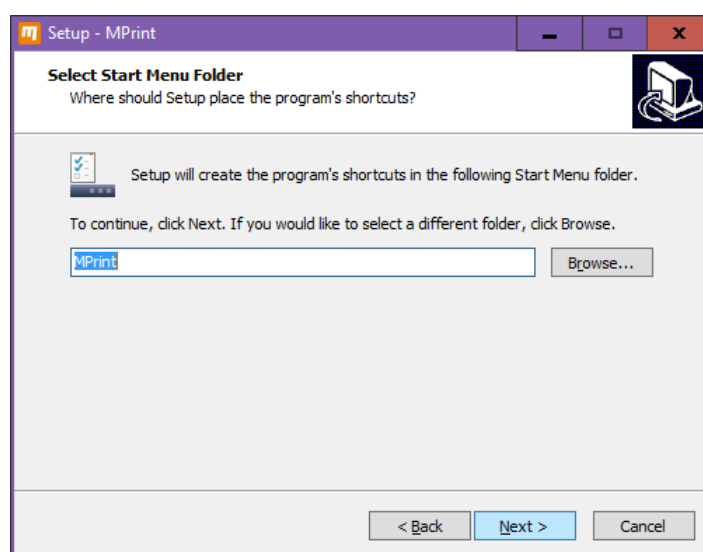
Figure 4 : Select Start Menu Folder screen

5. Click **Browse** to select a different Start menu folder if desired.
6. Click **Next** to display the Select Additional Tasks screen.
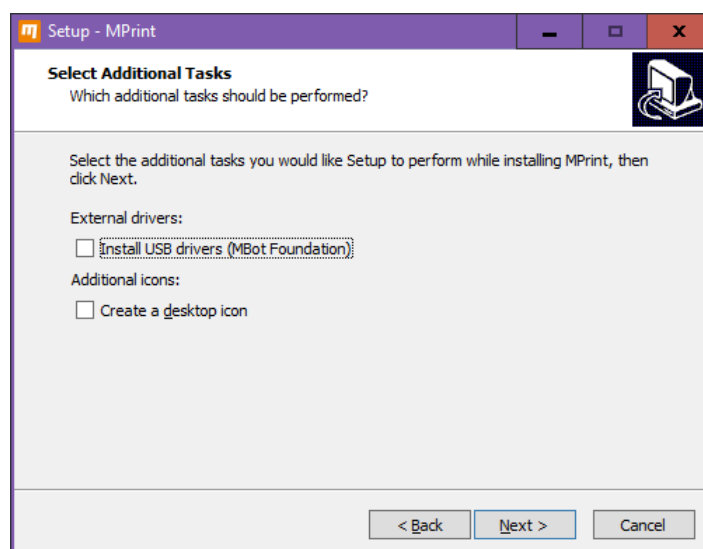
Figure 5 : Select Additional Tasks screen

7. Choose whether to install the MBot Foundation Universal Serial Bus (USB) drivers. Note that these drivers are not compatible with Windows 8 or later. The USB drivers are not required if printing from a Secure Digital (SD) card.

> **Tip**   The MPrint® software installer will install the driver installation files to the folder C:\Program Files (x86)\MPrint\drivers. Run dpinst64.exe (dpinst32.exe on a 32-bit operating system) in the drivers folder to install the drivers at a later time.

8. Choose whether to create a desktop icon.
9. Click **Next** to display the Ready to Install screen.
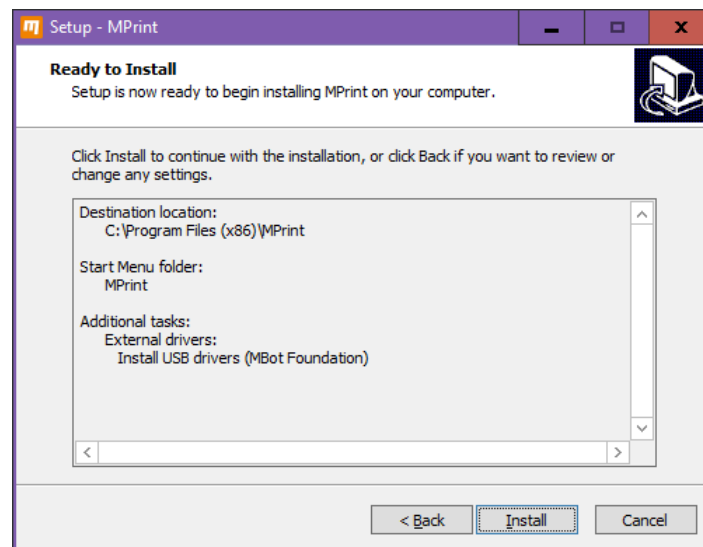
Figure 6 : Ready to Install screen

10. Confirm that the displayed settings are correct.
11. Click **Next**.
12. If the Install USB drivers option is selected, a separate installer will be launched during the installation. Follow the prompts of the driver installer to choose which drivers to install.
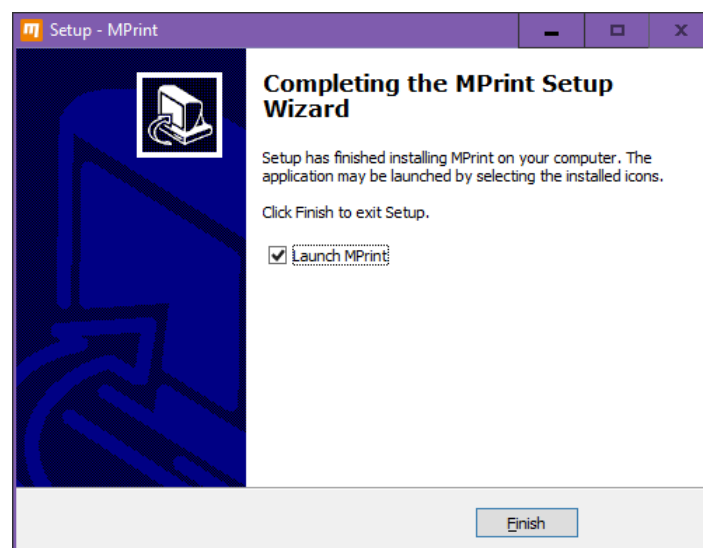
Figure 7 : Complete the MPrint Setup Wizard screen

13. On the Completing the MPrint Setup Wizard screen, choose whether to launch the MPrint® software when the installation completes.
14. Click **Finish**.

To launch MPrint®, run it from the Windows Start menu.

4.   Navigating the Printer Front Panel

A liquid-crystal display (LCD) screen and five buttons appear on the front panel of the printer. The printer displays the main menu shown in Figure 8 when it is ready to print.
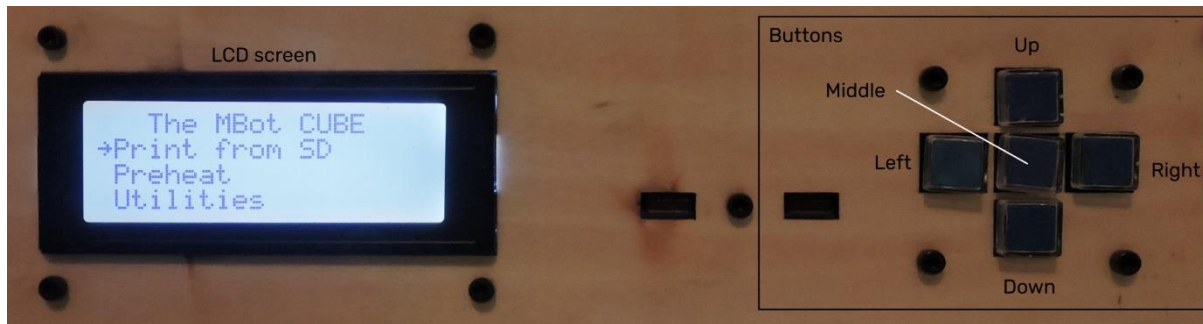
Figure 8 : Front Panel Layout with Main Menu Displayed

This section briefly describes the main concepts that are useful when operating the user interface. How to access specific features will be described in more detail in later sections.

The arrow to the left of the Print from SD menu item in Figure 8 marks the currently selected menu item.

Table 2 : Button Actions

Button(s)	Actions
Up and **Down**	Select a menu item. Note that some menus have more than one screen of menu items. Press the down button when at the bottom of the screen to show the next page of menu items.
Middle	Activate the selected menu item. Menu items either perform actions or open deeper levels of menus, depending on the item.
Left	Return to the previous menu level.

Figure 9 : Screen with Special Button Assignments

Some screens assign special meanings to the buttons. Figure 9 shows an example of such a screen - Jog mode. The text on the screen is organised to represents the functions of the buttons in corresponding positions. The **up** button jogs the print head in the positive direction on the y axis. The **right** button switches to the z axis control screen. And so on.

5. Filament Loading and Unloading

5.1. Filament Selection

The MBot Cube Duo uses filament with a thickness of 1.75 mm. Filament spools are available from various suppliers. While filament thickness is standardised, spool sizes vary. The dimensions that are typically specified for filament spools are shown in Figure 10.
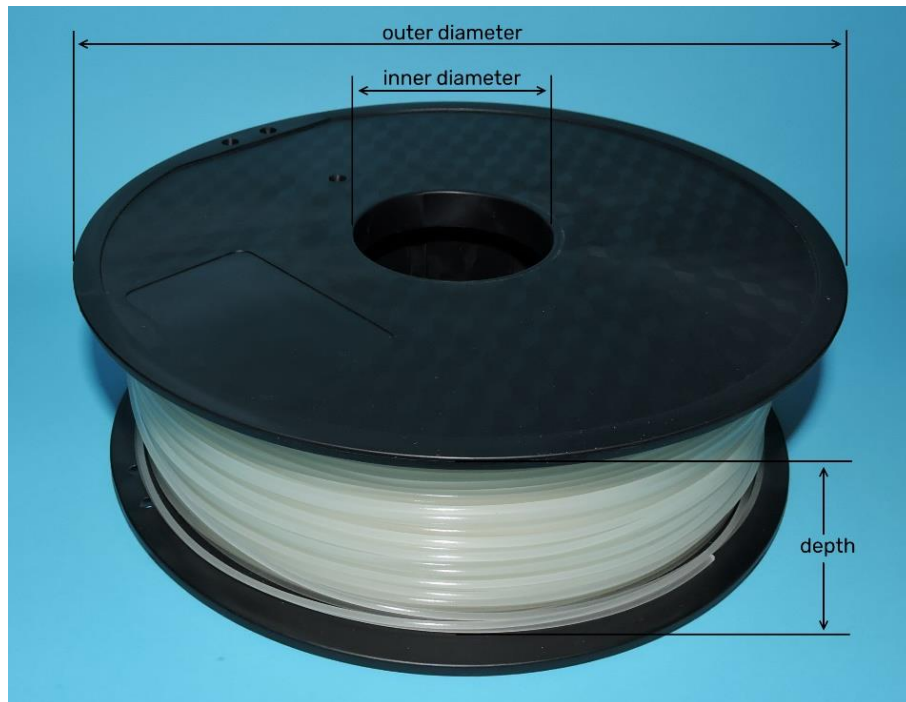

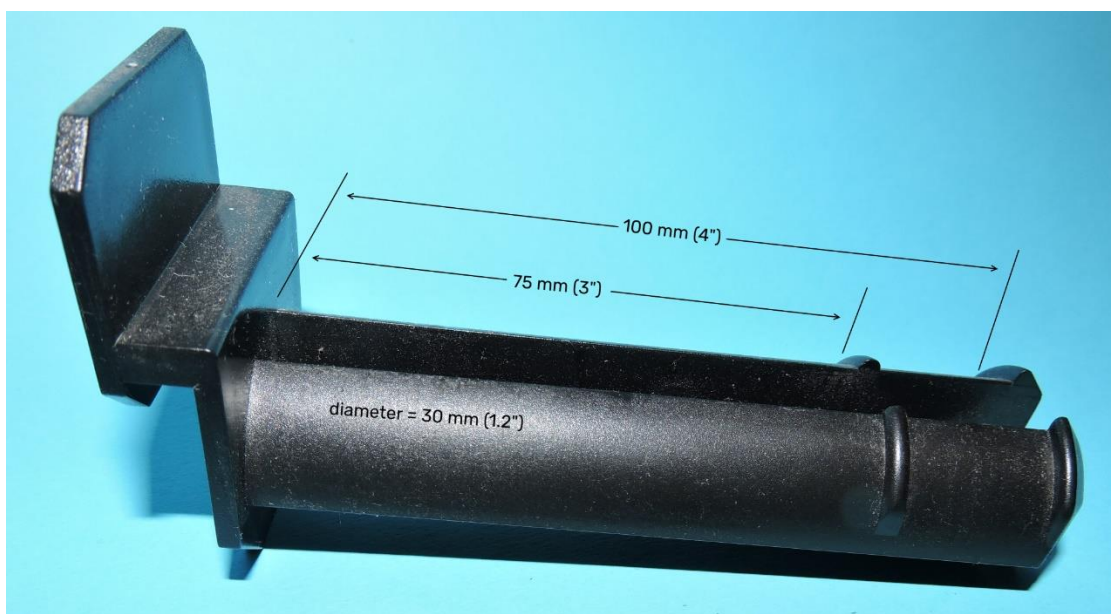*Figure 10 : Spool Dimensions*

Figure 11 : Spool Holder Dimensions

The dimensions of the spool holders supplied with the printer determine which spools are compatible. The inner diameter of the filament spool should be larger than 30 mm (1.2"). The depth of the spool should ideally be less than 75 mm (3"), with a maximum depth of 100 mm (4").

Tip	You can print your own spool holders if the dimensions of the supplied ones are not what you need.

The distance between the center points of the two spool holders is 20 cm (7.9"). When using both extruders, keep in mind that the two spools need to fit onto the two spool holders at the same time. This means that radius of spool one plus radius of spool two must be less than 17 cm (6.7").

Two material types are officially supported:

- Polylactic acid (PLA), and
- Acrylonitrile butadiene styrene (ABS).

These two materials are compared in Table 3 below.

Table 3 : Material Properties

Property	PLA	ABS
Material Type	Bioplastic derived from plant materials	Synthetic plastic
Extruder Temperature	180 – 220 °C (356 - 428 °F)	220 - 235 °C (428 - 455 °F)
Bed Adhesion	Good adhesion to non-heated bed	Poor adhesion to non-heated bed
Flexibility	More flexible than ABS	More rigid than PLA
Smell While Printing	Semi-sweet smell	Hot plastic smell

Tip	Apply a layer of firm hold hair spray to the print bed when printing with ABS, to unsure that prints stick to the bed. Allow the hair spray to dry completely before starting the print.

Warning	Hair spray can combust when exposed to high temperatures, causing serious injury and damage to property. Ensure that the hair spray is applied in a well-ventilated area. Ensure that the hair spray has completely dissipated before switching on the printer.

Use other materials that can be printed between 190 °C and 260 °C (374 °F and 500 °F) at your own risk.

5.2. Setting Temperature

You can set the temperature for each of the print heads (left and right) individually. This enables you to use two different types of filament with different printing temperatures.

> **Tip** When printing with a new spool of filament, start with the printing temperature that is recommended by the filament manufacturer. Print a small test print, and adjust the temperature if required.

To set the print temperature from the front panel:

1. Navigate to the main menu.
2. Select the Utilities menu item using the **up** and **down** buttons.
3. Press the **middle** button to enter the Utilities menu.
4. Select the Preheat Settings menu item and press the **middle** button. The Preheat Settings screen will be displayed – see Figure 12.
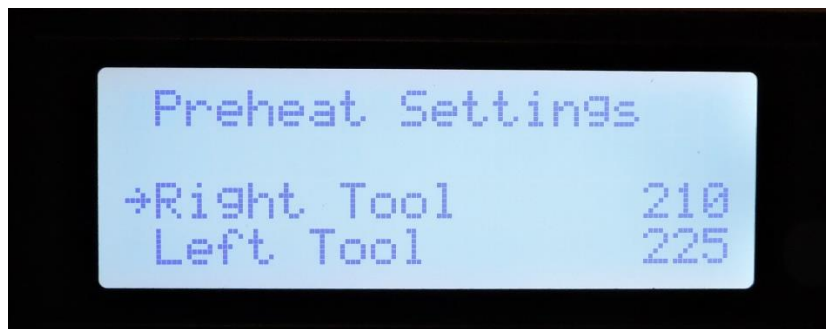

Figure 12 : Preheat Settings Screen

5. Press the **up** or **down** buttons to select the print head for which to change the temperature – right tool or left tool.
6. Press the **middle** button.
7. Press the **up** or **down** buttons until the desired temperature is reached.
8. Press the **middle** button to accept the temperature.
9. Repeat steps 5 to 8 to change the temperature for the other print head if desired.
10. Press the **left** button twice to return to the main menu.

By default, the temperatures that are set on the front panel of the printer override the temperatures that may be specified in the file that is printed. This means that you can print the same model in different materials without having to slice it again. The default value of Override GcTemp = On is recommended.

To change the temperature override setting (if necessary) from the front panel:

1. Navigate to the main menu.
2. Select the Utilities menu item and press **middle** button.
3. Select the General Settings menu item and press **middle** button. Note: This menu item appears on the second page of the menu.

4. Select the Override GcTemp menu item and press the **middle** button.
5. Press the **up** or **down** buttons to select the new value.
6. Press **middle** button to accept the selection.
7. Press the **left** button twice to return to the main menu.

5.3. Loading Filament

Tip	Apply multi-purpose lubricant to the surfaces of the filament spool that touch the spool holder. This reduces friction, which in turn reduces the risk of filament getting stuck.

Before starting with the filament loading process, ensure that the preheat temperature is set to the right value. See section 5.2 for more details.

To load filament:

1. Hang the filament spool on one of the spool holders.

    The orientation of the spool is important. See Figure 13 for the most optimal orientation, when looking at the printer from the back. Note the direction of rotation of the spools.
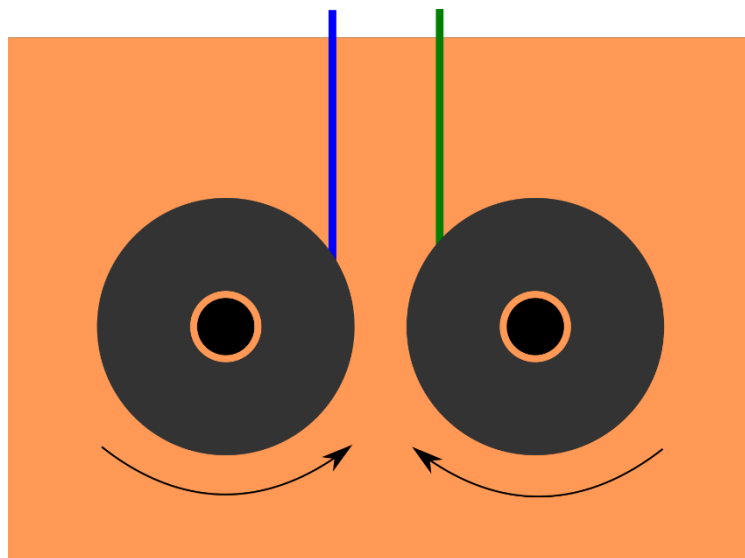

Figure 13 : Spool Orientation

2. Feed the filament manually through one of the feeding tubes.
3. Navigate to the main menu from the front panel of the printer.
4. Select the Utilities menu item and press **middle** button.
5. Select Filament Loading and press **middle** button.
6. Choose Load left or Load right and press **middle** button.
7. Wait for the print head to reach the correct temperature. A progress bar will be displayed on the screen while heating is in progress.
8. When the feeder motor is switched on, gently feed the filament manually into the top of the print head. See Figure 14.
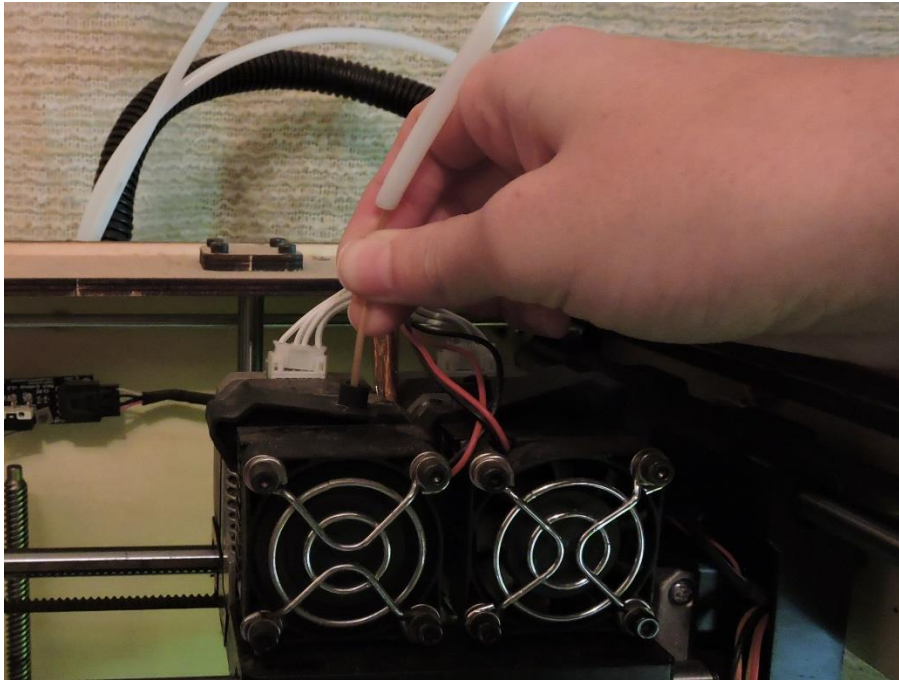
Figure 14 : Feeding Filament During Loading

9. When the filament is pulled by the motor, and filament is extruded, press the **middle** button to stop loading.

> **Tip**   If a different filament was used before, some of the old colour may be extruded first. Keep extruding until the new colour is cleanly extruded.

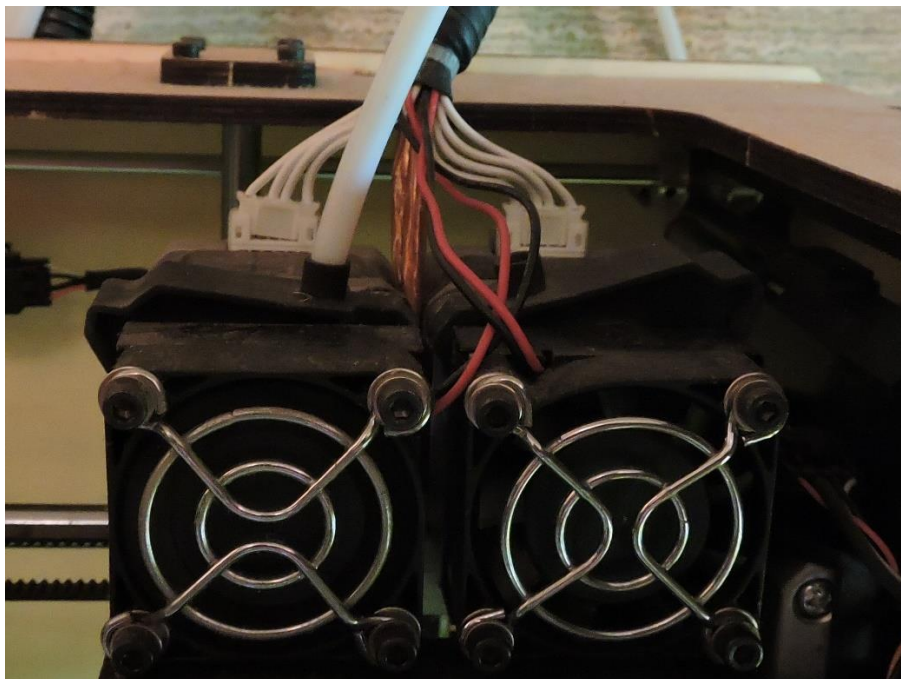10. Plug the feeding tube securely into the top of the print head. See Figure 15.

Figure 15 : The Feeding Tube in its Final Position

5.4. Unloading Filament

> **Tip**   It is recommended that filament should be unloaded before switching off the printer. If filament was not unloaded, first perform the load action for a few seconds. This will make the filament unloading process much easier.

Before starting with the filament unloading process, ensure that the preheat temperature is set to the right value. See section 5.2 for more details.

To unload filament:

1. Pull the feeding tube out of the top of the print head.
2. Navigate to the main menu from the front panel.
3. Select the Utilities menu item and press **middle** button.
4. Select Filament Loading and press **middle** button.
5. Choose Unload left or Unload right and press **middle** button.
6. Wait for the print head to reach the correct temperature.
7. The printer will switch on the feeder motor, reversing the filament out of the print head.
8. Gently pull the filament from the print head.
9. Once the filament is removed, press **middle** button to stop the motor.
10. Trim the end of the filament.
11. Manually pull the filament from the feeding tube.
12. Remove the spool from the spool holder.
13. Store the spool according to manufacturer recommendations.

> **Tip**   Wait for the print head cooling fans to switch off before powering down the printer. This will help to prevent any remaining filament from clogging the extruder.

6.   Preparing a Model for Printing

To 3D print something, you need a digital model of the object. The MPrint® software requires models to be in the STereoLithography (STL) file format. This is a very common file format that is supported by many Computer-Aided Design (CAD) applications. Several sample models are included in the MPrint® installation.

Tip	Thingiverse (http://www.thingiverse.com/) is an online repository of freely downloadable 3D models.

Once you have the model, it needs to be sliced. This means that the model is converted into the path in space that the print head will follow to print the object. Slicing is done with MPrint®.
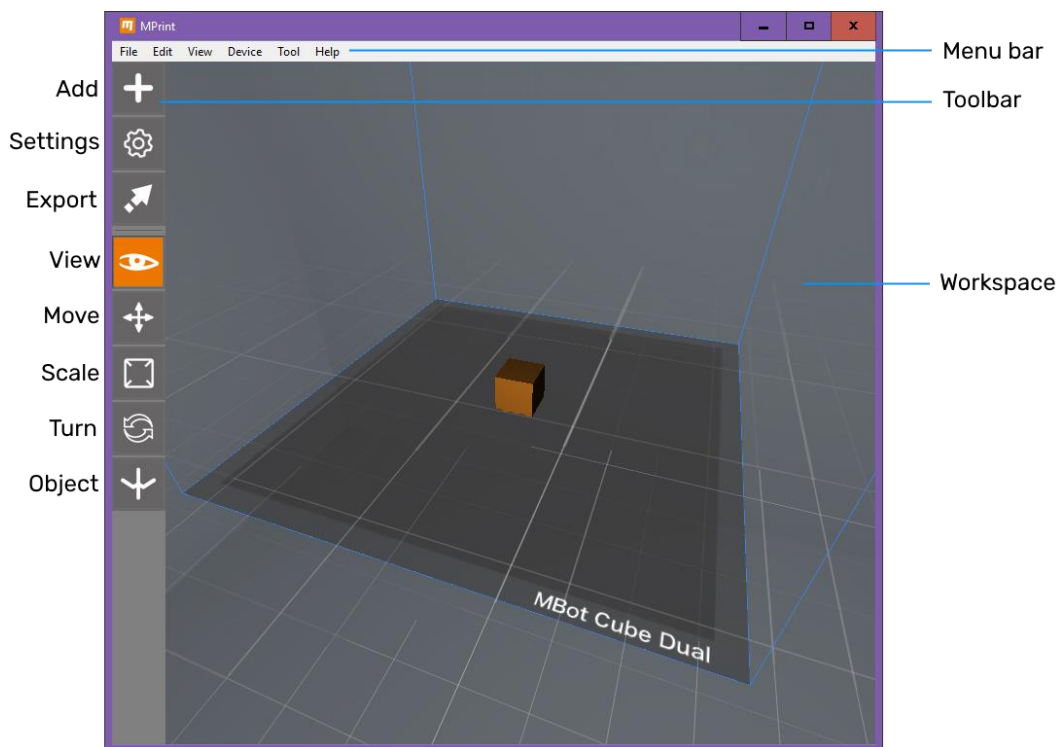

Figure 16 : Main Features of the MPrint® Software User Interface

6.1. Configuring MPrint®

It is important to configure MPrint® to use the correct printer profile. Otherwise the print may not turn out to be the expected size.

To choose the printer profile:

1. From the menu bar, choose Device > Select Type of Device > Others > MBot Cube Dual(17).

Note that you will have to perform this configuration again when you update the MPrint® software to a newer version.

6.2. Slicing a Sample Model

To slice the cube model sample:

1. From the **File** menu, choose **Examples**.
2. From the **Examples** menu, choose **20x20x20mm_cube.stl**. The cube is shown as in Figure 16.
3. Click the **Object** button on the toolbar.
4. Left click on the cube in the workspace.
5. Right click anywhere on the workspace. A popup dialog box is displayed (see Figure 17).
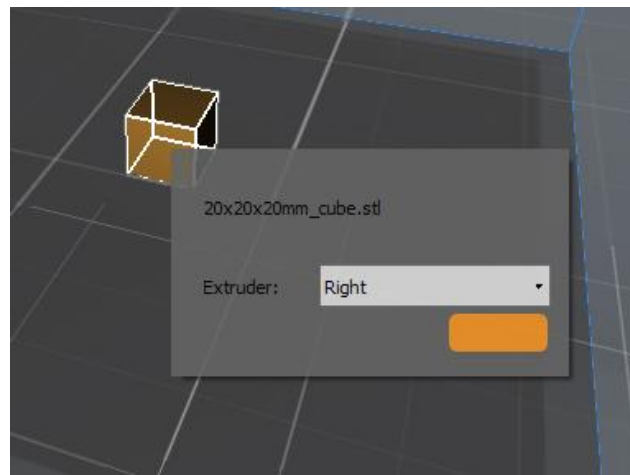

Figure 17 : Extruder Selection Dialog Box

6. Choose the extruder that you are planning to use – left or right.
7. Left click on the workspace outside of the popup to close the dialog box.
8. Click the **Settings** button on the toolbar. The GCode Generator dialog box is displayed (see Figure 18).
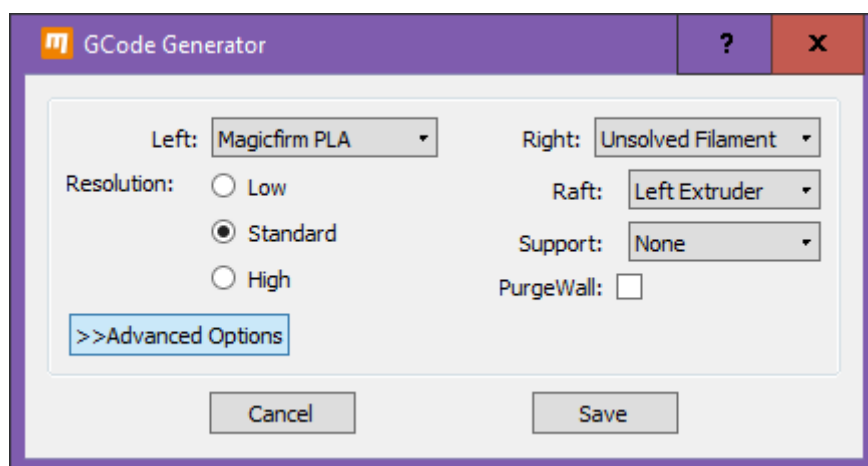

Figure 18 : GCode Generator Dialog Box

9. Choose the same extruder for printing the raft as used in step 6.

> **Tip**   The raft is printed first before the model itself. This is done to ensure that the print sticks to the print bed. Printing the raft with a different material (using the second print head) can make the raft easier to remove.

10. For Support, choose None.

> **Tip**   Support structures need to be printed if there are overhanging areas in the model. Figure 19 shows an example of such a model. The highlighted areas are not supported by anything if supports are not switched on.
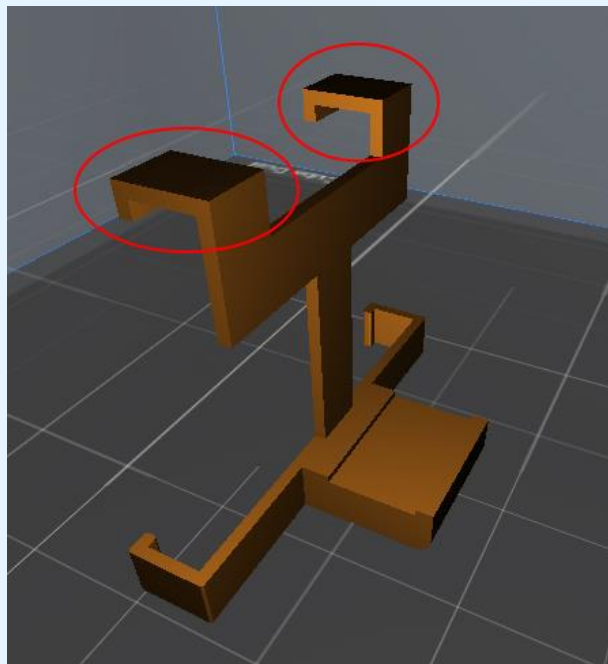>
> *Figure 19 : Model with Overhanging Areas*

11. Click **Save**.
12. Click the **Export** button on the toolbar.
13. Wait for the generation process to complete. Since the cube is a simple model, it will not take long.
14. Click the **Export** button.
15. Choose a location and for the .x3g file and click **Save**.
16. Transfer the generated file to the SD card that is provided with the printer.

> **Tip**   Decide on a file naming convention that indicates which print head will be used for the print. It will be invaluable if you want to print the same print again months later.

6.3. Slicing Other Models

To slice a model from an STL file:

1. Click the **Add** button on the toolbar.
2. Browse to the location of the STL file and select it.
3. Click **Open**.
4. Continue with the steps in section 6.2, starting with step 3.

Note that multiple models can be added. The print head to use for each of the models can be selected independently. Click on the **Move** button on the toolbar to move models into position.

7. Printing

Before continuing with this section, ensure that a sliced model is loaded on the SD card (see section 6). Load the filament for the print (see section 5.3).

To print from the SD card:

1. Insert the SD card into the SD card reader of the printer. Note the orientation of the card in Figure 20.

Figure 20 : Inserting the SD Card

2. Navigate to the main menu on the printer front panel.
3. Select Print from SD and press the **middle** button.
4. Select the generated .x3g file.
5. Press **middle** button. This action starts the print.
6. When the print is complete, remove it from the print bed.
7. Remove the raft from the bottom of the print.

Tip	Sand the surface of the print with sand paper to smooth it if desired.

8. Glossary

Acrylonitrile butadiene styrene (ABS) – A synthetic plastic used in 3D printing.

Cartesian printer – A 3D printer that moves its print head along the x-, y- and z-axis.

Computer-Aided Design (CAD) – The use of computer software to create technical drawings.

Extrude – The process of shaping a molten material by forcing it through a hole.

Fused Deposition Modelling (FDM) – An additive manufacturing process where 3D objects are created by depositing successive layers of material.

Liquid-crystal display (LCD) – A flat screen display that uses liquid crystals.

Model – An electronic description of a 3D object.

Polylactic acid (PLA) – A bioplastic used in 3D printing.

Raft – A structure that is printed first, to ensure that the print sticks to the print bed.

Slicing – The process of transforming a model into a toolpath for a 3D printer.

STereoLithography (STL) – A file format for 3D models.

Support – Extra material that is printed to support overhanging areas.

Toolpath – The path through space that the print head follows during printing.