Prusa i3
Rework
ASSEMBLY INSTRUCTIONS
REV 1.5
INTRODUCTION

• Target :
Prupose a visual guide of the differents steps to build and use a Prusa i3 Rework.

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INTRODUCTION

PRUSA I3 REWORK INTRODUCTION

Prusa i3 is the third version of the open source 3D printer From Prusa.

This version is based on «EiNSTeiN» variant (M10 threaded rods instead of M8). Our version is based on an aluminium frame water jet cutted and threaded rods.

Axis motion are made on linear bearings, belts and pulleys or threaded rods and NEMA 17 motors.

The technical team of Emotion Tech realized several improvements on the new version 1.5:

- A new extruder with the following features:
  - 1.75 mm filament compatible
  - light, ergonomic and compact
  - auto-leveling probe
  - automatic print cooling

- Leadscrew Z axis insuring faster and accurate movements

- Relocating the X and Y axis endstops to simplify the wiring

- Modification of the « Z top Left » and « Z top Right » for more rigidity

- Belt tensioner added on the axis X

- Miniaturization of the « Y Idler » to support a 624 ball bearing.

The following picture represents the mechanical body and X/Y/Z axis orientation.
SAFETY INSTRUCTIONS

General safety instructions

**DO NOT LEAVE THE PRINTER UNATTENDED**

The nozzle can reach 270°C, to avoid burning, do not touch the nozzle while the printer is working.

A supervisor is needed when the printer is used with young people.

**KEEP PRINTER AWAY FROM CHILDREN AND ANIMALS**

Operate in a ventilated room. Plastic fumes effects are not yet known. In case of use in a closed room, we recommend the use of an extractor fan.

The addition of protections is your own responsibility.

Safety can be improved by:

- An emergency stop button
- Housing protection
- Smoke detector

**CE marking**

Prusa i3 Rework 1.5 is a 3D printed kit. It includes all the parts you need for assembling but does not include additional protections.

**Electrical safety**

The power supply provided is labelled CE. The power supply is protected against short-circuit and do not need any modifications. The printer operate at voltage of 12V and is not concerned by the low voltage directive.

**Further informations**

Information above are not exhaustive.

We used sources of informations we consider as reliable. However, we cannot guarantee that all these information are true and complete.

We assume no liability for loses, injuries or damages due to assembly, transporting, storage or removal of the product.
INTRODUCTION

NEEDED TOOLS LIST

- Mallet
- Flat screwdriver
- Cross-Headed screwdriver
- Open-end wrench 5.5, 7 et 17
- Allen key (supplied)
- M4 Allen key
- Flat clip
- Wire cutter
- Cutter
- Measuring tape
ASSEMBLY
BILL OF MATERIALS

A. Printed parts

1x X End Idler
1x X End Motor
1x Y Belt Holder
1x X Stretcher

1x Z Axis Bottom Left
1x Z Axis Bottom Right
1x Z Axis Top Left
1x Z Axis Top Right

4x Y Corner
1x Y Idler
1x Y Motor
3x Arduino Washer
ASSEMBLY

B. Extruder

1x Body Extruder
1x Extruder Idler
1x Fan Duct
1x Carriage

1x Hexagon hot-end
(cartridge heater and thermistor included)
1x Drive wheel
2x fans
Inductive sensor
ASSEMBLY

C. Smooth and threaded rods

- 2x 8 x 320 mm smooth rod
- 2x 8 x 350 mm smooth rod
- 2x 8 x 370 mm smooth rod
- 2x 8 x 300 mm lead screw
- 4x 10 x 210 mm threaded rod
- 2x 10 x 380 mm threaded rod

D. Mechanical parts

11x LM8UU linear bearing
2x 5*8 coupling
2x trapezoidal nut drive
3x 624 bearing
5x NEMA 17 Motor
1x spring
1x GT2 belt (760 mm)
1x GT2 belt (900 mm)
2x GT2 pulley
ASSEMBLY

Heated bed

1x Black aluminium plate

1x heater patch 20x20 140w

1x Kapton tape

2x Thermistor
F. Electronic

- 1x RAMPS
- 1x Arduino Mega 2560
- 4x stepstick
- 2x Endstop
- 1x inductive sensor stick
- 1x power supply
ASSEMBLY

Screw, nut & washer

- 2x M3 x 10 mm screw
- 36x M3 x 14 mm screw
- 8x M3 x 20 mm screw
- 4x M3 x 30 mm screw
- 4x M3 x 50 mm screw (or 60)
- 4x M4 x 20 mm screw
- 5x M3 setscrew

- 2x M2 nut
- 32x M3 nut
- 2x M3 wing nut
- 6x M4 nut
- 34x M10 nut

- 55x M3 washer
- 34x M10 washer
- 4x M3 x 8 mm brace

Note: Screws, nuts and washers are provided in additional quantities.

H. Others

1x main frame

1x heated bed mount
MECHANICAL ASSEMBLY
Y-Axis assembly

A. Heated bed mount

Needed parts:
- heated bed mount
- Y Belt Holder
- 3x LM8UU linear bearing
- 2x M3 x 20 mm screw
- 2x M3 washer
- 2x M3 nut
- 3x zip ties

Fix linear bearing in their positions with zip ties.

Fix Y belt holder in the center of the heated bed mount with the help of M3 screws, washers and nuts.
### B. Transverse parts

**Needed parts:**
- 4x Y Corner
- Y Idler
- Y Motor
- 1x 624 bearing
- 4x 0 x 210 mm rod
- 22x M10 nut
- 22x M10 washer
- 2x M4 x 20 mm screw
- 2x M4 nut

1. Set up the 624 bearing in the Y Idler.

2. Mount the X belt stretcher
Prepare Y-Axis threaded rods on the Y idler

Threaded rods 10 x 210 mm

M10 nut and washer

32 mm
Prepare the Y-Axis threaded rods on the motor side.

Note (*) : the following indicated sizes don’t need to be precise right now, it’s only usefull for the next step of the assembly.
Note: If needed, drill again each Ø10 hole.
Mount the «Y Corner» elements on the 10mm threated rods and set up the «Y Idler»

186 mm

M10 nuts

M10 washers
Setup the Y Corner on the other assembly
MECHANICAL ASSEMBLY

Longitudinal parts assembly

Needed parts:

- heated bed mount assembly
- last assemblies

2x 8 x 350 mm smooth rod
2x 10 x 380 mm threaded rod
12x M10 nut
12x M10 washer

Preparing threaded rod

Note (*) : the following indicated sizes don't need to be precise right now, it's only useful for the next step of the assembly.
The smooth rod must be against the Y corner

Fix rods with zip ties passing by the dedicated hole

8 x 350 mm smooth rod

Note: heads of zip ties must be on the side of Y corner to avoid blocking Y-Axis motion.
X-Axis assembly

X End Idler & X End Motor

Needed parts:

- X end Idler trapezoidal
- X end Motor trapezoidal
- X Stretcher
- 1x 624 bearing
- 4x LM8UU linear bearing
- 1x endstop
- 2x trapezoidal nut drive
- 1x M3 wing nut
- 8x M3 nut
- 7x M3 x 14 screw
- 1x M3 x 50 screw (or 60)
- 1x M4 x 20 screw
- 3x M3 washer
- 1x M4 nut

Note: if needed, drill the Ø8 holes.
Mount the linear bearings on the X End Motor and X End Idler.

**Note**: if needed, it can be possible to tighten LM8UU with zip ties.
Mounting X Stretcher

1. M3 x 50 screw
2. M3 nut
3. M4 x 20 screw
4. 624 bearing
MECHANICAL ASSEMBLY

Trapezoidal nut drive mount

M3 wing nut
M3 washer
M3 nut
M3 x 14 screw
Endstop
M3 washer
M3 nut
M3 x 14 screw
## MECHANICAL ASSEMBLY

### X-Axis assembly

<table>
<thead>
<tr>
<th>Needed parts:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• X mounted End Idler</td>
</tr>
<tr>
<td>• X mounted End Motor</td>
</tr>
<tr>
<td>• X Carriage</td>
</tr>
<tr>
<td>• 2x 8 x 370 mm smooth rod</td>
</tr>
<tr>
<td>• 4x LM8UU linear bearing</td>
</tr>
<tr>
<td>• 8x zip ties</td>
</tr>
</tbody>
</table>

![Diagram of X-Axis assembly]

1. 8 x 370 mm threaded rod
2. LM8UU linear bearing
MECHANICAL ASSEMBLY

«X-Carriage» on X-Axis Mount

tackle the «X-Carriage» on bearings

Fix zip ties
MECHANICAL ASSEMBLY

362 mm
Z and X-Axis assembly

Needed parts:

- main frame
- Mounted X-Axis
- Z Axis Top Left
- Z Axis Top Right
- Z Axis Bottom Left
- Z Axis Bottom Right
- 2x 8 x 320 mm smooth rod
- 2x 8 x 300 mm threaded rod
- 16x M3 x 14 mm screw
- 10x M3 nut
- 16x M3 washer
- 2x 5 x 8 coupling
- 2x NEMA 17 motor
MECHANICAL ASSEMBLY

M3x14 screw

M3 washer
MECHANICAL ASSEMBLY

Connector

M3 washer

M3 x 14 screw
MECHANICAL ASSEMBLY

Slide the smooth rods through the «Z Axis Top» elements halfway of the main frame.
Note: Smooth rods must be parallel
MECHANICAL ASSEMBLY

Trapezoidal rod

5 x 8 coupling
Rod / axis coupling

- Flexible portion of the coupler
- On the flat side of the axis
- Inserting rod until this level
- Inserting axis until this level
MECHANICAL ASSEMBLY

Motors assembly

Needed parts:

- 2x NEMA 17 motor
- 2x GT2 pulley
- 8x M3 x 14 mm screw
- 4x M3 pression screw
- 8x M3 washer
- 2x M3 nut

![Diagram of motor assembly](image)

1. on the flat side of the axis
MECHANICAL ASSEMBLY

Connector

M3 washer

M3 x 14 screw
Frame assembly

Needed parts:
- mounted Y frame
- mounted main frame

Fix loosely the Y frame on to the main frame
Adjust and tighten the Y frame on to the main frame.
Belts assembly

X-Axis belt

Needed parts:

- 1x 900 mm GT2 belt
- 4x zip ties
Y-Axis belt

Needed parts:
- 1x 760 mm GT2 belt
- 4x zip ties

Tighten the belt gently to avoid distortion of it.
MECHANICAL ASSEMBLY

Heated bed assembly

Needed parts:
1x Aluminium plate
1x Heater patch
1x Thermistor
4x M3 x 20 mm screw
4x M3 nut
20x M3 washer or 4 brass spacers

1. Fixing of the heater patch on the aluminium plate
2. Fixing of the thermistor on the center of the plate with Kapton tape

Note: for more reliable temperature reading, add thermal paste on the thermistor

Example of a mounted plate
MECHANICAL ASSEMBLY

Note: the aluminium side of the heating plate should be facing upward.

Note: in case of thin isolating material, replace spacers by washers.

- M3 x 20 screw
- M3 spacer
- Heating plate
- Isolating material

M3 nut
**WARNING:** take care to fix the plate's cables at the indicated point in order to be sure they can not become brittle due to the movements of the axis.

Heated bed cables routing on the side

**Note:** thread the cables into the braided sleeves. To prevent the sleeve from fraying, heat the ends and roll them inward.

**Note:** fix cables without blocking Y-Axis motion
Hexagon assembly

Needed parts:

- 1x Hexagon kit
- 3x zip ties
- 1x heater cartridge
- 1x thermistor

Assembling and dismantling operations must be carried out hot!

1. Loosen the central tube

To have more taken, use a screwdriver

Note: more informations are available about how to demount, clean and remount Hexagon printhead on a stand-alone documentation downloadable on our website.
1. Tighten the nozzle

7 wrench (not supplied)

To have more taken, use a screwdriver

2. Tighten the central tube

There should not be any space between the nozzle and the head
MECHANICAL ASSEMBLY

Print head: direction of assembly

1°) silicon sleeve on to the heating block
2°) heater cartridge into the heating block
3°) headless screw in the heating block
4°) thermistor through the sleeve, in the heating block, it must be pressed into abutment against the receptacle.

Caution! If the thermistor goes out of the hot end, your printer could be damaged.
Extruder assembly

Needed parts:

- body extruder
- extruder idler
- fan duct
- 1x Hexagon hotend
- 1x drive wheel
- 2x 3x3cm fan
- 1x spring
- 1x 624 bearing
- 1x inductive sensor
- 3x M4 x 20 mm screw
- 1x M3 x 50 mm screw (or 60)
- 4x M3 x 14 mm screw
- 1x M3 x 10 mm screw
- 3x M3 x 20 mm screw
- 4x M3 nut
- 3x M4 nut
- 10x Ø3 mm washer
- 1x Ø3 wing nut
- 1x pressing screw

Note: check that nothing obstructs the passage of the filament in the body of the extruder.
MECHANICAL ASSEMBLY

- M3 washer
- M3 x 14 screw
- M3 x 10 screw
MECHANICAL ASSEMBLY

M3 x 20 screw

M3 washer

M3 x 20 screw
MECHANICAL ASSEMBLY

- M4 nut
- 624 bearing
- M4 x 20 screw
MECHANICAL ASSEMBLY

Note: please clean the support's residues.
Note: the fan must have the sticker facing the Hexagon nozzle.
MECHANICAL ASSEMBLY

Note: the fan must have the sticker facing the Hexagon nozzle
MECHANICAL ASSEMBLY

- M3 x 14 screw
- M3 washer
- M3 nut
Position the inductive sensor loosely (next step in the user guide)
Note: pass the filament in the guide to stall the drive wheel to its optimum spot.
ELECTRONIC ASSEMBLY
Electronic and wiring

The following instructions are about wiring of the Arduino that is the microcontrolling board that is receiving the information from the PC. RAMPS is the additional board that allow to drive different components and also receive information from all sensors.

Organization of cables and sleeves

The various connections will be detailed later in this document.

It is preferred to connect cables of each axis set within the same sleeve. Each sleeve should include a loop with sufficient clearance that will allow its axis to move freely.

Each sleeve is fixed to the frame or on anchoring points using zip ties so that movements do not create in the long term false-contacts on different connectors.

You will find below some illustrations to understand where to make these loops.

![X axis loop](image1.png)

![Y axis loop](image2.png)

![Z axis loop](image3.png)
Electronic mount

**Needed parts:**
- RAMPS
- Arduino
- 4x stepstick
- 3x Arduino washer
- 3x M3 x 30 mm screw
- 3x M3 nut
- 3x M3 washer

1°) Fit the RAMPS card on the Arduino board carefully.

2°) Connect each motor driver on the RAMPS, please pay attention to orientation of the board.

3°) A free slot should remain next to the first extruder (this slot will be used for an optional second extruder).

**Do not inverse stepstick’s wiring to avoid damaging electronic equipment.**
Secure the assembly to the rear of the main frame with the interposition Arduino washers between the electronic cards and the aluminum frame. **These washers act as insulation.** The power supply plugs are oriented downward. Everything is held in place by three screws M3x30 mm (head front of the frame), three Ø3 mm washers (on the Arduino) and three M3 nuts.
**Wiring**

**Motor’s wiring**

Reverse the motor’s plug orientation will affect the spin direction.

Note: The color of the cables may vary depending on the manufacturer.
Endstops wiring

Connect the two endstop using the cables provided («Endstop» marked on each plug).

Make sure the solder from the Endstop is not in contact with a conductive part (e.g. frame) to avoid a short circuit.

Be careful to respect the following connections:

CAUTION: REVERSAL OF CONNECTIONS SENSOR LIMIT CAUSES SERIOUS DAMAGE TO ELECTRONICS CARDS, SO BE CAREFUL WHEN CONNECTING IT.

Be careful to plug in the endstop's connector in this direction in order to not degrade equipment.
Cartridge heater and PCB wiring

The cartridge heater is not polarized and will be connected on the D10 connector.

PCB heating plate is not polarized either and can be plugged on the D8 connector (close to the MOSFET with the heat sink).
**Thermistors wiring**

Thermistors are not polarized so there is no risk of mis-connection.

Be careful about the position of the extrusion nozzle and heatbed thermistors connectors.
Fans wiring

The fan that cools the printed object is connected on the D9 connector to command it directly from the software.

**WARNING**: the fan is a polarized component, the direction of the connection must be correct as this may cause damage to the material.

Note: cut out the fan's connector, strip it and insert it in the D9 connector.
Inductive probe wiring

Carefully follow the wiring direction of the inductive interface card. Connect the interface card directly on the RAMPS card.

WARNING: set up the inductive sensor board connectors with caution.

WARNING: fix the interface card using kapton tape by resting on yellow rectangular components behind.

Note: the interface card must be connected directly to the RAMP²S board.
Power supply wiring

This printer is provided with a 12V power supply but without wiring cable.

Strip the power supply wire properly to obtain a clean and safety connection.

The wire between the power supply and the RAMPS board is made with additional wiring cables.

Strip end of cables properly and connect it to the supply power and in the other side with removable connectors like in the diagram below.

Now you can read the next notice to run your 3D printer.
CONGRATULATION!

Your printer is now operationnal
Thank you for choosing Prusa i3 Rework rev. 1.5

Now you can follow the first use instructions guide available on our website, in the «support» section:

[link to the first use instructions]

www.reprap-france.com