

Manufacturing Configuration for **dvi3v** Hardware

v3.9.2.208

Peter Felecan

with Claude (Anthropic AI), model Sonnet 5

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1 Introduction

1.1 Purpose

This document describes the actual manufacturing configuration used to fabricate the dvi3v camera stand hardware.

The configuration is extracted from .3mf files which contain the complete slicer settings used for production prints.

1.2 .3mf Files in Hardware Directory

Each hardware component has a corresponding .3mf file containing:

- Complete slicer configuration (PrusaSlicer 2.9.4)
- Print orientation on bed
- Material settings (PETG)
- Layer heights, speeds, temperatures
- Infill patterns and densities

1.3 File Naming Convention

- Base-left_enfolding.3mf - Left base component
- Base-right_enfolding.3mf - Right base component
- Base-union.3mf - Union truss connector
- Base-screw.3mf - M6 screw model
- CameraBase.3mf - Camera mounting platform

- `VerticalBar.3mf` - Vertical support bar

2 Slicer Configuration

2.1 Software

- Slicer: PrusaSlicer 2.9.4
- Printer: COREONE (or COREONEL)
- Nozzle: 0.6mm high-flow
- Bed: 250mm × 220mm

2.2 Material Settings (PETG)

2.2.1 Temperatures

- First layer bed: 85°C
- Bed: 85°C
- First layer nozzle: 255°C
- Nozzle: 255°C (PETG)
- Chamber: 35°C

2.2.2 Material Notes

All components printed in PETG for:

- Higher strength than PLA
- Better temperature resistance
- Less brittleness
- Improved layer adhesion

3 Layer Configuration

3.1 VerticalBar Settings

3.1.1 Basic Layers

- Layer height: 0.2mm (structural profile)

- First layer height: 0.2mm
- Bottom solid layers: 4 (0.8mm total)
- Top solid layers: 4 (0.8mm total)

3.1.2 Perimeters

- Perimeters: 2 walls
- External perimeter speed: 50mm/s
- Internal perimeter speed: 70mm/s
- External perimeter width: 0.62mm
- First layer width: 0.68mm (slightly oversized)

3.1.3 Infill

- Pattern: Gyroid
- Density: 15%
- Speed: 100mm/s
- Extrusion width: 0.65mm
- Overlap: 15%

3.1.4 Support

- Support material: No (geometry designed to avoid supports)
- Raft: No
- Brim: No

3.2 Base Components

Similar settings to VerticalBar:

- 0.2mm layers
- PETG material
- 15% gyroid infill
- 2 perimeters

4 Speed Configuration

4.1 First Layer (Critical for Adhesion)

- Speed: 45mm/s
- Acceleration: 500mm/s²
- Ensures reliable bed adhesion

4.2 Normal Printing

- Perimeters: 70mm/s
- External perimeters: 50mm/s (slower for quality)
- Infill: 100mm/s (fast, less critical)
- Bridge: 30mm/s
- Default acceleration: 3000mm/s²

4.3 Acceleration Profiles

- First layer: 500mm/s²
- Perimeters: 2500mm/s²
- External perimeters: 1500mm/s²
- Infill: 6000mm/s²
- Bridge: 1500mm/s²

Note: Dynamic acceleration based on layer height (G-code modifies above layer 150mm)

5 Cooling Configuration

5.1 Fan Control

- Cooling: Enabled
- Disable fan first layers: 3
- Bridge fan speed: 60%
- Regular fan: Auto (dynamic)
- Logic: Consistent surface cooling

5.2 Dynamic Speeds

- Dynamic fan speeds: Enabled
- Dynamic overhang speeds: Enabled
- Allows adaptive cooling based on geometry

6 Print Orientation

6.1 VerticalBar

Printed **diagonally** on bed to accommodate height:

- Component exceeds 220mm Y dimension
- Rotation: $\sim 45^\circ$ to fit within 250×220mm bed
- Ensures full part can print without splitting

6.2 Base Components

- Left/Right: Flat on bed (designed orientation)
- Union truss: Flat on bed
- Screw: Upright (threaded axis vertical)

6.3 CameraBase

- Flat on bed with camera opening upward
- No supports needed due to design

7 Extrusion Widths

Feature	Width	Purpose
First layer	0.68mm	Extra adhesion
External perimeter	0.62mm	Clean outer surface
Internal perimeter	0.65mm	Standard
Infill	0.65mm	Standard
Support (if used)	0.50mm	Easy removal

Note: 0.6mm nozzle allows wider extrusions than standard 0.4mm

8 Retraction Settings

- Retraction length: Standard (PrusaSlicer default for PETG)
- Retraction speed: 25mm/s (deretracton)
- Prevents stringing while avoiding nozzle clogs

9 Quality vs Speed Trade-offs

9.1 0.2mm Structural Profile (Used)

- Layer height: 0.2mm
- Balance between:
 - Dimensional accuracy (good)
 - Print time (moderate)
 - Strength (excellent - more layer bonding)
- Typical print time: ~4-6 hours for VerticalBar

9.2 0.32mm Speed Profile (Previous, Abandoned)

- Layer height: 0.32mm
- Advantages:
 - Faster printing (~40% time reduction)
- Disadvantages:
 - Less dimensional accuracy
 - Weaker layer bonding
 - Visible layer lines
- **Reason for change:** Wobbling issue indicated insufficient structural rigidity at coarser layers

10 Lessons Learned from Manufacturing

10.1 Why PETG Instead of PLA

- PLA was mentioned in test object specs (black, matte)
- Actual jig uses PETG for structural components
- Rationale: Higher strength requirements for camera support

10.2 Why 0.2mm Layers

- Original design suggested "structural" profile
- 0.32mm speed profile caused wobbling
- 0.2mm provides:
 - Better layer adhesion
 - Improved dimensional accuracy
 - Necessary rigidity for tall vertical structure

10.3 Why 15% Gyroid Infill

- Lower than typical 20% for non-structural parts
- Gyroid pattern provides:
 - Isotropic strength (equal in all directions)
 - Material efficiency
 - Adequate rigidity for this application
- Saves material and print time vs solid infill

10.4 Why Only 2 Perimeters

- Standard for this nozzle size (0.6mm)
- $2 \times 0.62\text{mm} = 1.24\text{mm}$ wall thickness
- Adequate for this geometry
- More perimeters would increase print time without significant strength gain

10.5 Why No Supports

- Geometry designed to be support-free
- Fillets and angles avoid $>45^\circ$ overhangs
- Support removal can damage surface finish
- Support-free design is superior engineering

10.6 Why Diagonal Printing for VerticalBar

- Extended height (200mm junction + extension) exceeds Y bed (220mm)
- Diagonal rotation fits within 250×220mm bed
- Alternative would be:
 - Splitting into multiple parts (adds assembly complexity)
 - Larger printer bed (e.g., Prusa XL with larger platter)
- Diagonal orientation maintains single-piece integrity

11 Material Usage Strategy

11.1 Jig Components → PETG

All camera stand structural components use PETG:

- Base (left, right, union, screw)
- VerticalBar
- CameraBase

Rationale:

- Mechanical requirements: rigidity, strength, durability
- Temperature resistance (hot environments, sunlight)
- Impact tolerance (repeated handling, assembly)
- Layer adhesion for tall prints (VerticalBar)
- Less brittleness than PLA

11.2 Test Instrumentation → Black PLA

All test objects use black matte PLA:

- Geometric shapes (circles, squares, rectangles, triangles)
- Reference patterns
- Calibration objects

Rationale:

- Dimensional accuracy (PLA shrinks less than PETG)
- Matte black surface minimizes reflections
- High contrast with white A4 paper background
- Easy to print (lower temperatures, no warping)
- Less expensive for consumable test objects
- Sufficient strength for non-structural test pieces

11.3 Material Properties Comparison

Property	PETG (Jig)	PLA (Test)
Strength	Higher	Moderate
Rigidity	High	Moderate
Temperature limit	~80°C	~50°C
Warping	Moderate	Minimal
Shrinkage	~0.7%	~0.3%
Brittleness	Low	Higher
Print difficulty	Moderate	Easy
Cost	Higher	Lower
Use case	Structural	Dimensional tests

12 Comparison: Design Intent vs Actual Manufacturing

12.1 CommonParameters.scad Comments

```
// Print in black PLA, 0.2mm layers, matte finish
```

12.2 Actual Manufacturing - Material Distinction

12.2.1 Jig Components (Structural - PETG)

- Material: PETG
- Layers: 0.2mm ✓ (matches)
- Finish: Natural PETG or red (Base)
- Reason: Structural requirements - camera stand needs rigidity, temperature resistance, impact tolerance

12.2.2 Test Instrumentation Objects (Black PLA - ACTUAL)

Settings (from .3mf files in TestInstrumentation/GeometricShapes/):

Material Black PLA (matte finish)

Printer Prusa XL with 0.6mm HF nozzle (Tool 1 / Extruder 1)

Layer height 0.2mm

Infill 100% (solid objects)

Perimeter speed 30mm/s (conservative for accuracy)

Infill speed 30mm/s

External perimeter speed 30mm/s

First layer speed 40mm/s

Nozzle temperature 230°C (PLA, second extruder/tool 1)

Bed temperature 60°C (both first and subsequent layers)

Reason::

- PLA loaded in Prusa XL tool 1 (second extruder)
- Excellent dimensional accuracy with PLA
- Matte black finish provides needed contrast
- 30mm/s speed prioritizes precision over the 200mm/s maximum

Note: All actual print settings preserved in .3mf files for reproducibility. These settings are specific to test instrumentation objects, distinct from hardware/jig components which use PETG.

12.3 Color Strategy for Jig

- Red base (structural PETG)
- Natural/white structures (CameraBase, VerticalBar in PETG)
- High contrast aids computer vision in photographs

13 Manufacturing Files Location

13.1 Jig Components

All jig .3mf files are stored in:

```
hardware/  
  Base-left_enfolding.3mf  
  Base-right_enfolding.3mf  
  Base-union.3mf  
  Base-screw.3mf  
  CameraBase.3mf  
  VerticalBar.3mf
```

Same directory as corresponding .scad files for easy access.

13.2 Test Instrumentation Objects

All test object .3mf files are stored in:

```
TestInstrumentation/GeometricShapes/  
  Circle25mm/Circle25mm.3mf  
  Circle50mm/Circle50mm.3mf  
  Circle75mm/Circle75mm.3mf  
  Square25mm/Square25mm.3mf  
  Square50mm/Square50mm.3mf  
  Square75mm/Square75mm.3mf  
  Rectangle50x100mm/Rectangle50x100mm.3mf  
  Triangle80mm/Triangle80mm.3mf
```

These .3mf files contain the actual print settings used, documenting the exact manufacturing process for reproducibility.

14 How to Use These Files

14.1 Opening in PrusaSlicer

1. Open .3mf file in PrusaSlicer
2. All settings automatically loaded
3. Can modify if needed
4. Slice and send to printer

14.2 Extracting Configuration

.3mf files are ZIP archives containing:

- `3D/3dmodel.model` - Geometry (STL-like)
- `Metadata/Slic3r_PE.config` - Complete slicer settings
- `Metadata/thumbnail.png` - Preview image

Extract configuration:

```
unzip -p component.3mf Metadata/Slic3r_PE.config > settings.txt
```

14.3 Analyzing Multi-Tool Printer Settings

CRITICAL: For multi-tool printers (e.g., Prusa XL with multiple extruders), always identify which tool was actually used before documenting settings.

14.3.1 Multi-Tool Configuration Format

In PrusaSlicer config files, settings for multiple tools are comma-separated::

- `filament_type = PETG;PLA;PETG` (Tool 0, Tool 1, Tool 2)
- `temperature = 250,230,250` (Tool 0, Tool 1, Tool 2)
- `bed_temperature = 80,60,80` (Tool 0, Tool 1, Tool 2)

14.3.2 Identifying the Used Tool

Check these parameters to determine which extruder/tool was used:

```
grep "perimeter_extruder\|infill_extruder" Metadata/Slic3r_PE.config
```

Example output::

- `perimeter_extruder = 1` → Tool 1 (second extruder, index 1)
- `infill_extruder = 1` → Tool 1

Tool indexing is zero-based: Tool 0, Tool 1, Tool 2, etc.

14.3.3 Extracting Correct Settings

Once tool is identified, use the corresponding value from each setting:

Given:

```
filament_type = PETG;PLA
temperature = 250,230
perimeter_extruder = 1
```

Then:

```
Material = PLA (second value, index 1)
Temperature = 230°C (second value, index 1)
NOT PETG at 250°C (which is Tool 0, index 0)
```

14.3.4 Common Mistake

DO NOT assume the first values in comma-separated lists are the used settings. Always check which extruder was actually selected.

Example from this project::

- Test instrumentation: Tool 1 = PLA at 230°C
- Hardware/jig: Tool 0 = PETG at 250°C
- Different tools used for different purposes

14.4 Reusing Settings for New Designs

1. Open .3mf file
2. Import new STL
3. Settings automatically applied
4. Adjust if geometry significantly different

15 Conclusion

The .3mf manufacturing files provide complete fabrication context that bridges the gap between design intent (OpenSCAD) and physical reality.

Key insights:

- Material choice driven by structural requirements (PETG)
- Layer height critical for dimensional accuracy (0.2mm)
- Print orientation dictated by geometry vs bed size (diagonal)
- Infill and perimeters balanced for strength vs efficiency

These files serve as manufacturing "recipes" that can be reused and adapted for future components.