

recycl3Dprint



UNIVERSAL CONVERSION KIT TO ENABLE DIRECT PELLET EXTRUSION IN FILAMENT 3D PRINTERS

DOCUMENTATION. V.5.1



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1.- WELCOME

Thank you for purchasing a recycl3dprint product! Your wallet and our planet will be grateful. Before making use of your LILY Kit, please read through this documentation. It is short and well structured. Please make sure to follow each step. If you don't, you may not be able to experience The LILY Kit to the fullest or even damage it.

Your LILY Kit is designed to work with various materials like ABS, PLA and other thermoplastics. It is also able to cope with varying geometries of pellets, like virgin pellets or recycled irregular chunks. In order to achieve the best results, you will need to fine tune the settings according to each material and geometry. That's why it's so crucial to take the time to learn about your new LILY Kit.

In this manual, you will learn how to set up and start printing your LILY Kit. You will be introduced to recycling processes, in order to turn your waste plastic into new 3D prints and the kinds of plastics that can be printed with direct pellet extrusion. By the time you finish reading this documentation, you will know everything you need to start experimenting.

2.- LEGAL NOTICES & PRODUCT WARRANTY

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Contact the recycl3dprint Support Team for up-to-date information via info@recycl3dprint.com.

In order to protect recycl3dprint proprietary and confidential information and/or trade secrets, this document may describe some aspects of recycl3dprint technology in generalized terms.

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5.- SAFETY & COMPLIANCE

This equipment and its components have been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. Modifications not expressly approved by the manufacturer or registrant of this equipment can cause injury or damage.

There are some safety considerations to avoid potential hazards that could harm you or others or cause product or property damage:



WARNING: Do not touch any part of the LILY Pellet Extruder during operation, temperatures above 200°C. Always allow the extruder to cool down before touching it directly.



WARNING: The LILY Kit includes moving parts that can cause injury. Do not insert fingers or hands while in operation.



CAUTION: Avoid leaving the The LILY Kit unattended during operation. If you must leave the LILY Kit unattended during a print, exercise caution and follow these guidelines:

- Verify that the The LILY Kit has started the print and is operating normally.
- Ensure that enough granule feedstock is stored in the Auto Pellet Dispenser and that the hose is free of tangles so that feedstock is being delivered properly.
- Monitor your print periodically.



CAUTION: Use caution when printing with materials that have not been tested by recycl3dprint for use with The LILY Kit.



CAUTION: In case of emergency disconnect power supply from wall socket. The socket outlet must be located near the equipment and must be easily accessible.



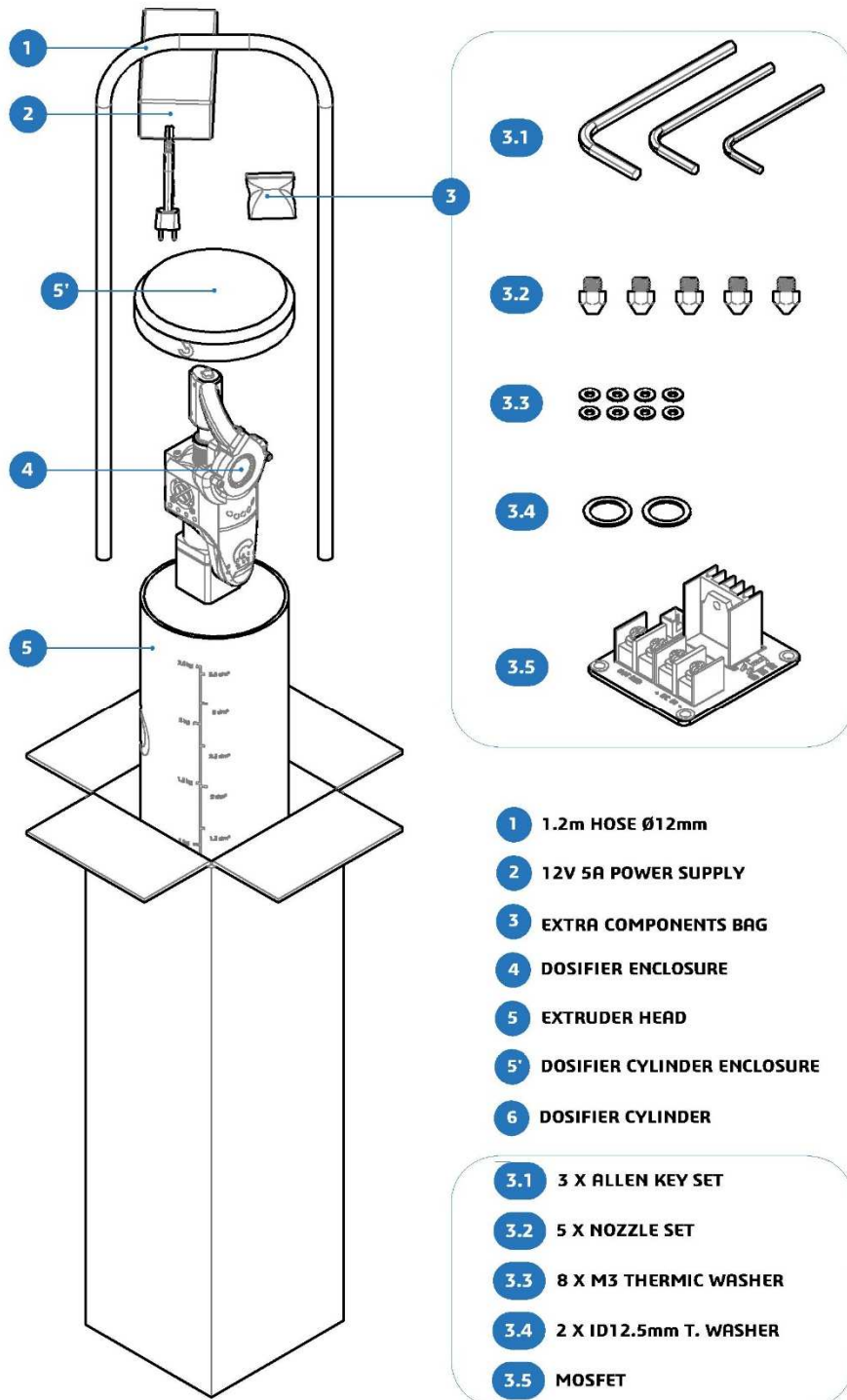
CAUTION: The LILY Kit melts plastic during extrusion and plastic odors are emitted during this process. Make sure to set up the LILY Kit in a well-ventilated area.



CAUTION: Never disconnect the LILY Kit during or immediately after printing. Always allow the extruder to cool down completely before turning off your 3D printer or disconnecting in order to avoid clogging.

6.- WHAT'S IN THE BOX

Be careful while unboxing your LILY Kit. Here is a list of the components:



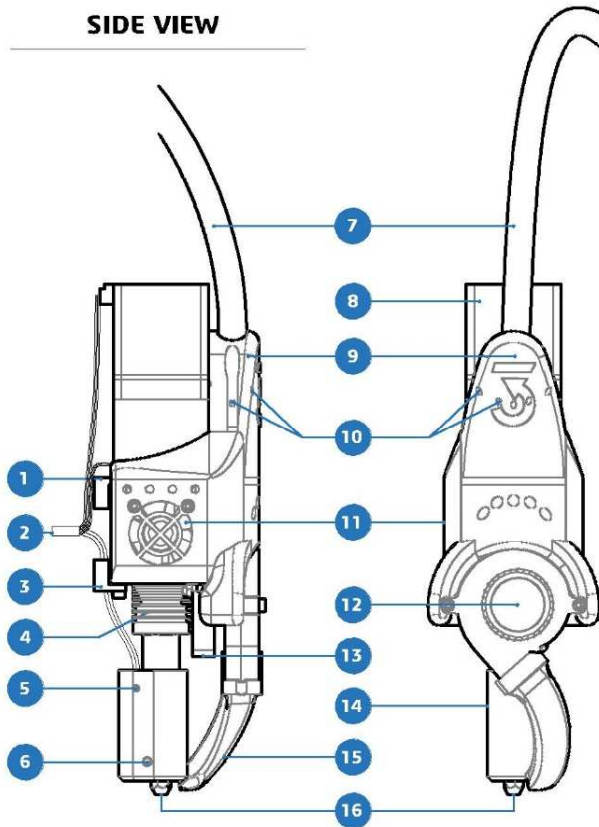
- 1 1.2m HOSE Ø12mm
- 2 12V 5A POWER SUPPLY
- 3 EXTRA COMPONENTS BAG
- 4 DOSIFIER ENCLOSURE
- 5 EXTRUDER HEAD
- 5' DOSIFIER CYLINDER ENCLOSURE
- 6 DOSIFIER CYLINDER

- 3.1 3 X ALLEN KEY SET
- 3.2 5 X NOZZLE SET
- 3.3 8 X M3 THERMIC WASHER
- 3.4 2 X ID12.5mm T. WASHER
- 3.5 MOSFET

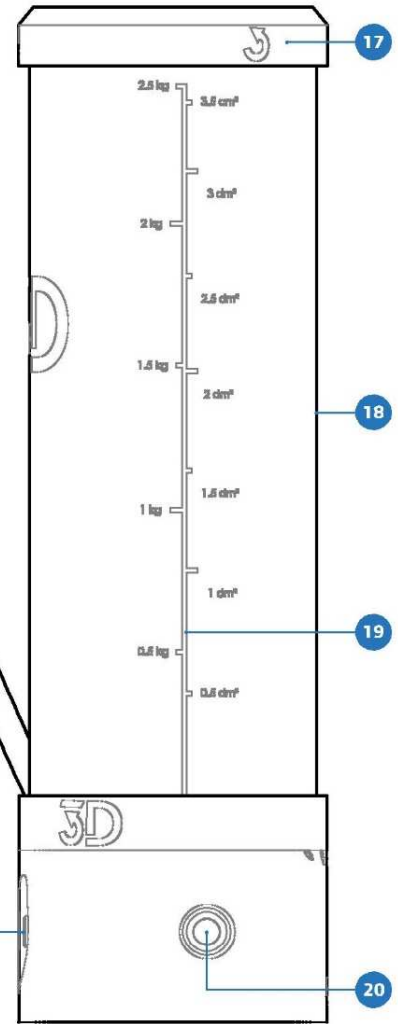
7.- GENERAL DESCRIPTION

EXTRUDER HEAD

SIDE VIEW

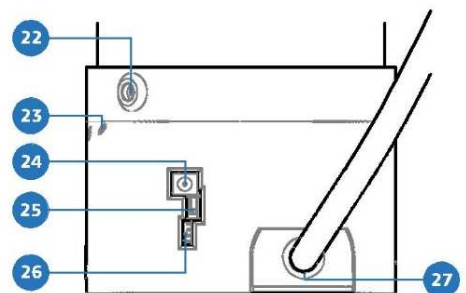


DISPENSER UNIT



- | | | |
|-----------------------|--------------------------|----------------------------|
| 1 MOUNTING PLATE | 10 AIR PRESURE OUTLETS | 19 VOL/WEIGHT RULE |
| 2 WIRE MANAGEMENT | 11 HOPPER COOLING FANS | 20 POWER ON BUTTON |
| 3 HOLDING BRACKET | 12 LAYER COOLING FAN | 21 AIR PRESURE REGULATOR |
| 4 HOPPER HEAT SINK | 13 HEAT SINK COOLING FAN | 22 LOCKING BOLT |
| 5 HOLDING SLAVE | 14 INSULATION COVER | 23 VENTILATION HOLES |
| 6 THERMISTOR | 15 LAYER C. FAN NOZZLE | 24 12V POWER CONNECTION |
| 7 HOSE | 16 NOZZLE | 25 USB PCB CONNECTION |
| 8 STEPPER MOTOR | 17 CONTAINER ENCLOSURE | 26 LEVEL SENSOR CONNECTION |
| 9 KNEE-CAP CONNECTION | 18 STOCK FEED CONTAINER | 27 HOSE CONNECTION |

REAR VIEW



8.- TECHNICAL SPECIFICATIONS

8.1.- LILY PELLETT EXTRUDER

Voltage:	12 or 24 V (consider use of mosfet)
Construction parts:	60% 3D printed ABS parts
Accepted granulate:	Industrial pellets and chunks up to 5 mm
Heater:	80 W, 6x47mm or 6x47.5mm
Nozzle:	Set: 1.0, 1.2 , 2.0, 2.5, 3.0. M6x1mm.
Flow rate capacity:	570mm ³ /rev [400-600 gr/h]
Dimensions:	226 x 61.5 x 72 mm (LxWxD)
Weight:	768gr (Standard) -998gr (Pro version)
Thermistor:	NTC3950 (280°C) or HT-NTC100K (350°C)
Granule level sensor:	IR sensor
Coupling type:	3D printed knee-cap
Cooling:	Hopper: 2 x 30 x 30 x10 mm axial fan Heat sink: 1 x 30 x 30 x10 mm axial fan Layer fan: Centrifugal brushless DC fan
Motor:	Type: Nema 17 bipolar 40mm Reduction: 20:1 planetary metal gear Current: 1.3 A
Mounting thread holes:	M4x0.7mm
Mounting holes distance:	BETA VERSION: 34x47.7, 34x61.4, 34x34mm BETA VERSION OPENBUILDS: 40x40, 40x53.30, 40x70.56, 40x22.74mm

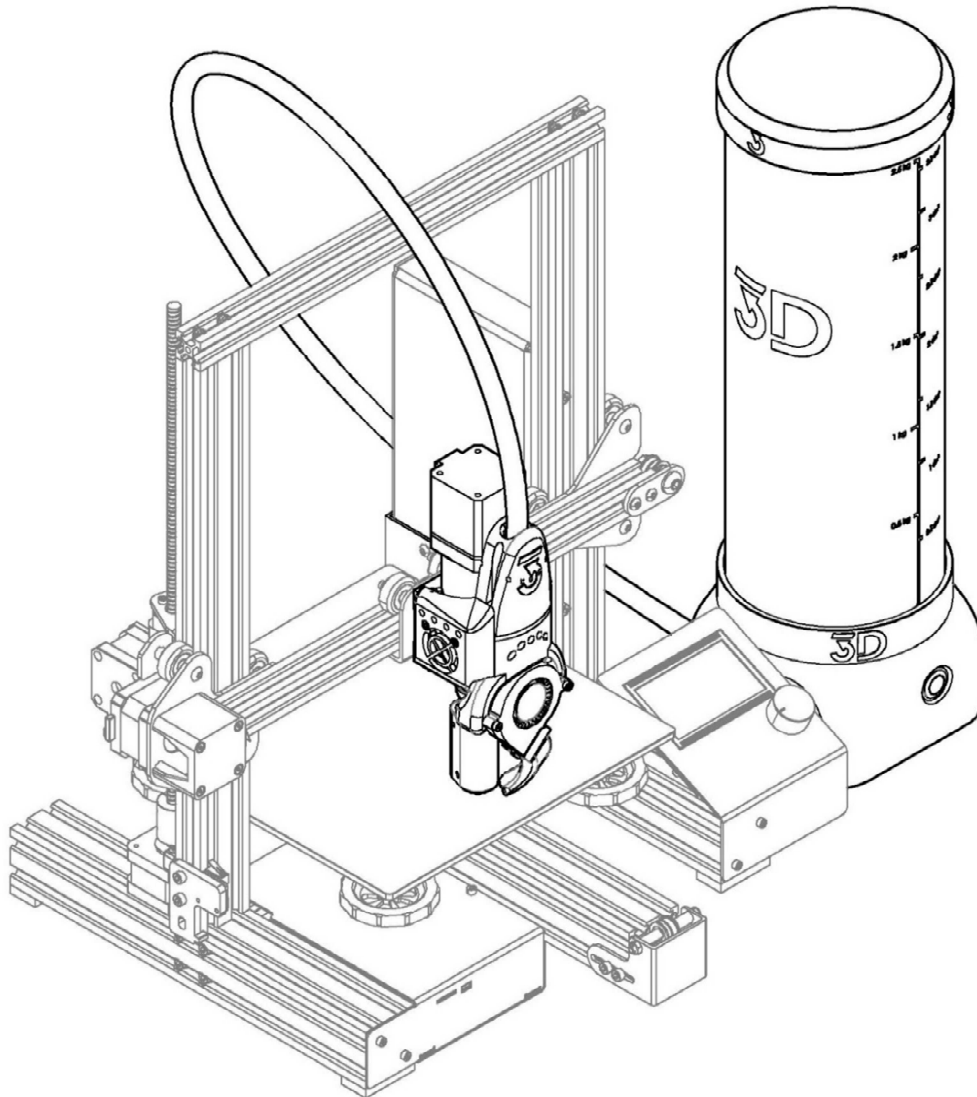
8.2.- AUTO PELLET DISPENSER

Voltage:	12 V (included ext. power supply)
AC Input:	100 – 240 V, ~2 amps, 50 – 60 Hz
Power Requirements:	12 V DC @ 5 amps
Connectivity:	USB micro
Construction parts:	80% 3D printed parts (HIPS, ABS and TPU)
Feedstock capacity:	Standar size 2.5 kg [3.5dm ³] (customizable)
Dispensing capacity:	1000-1600 gr/h
Accepted granulate:	Industrial pellet and chunks up to 5 mm
Tested max. scope:	3 m cylinder height and 5m long hose
Hose length:	1.2m (customizable)
Dimensions:	436 x 165 mm
Coupling type:	3D printed connector
Feeding Hose:	PE/TEFLON tubing (ID 9mm)
OS:	Code: Lily V.1.0 (customizable)
	Electronics: Recycl3Dprint board (Atmega Leonardo)
Air pump:	Type: Centrifugal brushless CC air pump
	Noise: <45-73 db
	Preassure: 7.5 KpaN (Adjustable)
	Air volume: 240-260 L/min

9.- FUSED GRANULAR FABRICATION

The LILY Kit consists of two autonomously interacting units. The LILY Pellet Extruder and the Auto Pellet Dispenser. The Auto Pellet Dispenser will autonomously provide granule feedstock to the extruder, when needed.

The LILY Pellet Extruder is then utilizing a screw extrusion system to compress and melt the granule feedstock. This technology is called Fused Granular Fabrication (FGF). The homogeneous molten plastic.



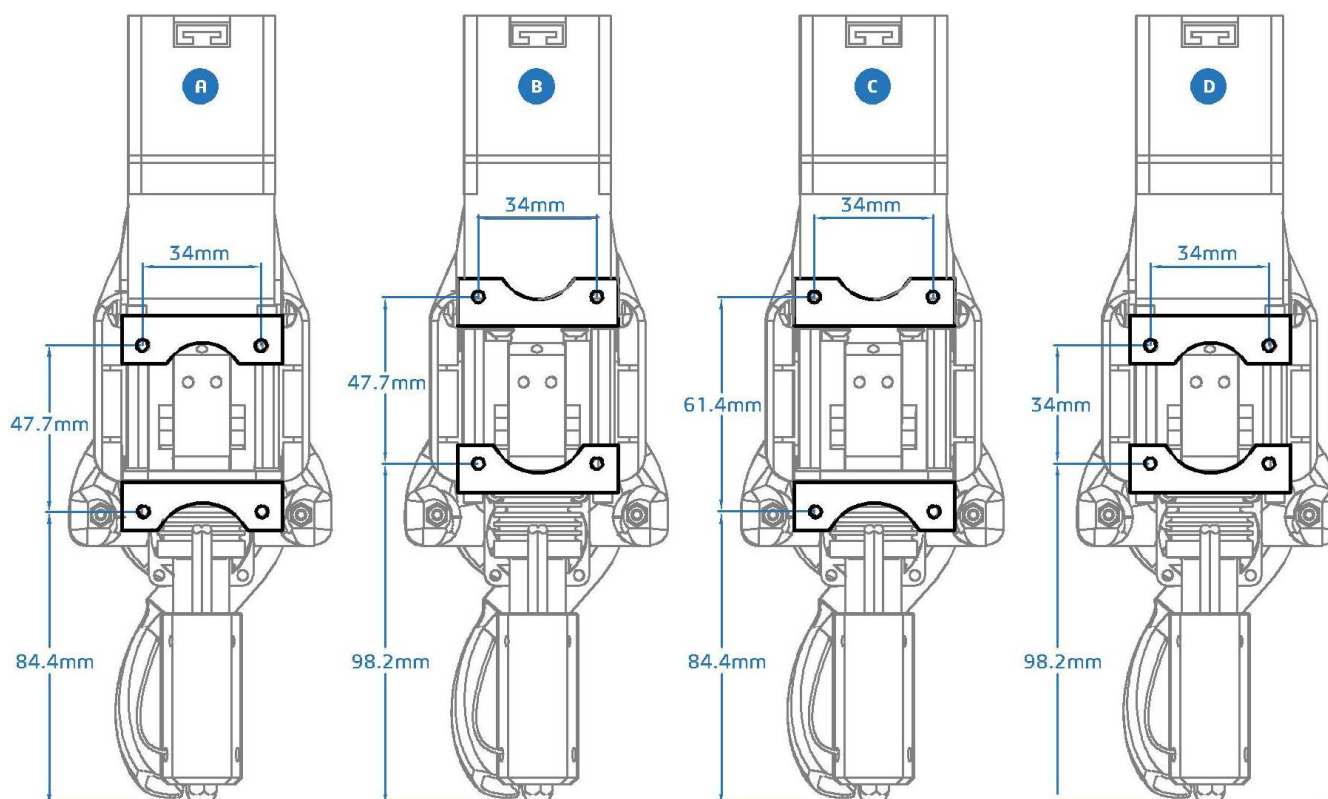
10.- GETTING READY TO PRINT

10.1.- EXTRUDER HEAD BOLT-ON

Depending on the orientation of the mounting plate and holding bracket the vertical distance between the screw holes will change (see diagram below). The different vertical distances that can be reached with the 4 configurations will allow you to match the hole layout of the most common 3d printer carriages. In case none of the 4 configurations helps to match the hole layout for the carriage of you printer, please read

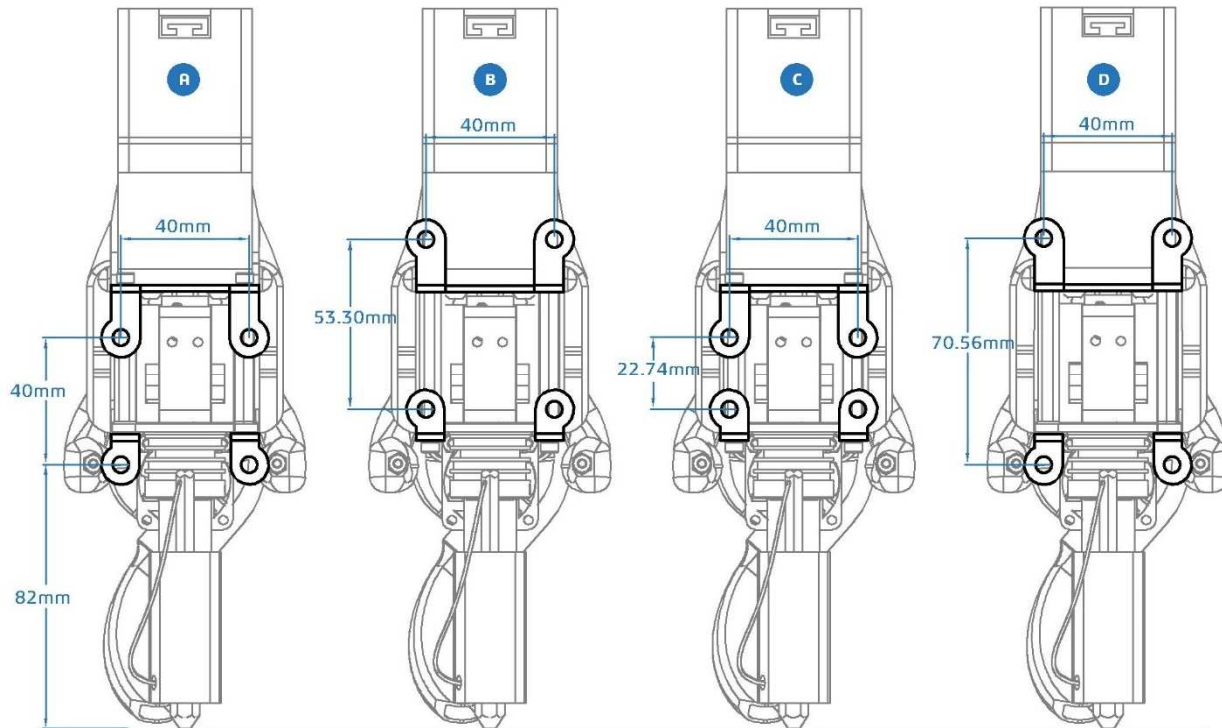
BETA VERSION:

1. OPTION A (facing downwards): 34mm width x 47.7mm high/84.4mm clearance.
2. OPTION B (facing upwards): 34mm width x 47.7mm high / 98.2mm clearance.
3. OPTION C (facing outwards): 34mm width x 61.4mm high / 84.4mm clearance.
4. OPTION D (facing inwards): 34mm width x 34mm high / 98.2mm clearance.

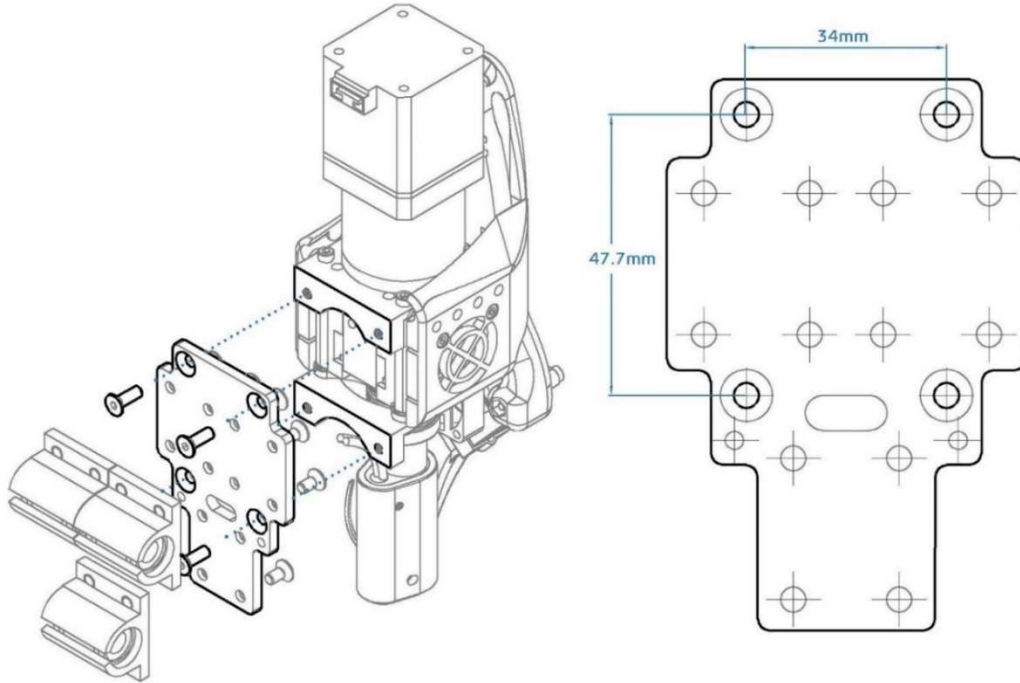


BETA VERSION OPENBUILDS

5. OPTION A (facing downwards): 40mm width x 40mm high.
6. OPTION B (facing upwards): 40mm width x 53.30mm high.
7. OPTION C (facing inwards): 40mm width x 22.74mm high.
8. OPTION D (facing outwards): 40mm width x 70.56mm high.



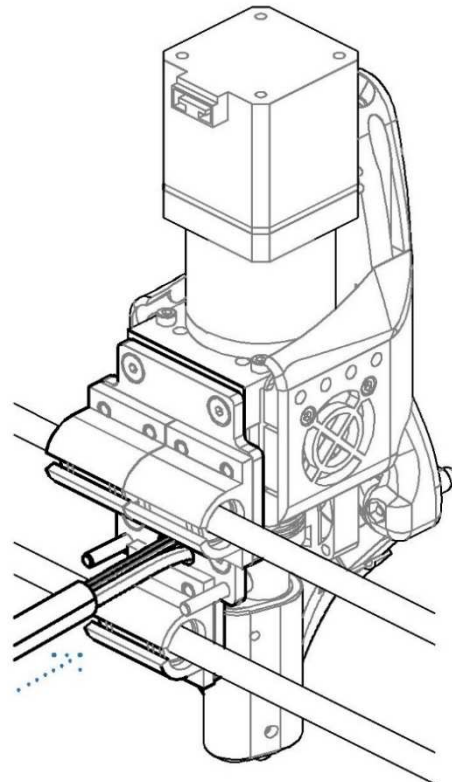
What to do in case none of the 4 configurations helps to match the hole layout for the carriage of your printer? You can either drill additional holes into the carriage, this is the most straightforward way. Alternatively you can create a coupling plate, that allows you to use the non matching hole layouts of the carriage and the LILY Pellet Extruder (see example coupling plate below for a Prusa style printer)



10.2.- CABLE MANEGEMENT

Pass all the extruder cables, bundled together by the cable organizer, through the hole of the carriage plate of your 3D printer (Please check the drawing on the right for reference). Use a zip tie for securing the bundle to the carriage plate.

Ensure there are no sharp edges exposed that can eventually cut into the cables during operation and ultimately damage the wiring. Depending on your 3D printer you can additionally attach the extruder cable bundle to the dispenser hose.

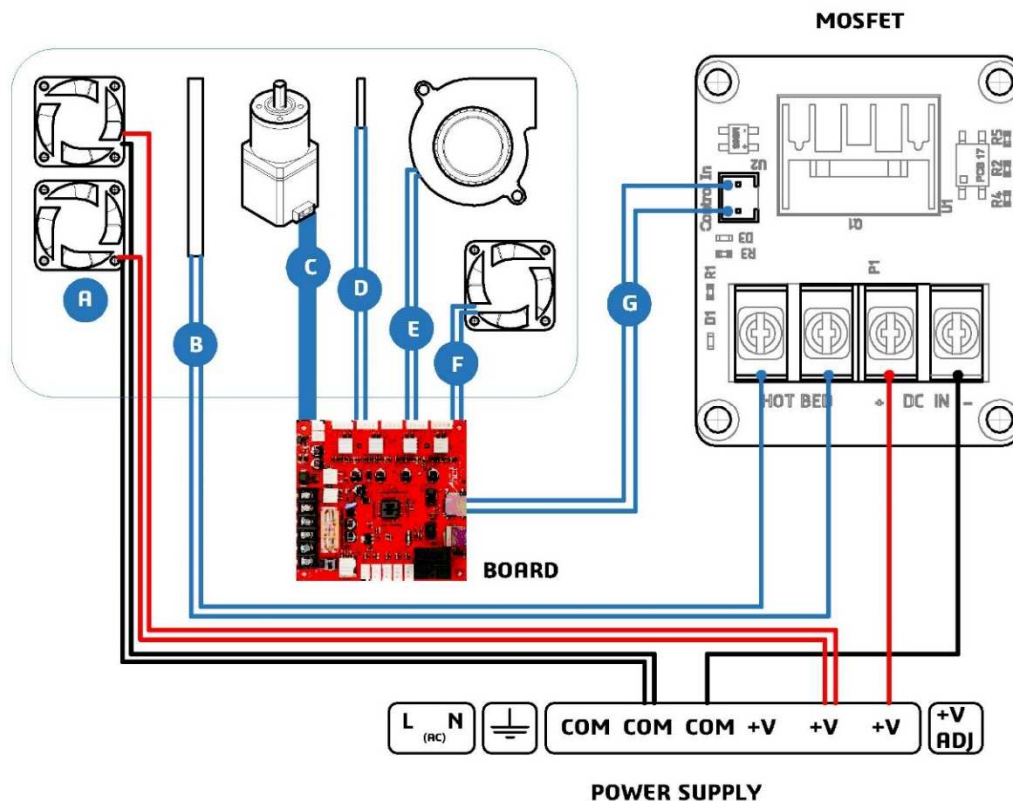


10.3 CONNECTING THE LILY PELLETT EXTRUDER TO YOUR 3D PRINTER

IMPORTANT: Please take in consideration using an external mosfet. This is a security measure, to secure, without us knowing the capacity of the electronics board of your 3D printer, that no damage will happen to the 3D printer. Most of the 3D desktop printers' electronics boards already have mosfets capable of handling the amount of current and voltages of the LILY Pellet Extruder. By adding the included external mosfet, the chance of overloading the board is greatly reduced. All cables are clearly marked with labels that are attached to each cable. Please follow the schematic below, which will explain you how to do with the following wiring.

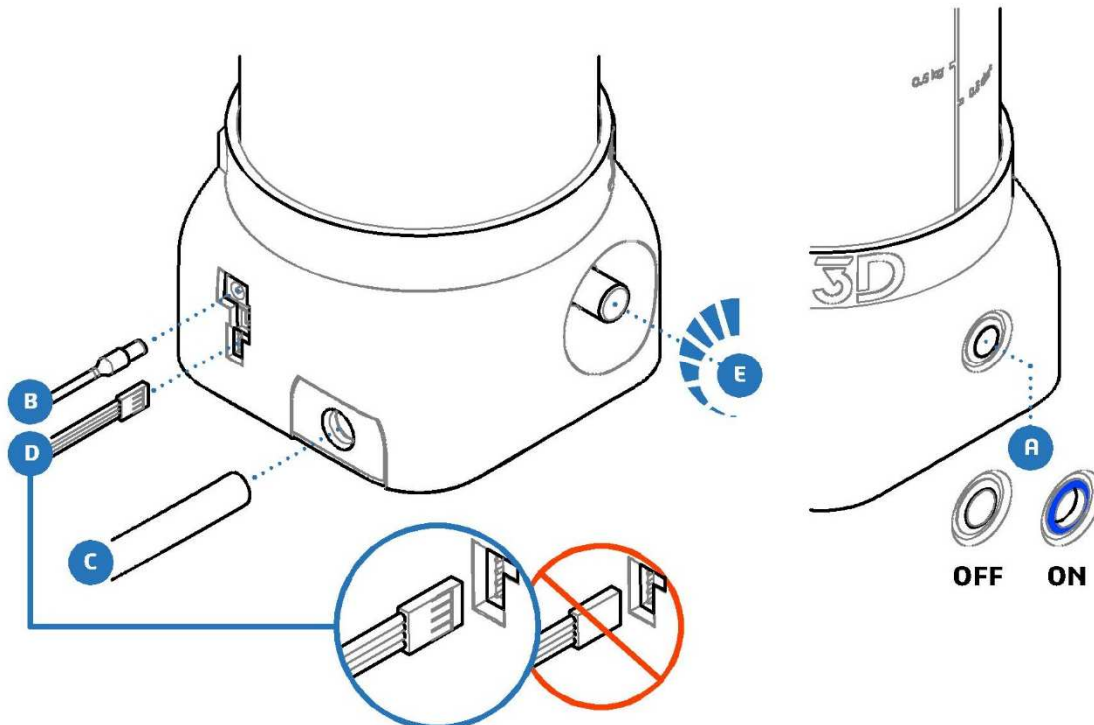
Extruder → 3D Printer Board / Extruder → Mosfet / Mosfet → 3D Printer Board

1. From the bundle connect the cables of the extruder motor (C), thermistor (D), the layer fan (E) and heat sink fan (F) to the board as normal.
2. Connect the control wires (G) of the mosfet to the board where the heating cartridge should be.
3. Connect the DC IN +/- terminals to your printer's power supply and insert the heating cartridge wires (B) into the terminals labeled "HOT BED". Recommended the use of crimped connections.
4. Connect the hopper cooling fans (A) directly to the power supply.



11.- PREPARING THE AUTO PELLETT DISPENSER

1. Ensure that the power switch on the Auto Pellet Dispenser is set to the OFF position (A)
2. Please use the included power supply cable to connect the Auto Pellet Dispenser to an electrical outlet
3. Insert the power supply connector into the power input on the back of the Auto Pellet Dispenser (B).
4. Connect the hose ends (C) to the hose connection on the dispenser and the Knee-cap on the extruder head.
5. Connect the level sensor wire connector (D) into the plug. Ensure that pins on connector faces are right.
6. Set the air pressure (E) to a midpoint and bulk some feed stock.
7. Plug the AC power cord into an electrical outlet.
8. Set the power switch to ON position (A). The led button will light up. This is the beginning of the dispensing program.
9. Tune to low air pressure (E) for a quite dispensing according to:
 - 9.1.- Density of the granule and average size.
 - 9.2.- Scope of the hose (length and high).
 - 9.3.- Position of the dispenser relative to the extruder head.



12.- FEEDSTOCK & TESTED MATERIALS

Keep the feedstock dry always in closed containers or sealed bags, humidity might cause degradation of material resulting into poor extrusion and printing quality.

12.1.- VIRGIN PELLETS AS FEEDSTOCK:
















Your LILY Kit is optimized to print objects by extruding virgin plastic pellets in various shapes such as cylindrical or spherical up to 5mm in diameter or length. Virgin feedstock raw material is usually consistent in size and shape offering consistency as well during extrusion processes

12.2.- RECYCLED PLASTIC AS FEEDSTOCK:

The LILY Kit is capable of utilizing a feedstock made from recycled waste plastic, be it print supports or filament spools. Thanks to one of the markets leading compression ratios the LILY Kit can use irregular sized feedstock with a size of 1 to 5 mm. Even though the LILY Kit can accommodate these irregularities in granule size. The extrusion reliability and quality increases by having consistency in the geometry and plastic type of the recycled feedstock. Meaning sorting the chunks so that the feedstock consists of consistently sized pieces eg only using 3-5mm chunks. Non evenly sized granules or irregular chunks can result in extrusion inconsistencies caused by a lack of pressure in the extrusion zone.

12.3.- TESTED MATERIALS:

More on custom blends and new materials feedstock:
www.recycl3dprint.com/support/tested_materials

TESTED MATERIALS			
ID	DESCRIPTION	RECYCLED	VIRGIN
 PETE			
 HDPE	RECYCLED HDPE WATER TANKS (CHUNKS), RECYCLED POST-PROCESSED HDPE (PELLETS)		
 V			
 LDPE	VIRGIN LINEAR LDPE, VIRGIN LDPE		
 PP	PP HOMOPOLYMER AND PP COOPOLYMER		
 PS	VIRGIN HIPS, VIRGIN GPPS, RECYCLED HIPS SPOOLS(CHUNKS)		
 OTHER	PLA RECYCLED, PLA VIRGIN (INGEO)		

13.- FIRMWARE CONFIGURATION

- 1.- Set the steps/mm of the extruder between 900-600steps/mm. Initially recommended 800steps/mm.
- 2.- Set the termistor NTC3950 (280°C) or HT-NTC100K (350°C);
Usually #5 and #13 respectively on Marlin:

```
#define TEMP_SENSOR_0 5
```
- 3.- Set the extruder PID by running Autotune PID for accurate values or set initially the default Lily v 5.1 PID :

```
#define DEFAULT_Kp 38.73
#define DEFAULT_Ki 2.72
#define DEFAULT_Kd 137.84
```
- 4.- Set the new margins on the machine acording the new position of the nozzle
- 5.- Tweak if necessary the velocities and accelerations according to your 3D printer and new masses and ultimately the jerk values (override with *M205 X Y Z E*).
- 7.- Increase if necessary the manual feed rate of extruder for a faster purges:

```
#define MANUAL_FEEDRATE {50*60, 50*60, 4*60, 5*60}
```

14.- COMANDS VIA INTERFACE

- 1.- `M106 F255` // Switch on layer fan (if needed)
- 1.- `M92 E(steps/mm)` // Set steps per milimeter.
- 2.- `M205 E 0.03` // Set a low Jerk for extruder.
- 3.- `M303 E0 S220 C3` // Run PID atotune for the extruder at 220°C three times
- 4.- `M301 P38.73 I2.72 D137.84`// Set PID.

15.- SLICING SETTINGS

- 1.- When using large nozzles vertical lift can help to avoid lossing steps.
- 2.- Purge the nozzle may help to get clean extrusion when starting a print.

`G28` ; home all axes
`G92 E0` ; zero the extruder length
`G1 F200 E25` ; extrude 25mm
`G92 E0` ; zero the extruder again
`G1 X20 Y30 Z-0.08` ; guillotine