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# 3D-Printed Android: A Tutorial

## *Part I of III*

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# Outline

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## Preparing the hardware

- Understanding the 3D printer specification
- Preparing the tools
- 3D Printing Instructions
  - Print settings for Guider II
  - Actuator Housing Profile for P1S
  - Actuator Shaft Profile for P1S
- Building the Actuator
- Setting up the Motor Controllers
- Building the Robot

## Preparing the software

- TBA
  - TBC
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# FlashForge Guider II



Print Technology	Fused Filament Fabrication(FFF)
Build Volume	280*250*300mm
Layer Resolution	0.05 - 0.4mm
Build Accuracy	±0.2mm
Positioning Accuracy	Z axis 0.0025mm; XY axis 0.011mm
Filament Diameter	1.75mm (±0.07)
Nozzle Diameter	0.4mm
Print Speed	10-100 mm/s

The FlashForge Guider 2 features a heated bed and a fully enclosed chamber, allowing for stable printing with PLA, ABS, PETG, and TPU with a 1.75mm filament. It uses a direct-drive extruder and a 0.4 mm nozzle by default. The printer is controlled via a 5-inch touchscreen and supports USB, Wi-Fi, and Ethernet for file transfer. We suggest using the Ethernet to communicate with the printer FlashPrint 5 is the recommended slicer software.

Link: [User Manual](#)

# Bambu Lab P1S



Print Technology	Fused Filament Fabrication(FFF)
Build Volume	256 × 256 × 256 mm
Layer Resolution	0.05 - 0.4mm
Build Accuracy	±0.1mm
Positioning Accuracy	Z axis 0.0125mm; XY axis 0.0025mm
Filament Diameter	1.75mm ( ±0.07 )
Nozzle Diameter	0.4mm (Swappable)
Print Speed	100-250 mm/s (Normal mode), 500 mm/s (Sport mode)

The Bambu Lab P1S features a textured heated bed and a fully enclosed chamber, allowing for stable printing with PLA, ABS, PETG, TPU, and industrial materials including those reinforced with fiber composites. It uses a direct-drive extruder and a 0.4 mm stainless steel nozzle by default. The printer supports print speeds up to 500 mm/s and is built on a CoreXY motion system with input shaping for high-speed performance. We use the Wi-Fi connection to communicate with the printer; Bambu Studio is the recommended slicer software.

Link: [User Manual](#)

# Preparing the tools (1/5)

- Metal putty knives are used to remove models from the FlashForge Guider II heated bed. They should not be used on the textured heated bed of the Bambu Lab P1S, as this can damage the surface.



# Preparing the tools (2/5)

- Plastic scrapers are used for removing prints from the [Bambu Lab P1S](#) textured bed without damaging the surface. Replaceable blades should be kept sharp to reduce the risk of scratching the bed. Do not use excessive force during removal. Maintain a blade angle of at most 30 degrees relative to the bed surface when detaching the model.



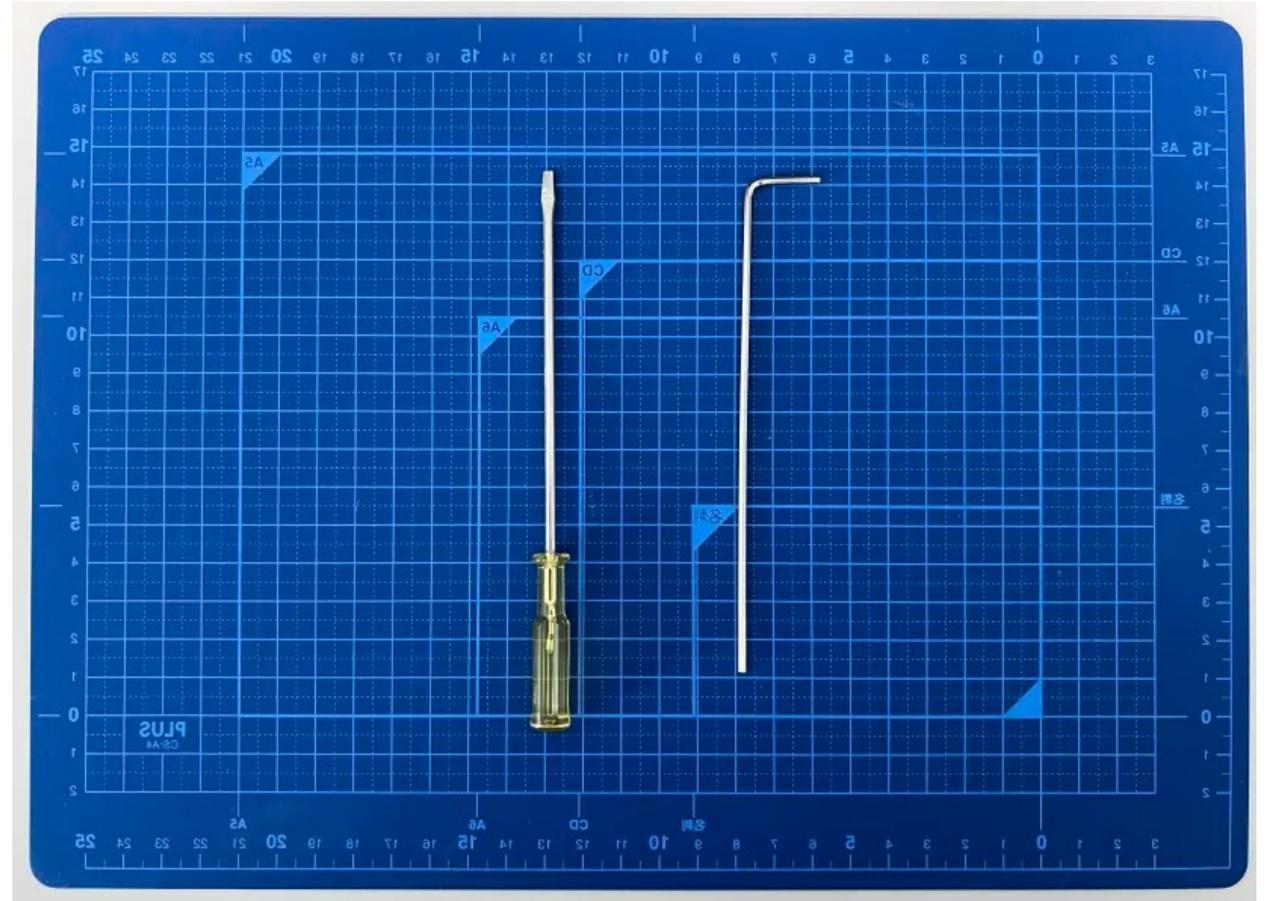
## Preparing the tools (3/5)

- Pliers are used for removing supports and cleaning up printed parts. Side cutters are best for trimming small support structures, while needle-nose and combination pliers help with gripping and breaking off larger sections. Always remove supports carefully to avoid damaging the model.



# Preparing the tools (4/5)

- The tool on the left is used for loosening internal supports for removal located in inside donut-shaped holes. The tool on the right is used to push out support material from narrow cylindrical cavities.



# Preparing the tools (5/5)

- Sanding sponges are used for removing residue and smoothing edges left after support removal. They also help reduce friction on moving parts, especially in models designed to house motors. Lower grits are for rough cleanup, while higher grits are used for fine finishing and surface polishing.





# Print settings for Guider II (1/2)

Printer

General

Shells

Infill

Supports

**Raft**

Additions

Cooling

Advanced

Others

General

Enable Raft

Margin

Space to Model (Z)

Above Raft Extrusion Ratio

Above Raft Maximum Speed

Bottom Layer

Layer Height

Path Width

Fill Density

Speed

- The following parameters are tuned for the FlashForge Guider II printer to improve raft removal. These settings allow the raft to peel away cleanly—like a banana skin—reducing the risk of injury to the operator.



# Print settings for Guider II (2/2)

The screenshot displays the printer settings for the FlashForge Guider II. The 'Raft' section is highlighted with a red box. The settings are as follows:

Category	Parameter	Value
Middle Layers	Layer Height	0.40mm
	Layers	1
	Path Width	0.4mm
	Fill Density	30%
	Speed	30mm/s
Top Layers	Layer Height	0.40mm
	Layers	3
	Path Width	0.4mm
	Speed	60mm/s
	Angle Between Model	90°

- The following parameters are tuned for the FlashForge Guider II printer to improve raft removal. These settings allow the raft to peel away cleanly—like a banana skin—reducing the risk of injury to the operator.



# Actuator Housing Profile for P1S (Quality)

## Layer height

Layer height  mm  
Initial layer height  mm

## Line width

Default  mm  
Initial layer  mm  
Outer wall  mm  
Inner wall  mm  
Top surface  mm  
Sparse infill  mm  
Internal solid infill  mm  
Support  mm

## Seam

Seam position   
Smart scarf seam application   
Scarf application angle threshold  °  
Scarf around entire wall   
Scarf steps   
Scarf joint for inner walls   
Role-based wipe speed

## Precision

Slice gap closing radius  mm  
Resolution  mm  
Arc fitting   
X-Y hole compensation  mm  
X-Y contour compensation  mm  
Auto circle contour-hole compensation   
Elephant foot compensation  mm  
Precise Z height

## Ironing

Ironing Type

## Wall generator

Wall generator

## Advanced

Order of walls   
Print infill first   
Bridge flow   
Thick bridges   
Only one wall on top surfaces   
Only one wall on first layer   
Smooth speed discontinuity area   
Smooth coefficient   
Avoid crossing wall   
Smoothing wall speed along Z(experimental)



# Actuator Housing Profile for P1S (Strength)

**Walls**

Wall loops

Detect thin wall

**Top/bottom shells**

Top surface pattern

Top shell layers

Top shell thickness  mm

Top paint penetration layers

Bottom surface pattern

Bottom shell layers

Bottom shell thickness  mm

Bottom paint penetration layers

Internal solid infill pattern

**Sparse infill**

Sparse infill density  %

Sparse infill pattern

Length of sparse infill anchor  mm or %

Maximum length of sparse infill anchor  mm or %

**Advanced**

Infill/Wall overlap  %

Infill direction  °

Bridge direction  °

Minimum sparse infill threshold  mm<sup>2</sup>

Infill combination

Detect narrow internal solid infill

Ensure vertical shell thickness

Detect floating vertical shells



# Actuator Housing Profile for P1S (Speed)

## Initial layer speed

Initial layer	50	mm/s
Initial layer infill	105	mm/s

## Other layers speed

Outer wall	200	mm/s
Inner wall	300	mm/s
Small perimeters	50%	mm/s or %
Small perimeter threshold	0	mm
Sparse infill	270	mm/s
Internal solid infill	250	mm/s
Vertical shell speed	80%	mm/s or %
Top surface	200	mm/s
Slow down for overhangs	<input checked="" type="checkbox"/>	

## Overhang speed

0	mm/s	10%
50	mm/s	25%
30	mm/s	50%
10	mm/s	75%
10	mm/s	100%

## Bridge

50 mm/s

## Gap infill

250 mm/s

## Support

150 mm/s

## Support interface

80 mm/s

## Travel speed

Travel 500 mm/s

## Acceleration

Normal printing	10000	mm/s <sup>2</sup>
Travel	10000	mm/s <sup>2</sup>
Initial layer travel	6000	mm/s <sup>2</sup>
Initial layer	500	mm/s <sup>2</sup>
Outer wall	5000	mm/s <sup>2</sup>
Inner wall	0	mm/s <sup>2</sup>
Top surface	2000	mm/s <sup>2</sup>
Sparse infill	100%	mm/s <sup>2</sup> or %

# Actuator Housing Profile for P1S (Support)

## Support

- Enable support
- Type: normal(auto)
- Style: Default
- Threshold angle: 29°
- On build plate only
- Remove small overhangs

## Raft

- Raft layers: 0 layers

## Filament for Supports

- Support/raft base: 4 Sup.PLA
- Support/raft interface: 4 Sup.PLA

## Advanced

- Initial layer density: 90 %
- Initial layer expansion: 2 mm
- Support wall loops: 0
- Top Z distance: 0 mm
- Bottom Z distance: 0.2 mm
- Base pattern: Default
- Base pattern spacing: 2.5 mm
- Pattern angle: 0°
- Top interface layers: 2 layers
- Bottom interface layers: 2 layers
- Interface pattern: Rectilinea...
- Top interface spacing: 0 mm
- Normal Support expansion: 0 mm
- Support/object xy distance: 1 mm
- Support/object first layer gap: 1 mm
- Don't support bridges
- Independent support layer height



# Actuator Housing Profile for P1S (Others)

## Bed adhesion

Skirt loops	<input type="text" value="0"/>
Skirt height	<input type="text" value="1"/> layers
Brim type	<input type="text" value="Auto"/>
Brim width	<input type="text" value="5"/> mm
Brim-object gap	<input type="text" value="0.1"/> mm

## Prime tower

Enable	<input checked="" type="checkbox"/>
Skip points	<input checked="" type="checkbox"/>
Internal ribs	<input type="checkbox"/>
Width	<input type="text" value="35"/> mm
Max speed	<input type="text" value="90"/> mm/s
Brim width	<input type="text" value="3"/> mm
Infill gap	<input type="text" value="150"/> %
Rib wall	<input checked="" type="checkbox"/>
Extra rib length	<input type="text" value="0"/> mm
Rib width	<input type="text" value="8"/> mm
Fillet wall	<input checked="" type="checkbox"/>

## Flush options

Flush into objects' infill	<input type="checkbox"/>
Flush into objects' support	<input checked="" type="checkbox"/>

## Special mode

Slicing Mode	<input type="text" value="Regular"/>
Print sequence	<input type="text" value="By layer"/>
Spiral vase	<input type="checkbox"/>
Timelapse	<input type="text" value="Traditional"/>
Fuzzy Skin	<input type="text" value="None"/>

## Advanced

Use beam interlocking	<input type="checkbox"/>
Interlocking depth of a segmented region	<input type="text" value="0"/> mm

## G-code output

Reduce infill retraction	<input checked="" type="checkbox"/>
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## Post-processing scripts

Empty text area for post-processing scripts.

## Notes

Empty text area for notes.



# Actuator Shaft Profile for P1S (Quality)

## Layer height

Layer height	0.2	mm
Initial layer height	0.2	mm

## Line width

Default	0.42	mm
Initial layer	0.5	mm
Outer wall	0.42	mm
Inner wall	0.45	mm
Top surface	0.42	mm
Sparse infill	0.45	mm
Internal solid infill	0.42	mm
Support	0.42	mm

## Seam

Seam position	Random
Smart scarf seam application	<input checked="" type="checkbox"/>
Scarf application angle threshold	155 °
Scarf around entire wall	<input type="checkbox"/>
Scarf steps	10
Scarf joint for inner walls	<input checked="" type="checkbox"/>
Role-based wipe speed	<input checked="" type="checkbox"/>

## Precision

Slice gap closing radius	0.049	mm
Resolution	0.01	mm
Arc fitting	<input checked="" type="checkbox"/>	
X-Y hole compensation	0	mm
X-Y contour compensation	0	mm
Auto circle contour-hole compensation	<input type="checkbox"/>	
Elephant foot compensation	0.15	mm
Precise Z height	<input type="checkbox"/>	

## Ironing

Ironing Type	No ironing
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## Wall generator

Wall generator	Classic
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## Advanced

Order of walls	inner/outer
Print infill first	<input type="checkbox"/>
Bridge flow	1
Thick bridges	<input type="checkbox"/>
Only one wall on top surfaces	Top surfaces
Only one wall on first layer	<input type="checkbox"/>
Smooth speed discontinuity area	<input checked="" type="checkbox"/>
Smooth coefficient	150
Avoid crossing wall	<input type="checkbox"/>
Smoothing wall speed along Z(experimental)	<input type="checkbox"/>



# Actuator Shaft Profile for P1S (Strength)

## Walls

Wall loops

Detect thin wall

## Top/bottom shells

Top surface pattern

Top shell layers

Top shell thickness  mm

Top paint penetration layers

Bottom surface pattern

Bottom shell layers

Bottom shell thickness  mm

Bottom paint penetration layers

Internal solid infill pattern

## Sparse infill

Sparse infill density  %

Sparse infill pattern

Length of sparse infill anchor  mm or %

Maximum length of sparse infill anchor  mm or %

## Advanced

Infill/Wall overlap  %

Infill direction  °

Bridge direction  °

Minimum sparse infill threshold  mm<sup>2</sup>

Infill combination

Detect narrow internal solid infill

Ensure vertical shell thickness

Detect floating vertical shells



# Actuator Shaft Profile for P1S (Speed)

## Initial layer speed

Initial layer	50	mm/s
Initial layer infill	105	mm/s

## Other layers speed

Outer wall	200	mm/s
Inner wall	300	mm/s
Small perimeters	50%	mm/s or %
Small perimeter threshold	0	mm
Sparse infill	270	mm/s
Internal solid infill	250	mm/s
Vertical shell speed	80%	mm/s or %
Top surface	200	mm/s
Slow down for overhangs	<input checked="" type="checkbox"/>	

## Overhang speed

0	mm/s	10%
50	mm/s	25%
30	mm/s	50%
10	mm/s	75%
10	mm/s	100%

## Bridge

50 mm/s

## Gap infill

250 mm/s

## Support

150 mm/s

## Support interface

80 mm/s

## Travel speed

Travel 500 mm/s

## Acceleration

Normal printing	10000	mm/s <sup>2</sup>
Travel	10000	mm/s <sup>2</sup>
Initial layer travel	6000	mm/s <sup>2</sup>
Initial layer	500	mm/s <sup>2</sup>
Outer wall	5000	mm/s <sup>2</sup>
Inner wall	0	mm/s <sup>2</sup>
Top surface	2000	mm/s <sup>2</sup>
Sparse infill	100%	mm/s <sup>2</sup> or %



# Actuator Shaft Profile for P1S (Support)

## Support

- Enable support
- Type:
- Style:
- Threshold angle:  °
- On build plate only
- Remove small overhangs

## Raft

- Raft layers:  layers

## Filament for Supports

- Support/raft base:  Sup.PLA
- Support/raft interface:  Sup.PLA

## Advanced

- Initial layer density:  %
- Initial layer expansion:  mm
- Support wall loops:
- Top Z distance:  mm
- Bottom Z distance:  mm
- Base pattern:
- Base pattern spacing:  mm
- Pattern angle:  °
- Top interface layers:  layers
- Bottom interface layers:  layers
- Interface pattern:
- Top interface spacing:  mm
- Normal Support expansion:  mm
- Support/object xy distance:  mm
- Support/object first layer gap:  mm
- Don't support bridges
- Independent support layer height:



# Actuator Shaft Profile for P1S (Others)

## Bed adhesion

Skirt loops

Skirt height

Brim type

Brim width

Brim-object gap

## Prime tower

Enable

Skip points

Internal ribs

Width

Max speed

Brim width

Infill gap

Rib wall

Extra rib length

Rib width

Fillet wall

## Flush options

Flush into objects' infill

Flush into objects' support

## Special mode

Slicing Mode

Print sequence

Spiral vase

Timelapse

Fuzzy Skin

## Advanced

Use beam interlocking

Interlocking depth of a segmented region

## G-code output

Reduce infill retraction

## Post-processing scripts

## Notes