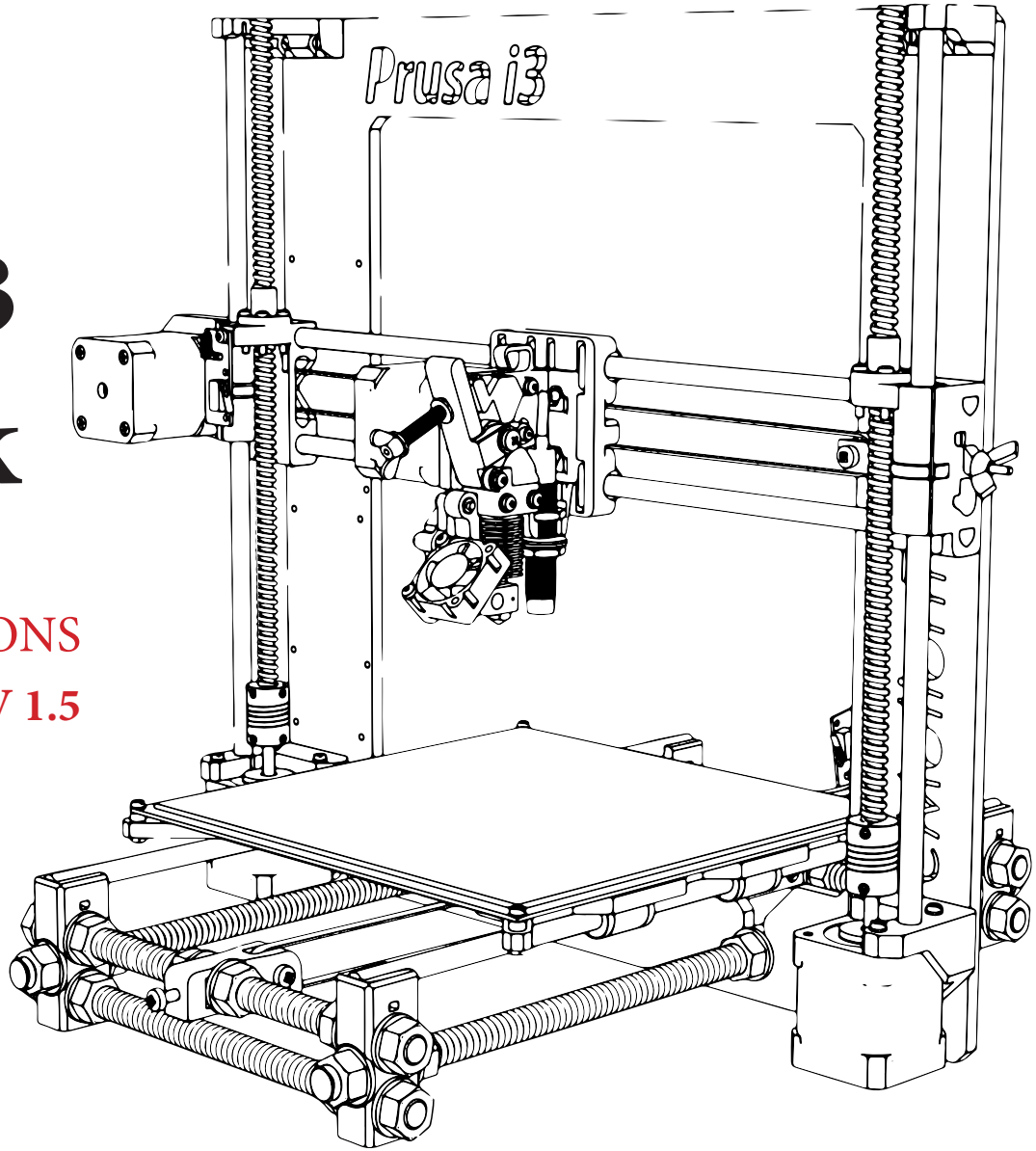
Documentation version 1.3.26

Prusa i3 Rework

ASSEMBLY INSTRUCTIONS

REV 1.5



INTRODUCTION

INTRODUCTION

• **Target :**

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

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Quentin CESVET
Maël DURAND

• **Photographics Credits :**
Pictures and 3D représentations made by eMotion Tech
http://www.emotion-tech.com

• **Sources :**

Prusa i3 EiNSTeiN VARIANT :
http://reprap.org/wiki/Prusa_i3_Build_Manual#EiNSTeiN_VARIANT
Prusa i3 Rework REV 1.0 :
http://reprap.org/wiki/Prusa_i3_Rework_Introduction/fr

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• **Update :**

Last update : 30/06/2016

• **Links :**

You can find more informations on the following links :

RepRap community : http://reprap.org/wiki/reprap
Repetier-Host software : http://www.repetier.com/
3D models database : http://www.thingiverse.com/

SUMMARY

PRUSA I3 REWORK INTRODUCTION

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

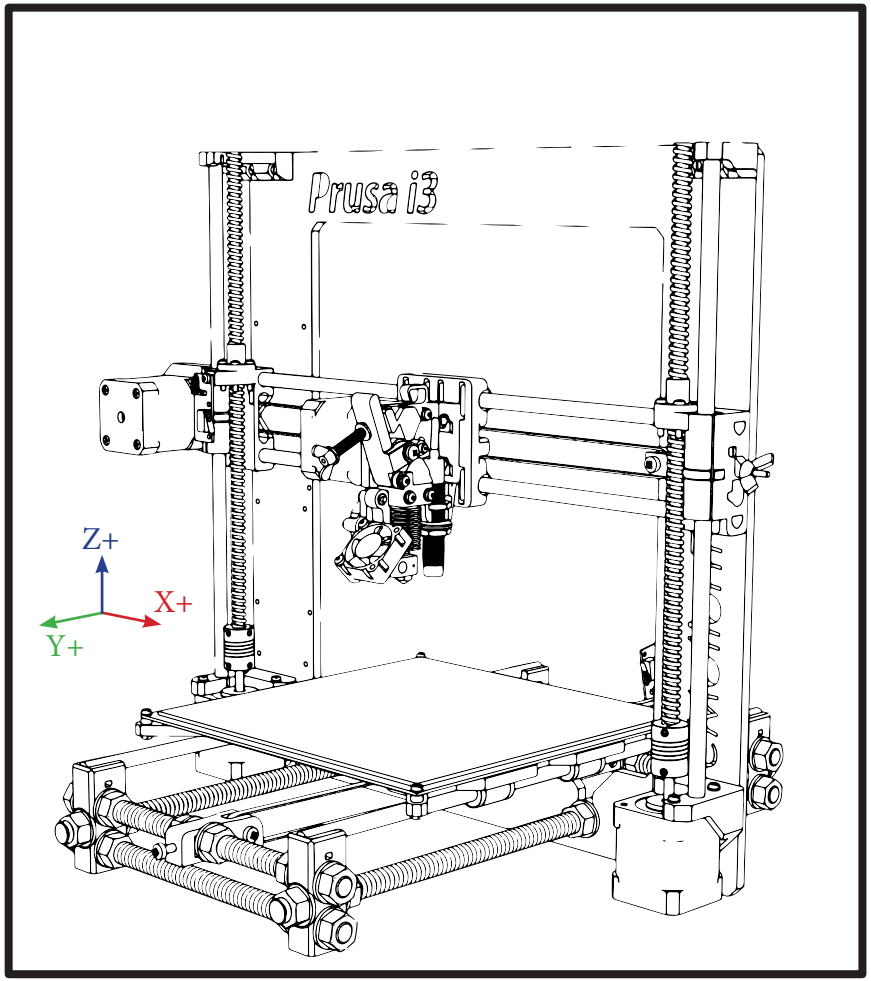
This version is based on «EiNSTeiN» variant (M10 threaded rods instead of M8). Our version is based on an aluminium frame water jet cutted and threaded rods.

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 effets 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.

NEEDED TOOLS LIST

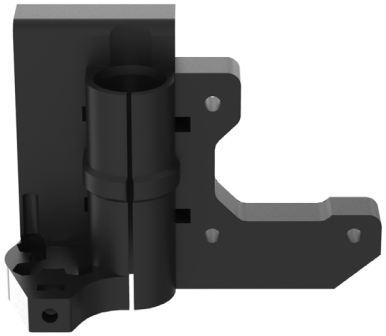
- Mallet
- Flat screwdriver
- Cross-Headed screwdriver
- Open-end wrench 5.5 , 7 et 17
- Allen key (supplied)
- M4 Allen key
- Flat clip
- Wire cutter
- Cutter
- Measering tape

ASSEMBLY

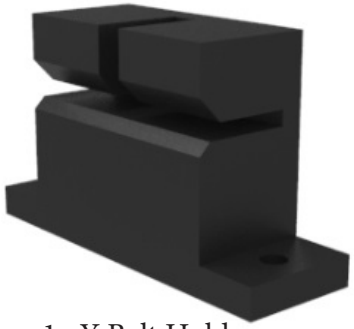
BILL OF MATERIALS

A. Printed parts

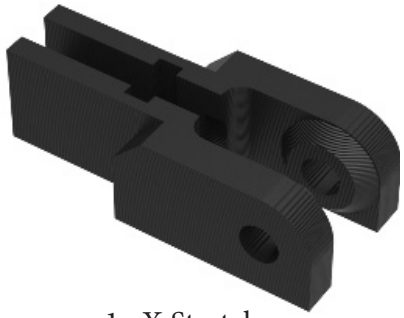
1x X End Idler



1x X End Motor



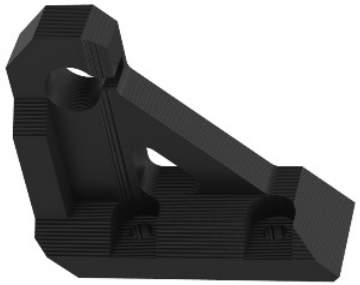
1x Y Belt Holder



1x X Stretcher

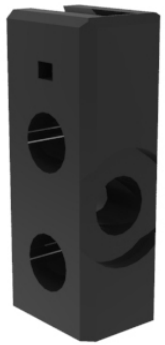
v1x Z Axis Bottom Left

1x Z Axis Bottom Right

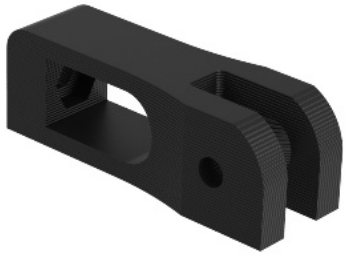


1x Z Axis Top Left

1x Z Axis Top Right



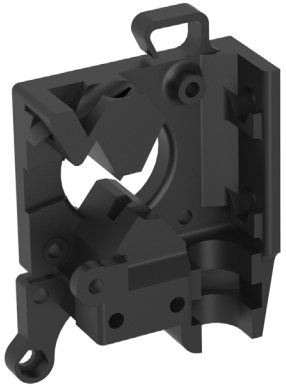
4x Y Corner



1x Y Idler

1x Y Motor

3x Arduino Washer



1x Body Extruder

1x Extruder Idler

1x Fan Duct

1x Carriage

B. Extruder

1x Hexagon hot-end
(cartridge heater and thermistor included)

1x Drive wheel

2x fans

Inductive sensor

C. Smooth and threaded rods

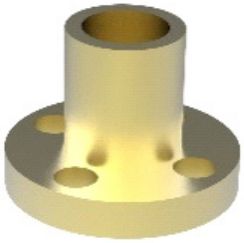
- 2x 8 x 320 mm smooth rod
- 2x 8 x 350 mm smooth rod
- 2x 8 x 370 mm smooth rod

- 2x 8 x 300 mm lead screw
- 4x 10 x 210 mm threaded rod
- 2x 10 x 380 mm threaded rod

D. Mechanical parts

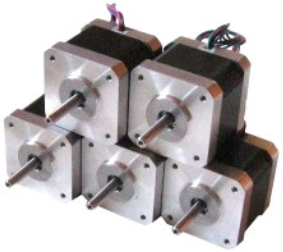
11x LM8UU linear bearing

2x 5*8 coupling



2x trapezoidal nut drive

3x 624 bearing



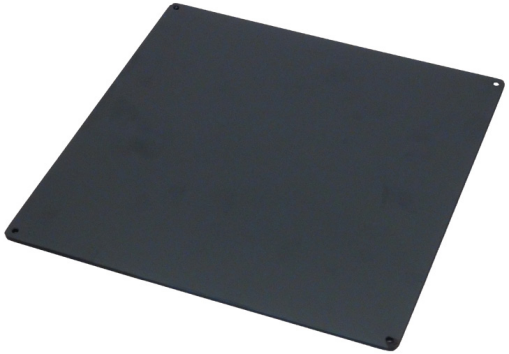
5x NEMA 17 Motor

1x spring

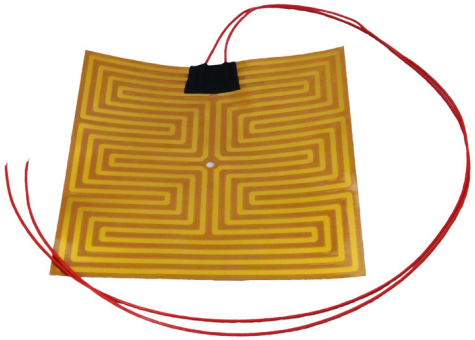
1x GT2 belt (760 mm)
1x GT2 belt (900 mm)

2x GT2 pulley

Heated bed

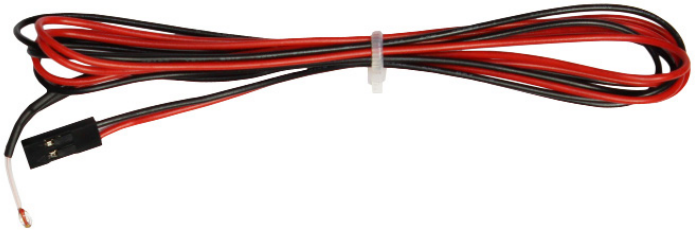


1x Black aluminium plate



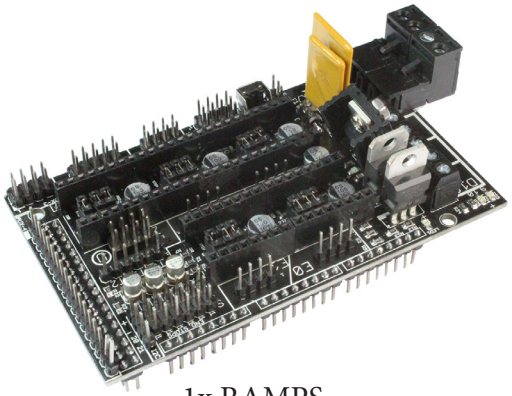
1x heater patch 20x20 140w

1x Kapton tape

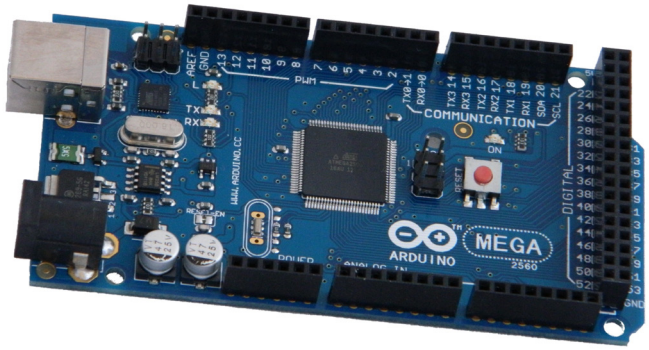


2x Thermistor

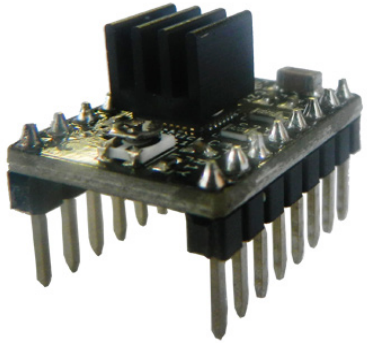
F. Electronic



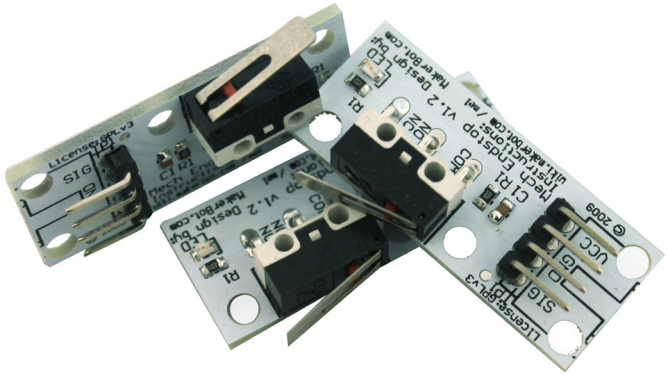
1x RAMPS



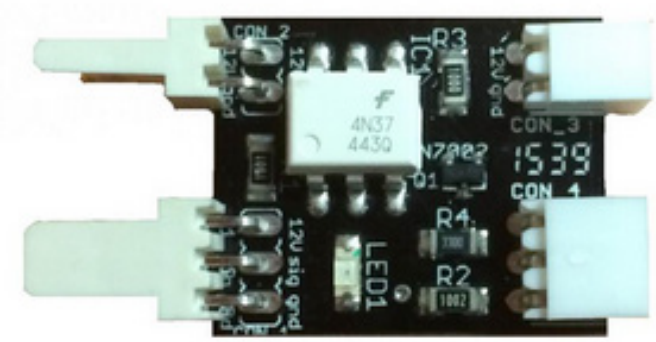
1x Arduino Mega 2560



4x stepstick



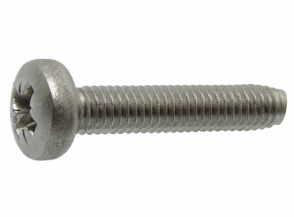
2x Endstop



1x inductive sensor stick

1x power supply

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

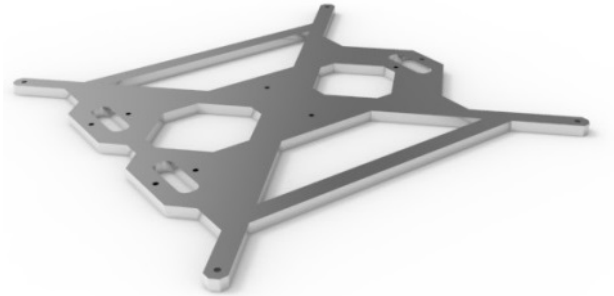
- 2x M2 nut
- 32x M3 nut
- 2x M3 wing nut
- 6x M4 nut
- 34x M10 nut

- 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

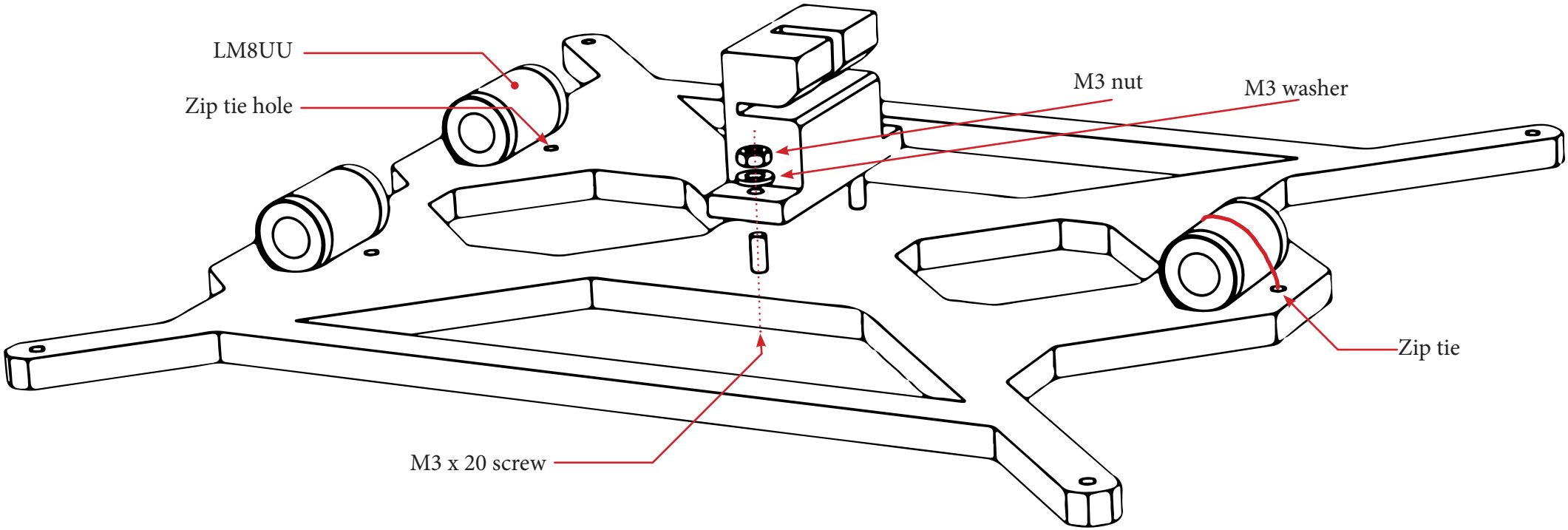
A. Heated bed mount

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.

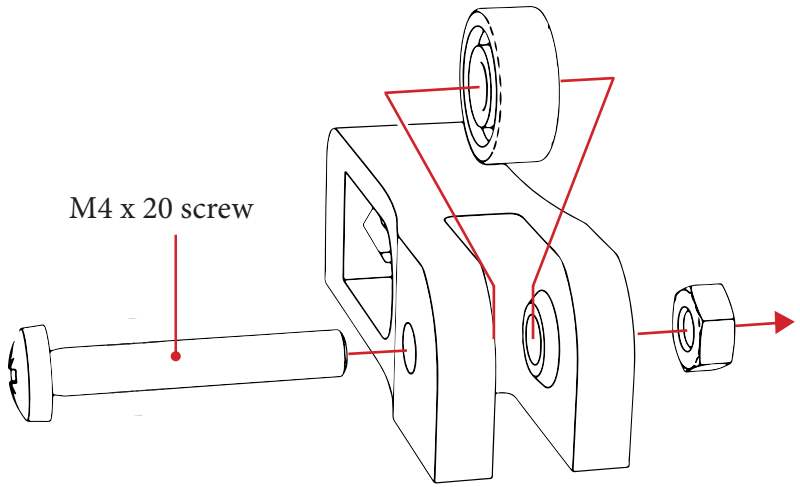


B. Transverse parts

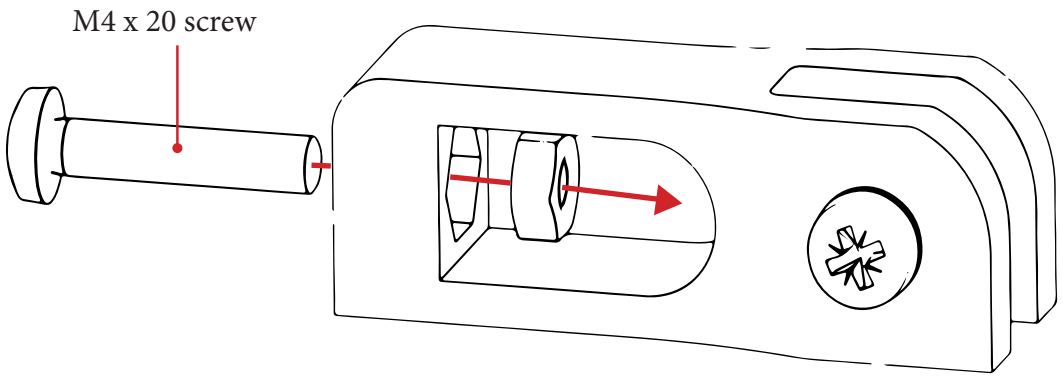
Needed parts :

- 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

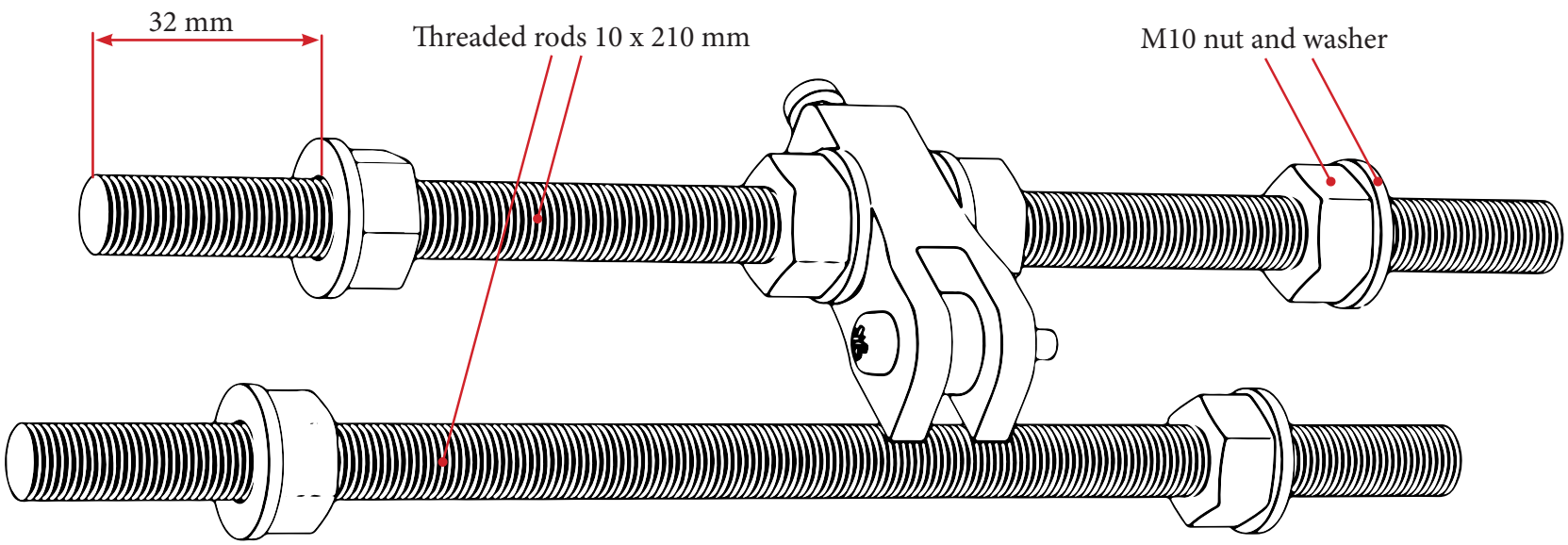
1 Set up the 624 bearing in the Y Idler.



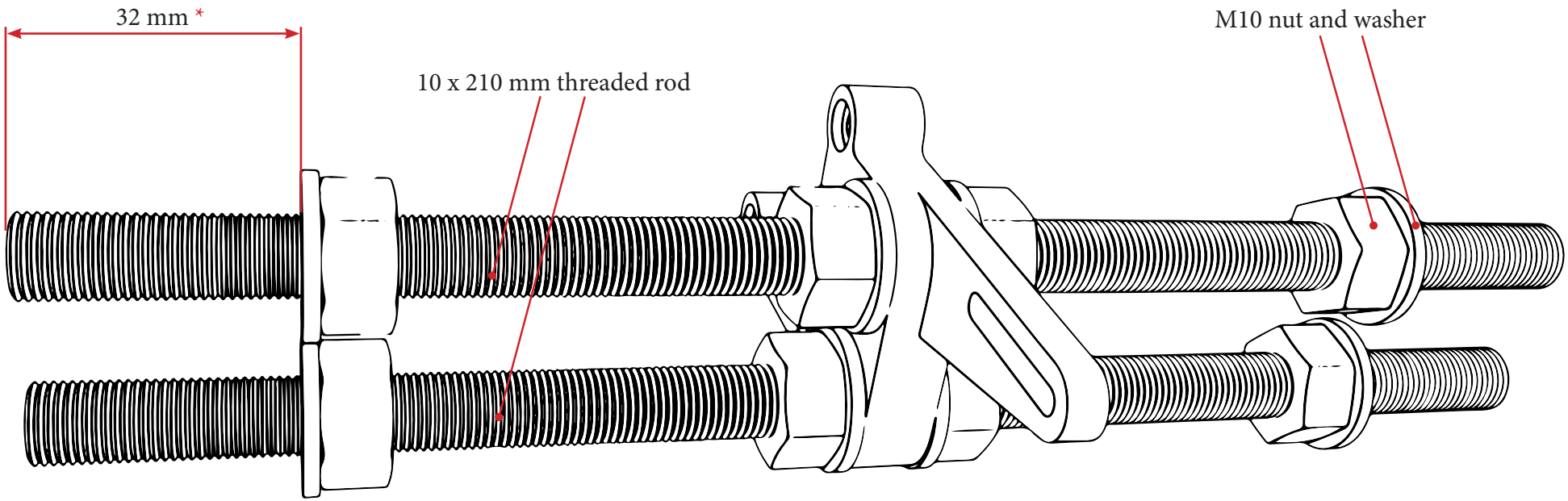
2 Mount the X belt stretcher



Prepare Y-Axis threated rods on the Y idler

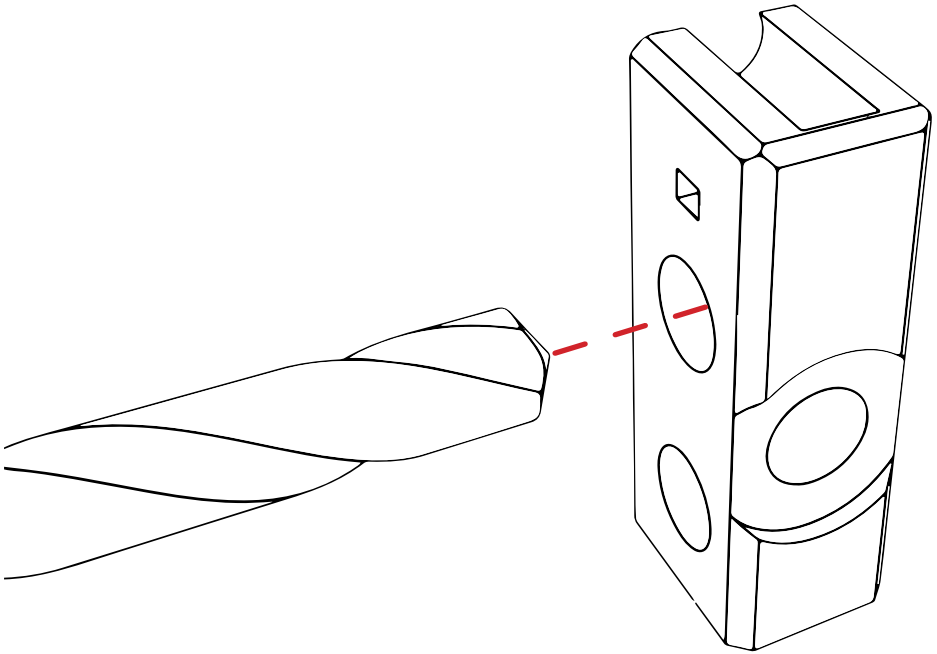


Prepare the Y-Axis threaded rods on the motor side.

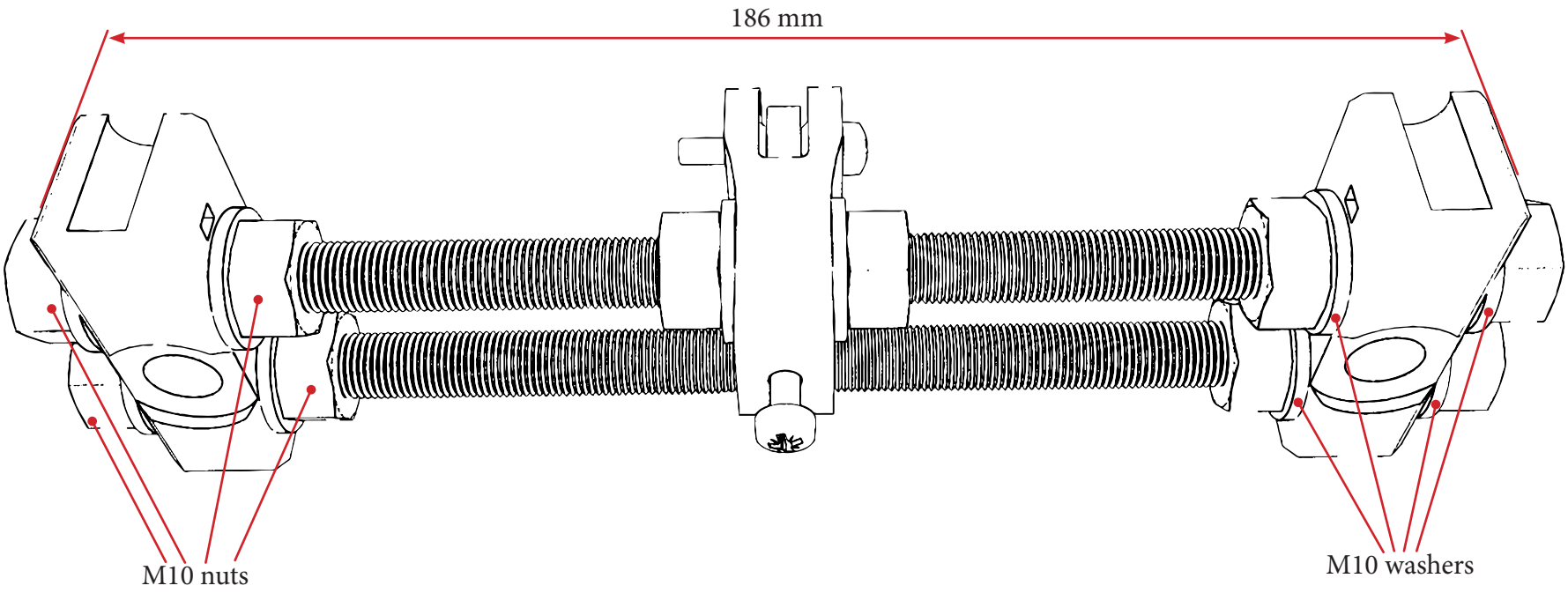


Note (*) : the following indicated sizes don't need to be precise right now, it's only usefull for the next step of the assembly.

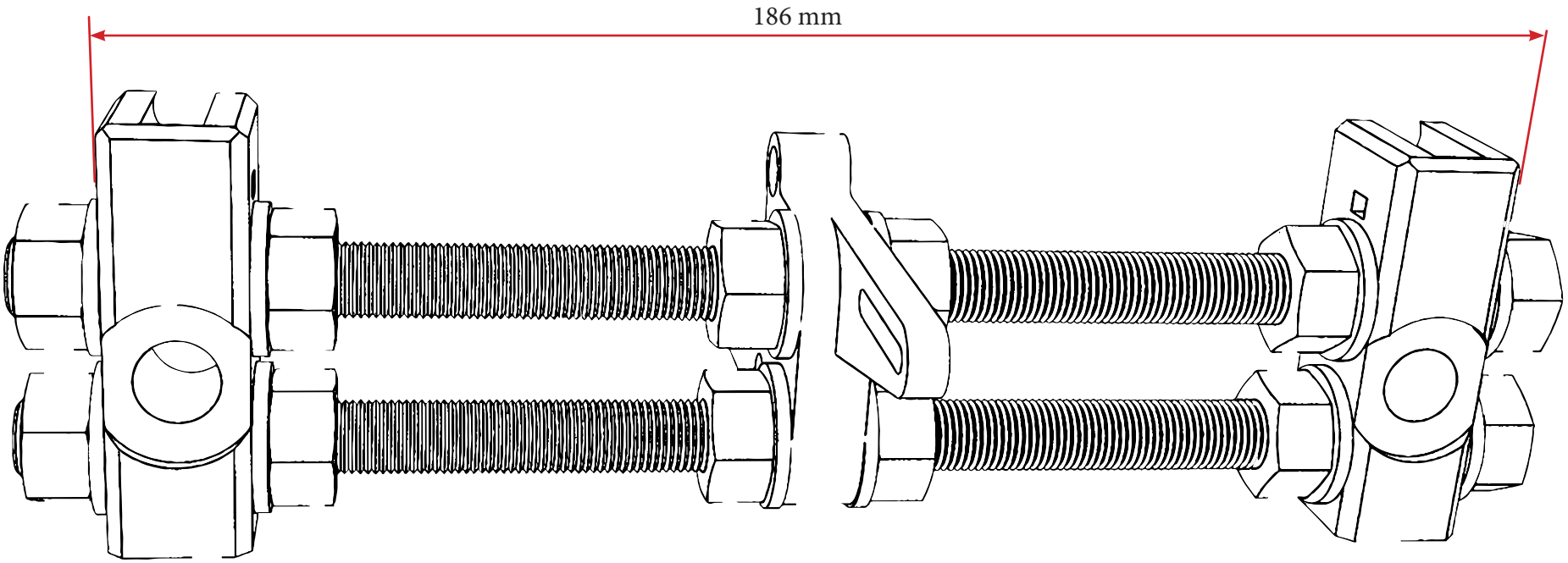
Note : If needed, drill again each Ø10 hole.



Mount the «Y Corner» elements on the 10mm threated rods and set up the « Y Idler»



Setup the Y Corner on the other assembly

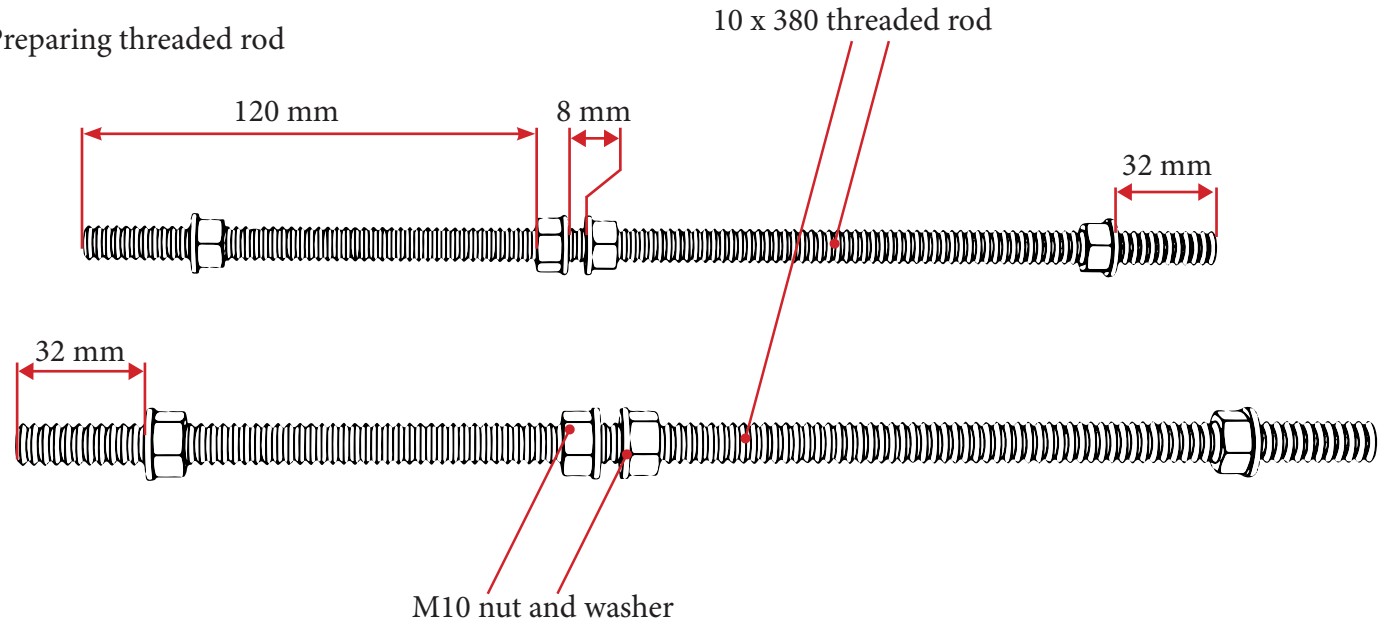


Longitudinal parts assembly

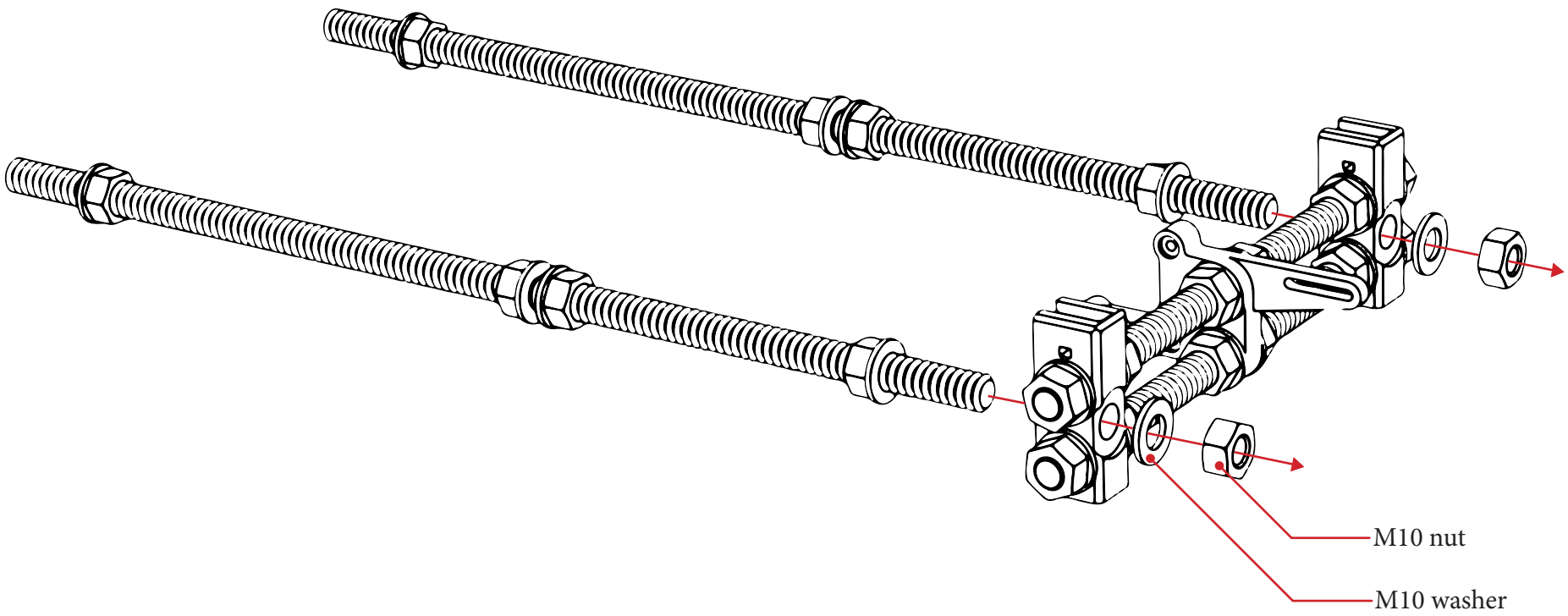
Needed parts :

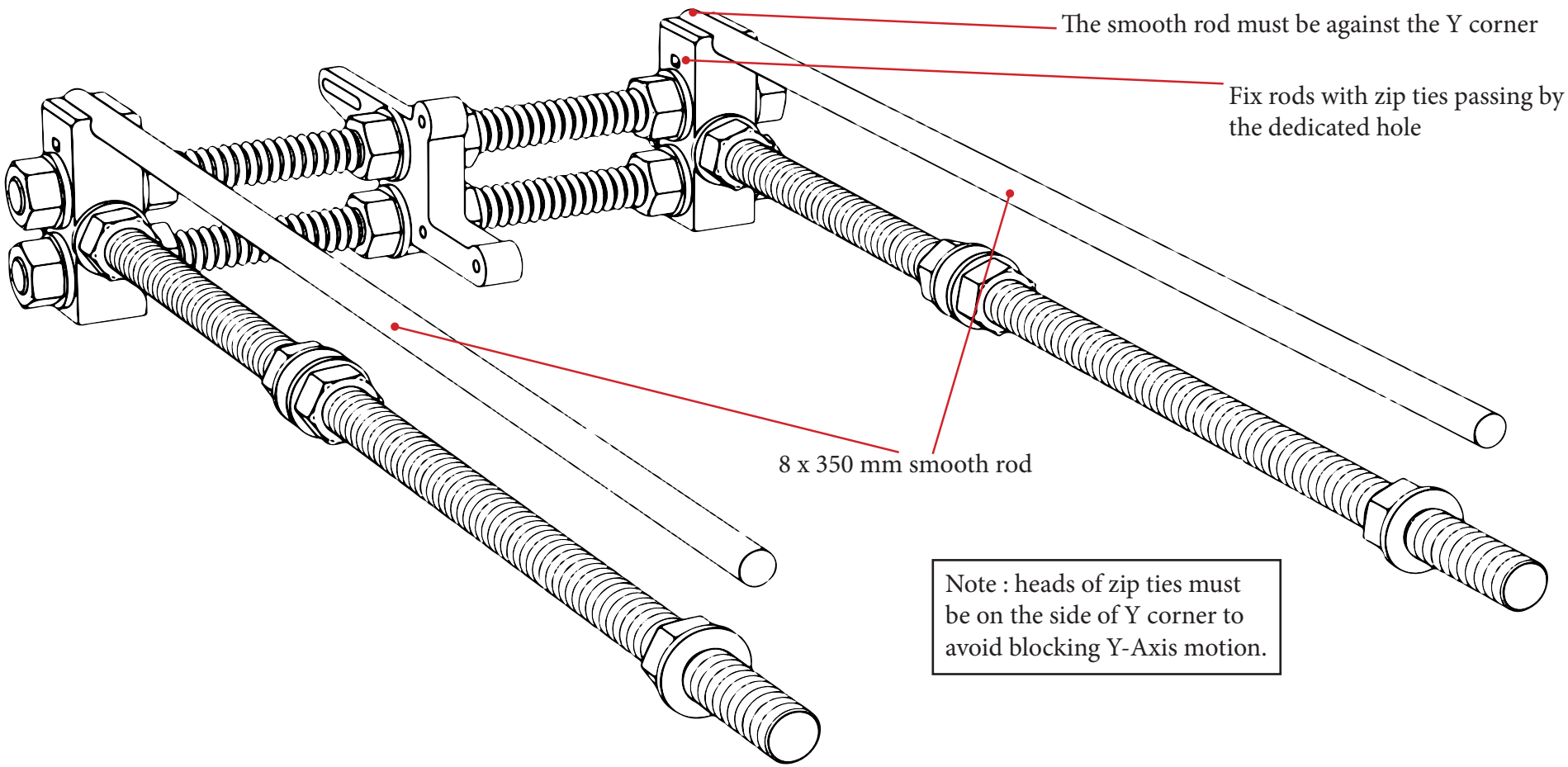
- heated bed mount assembly
- last assemblies
- 2x 8 x 350 mm smooth rod
- 2x 10 x 380 mm threaded rod
- 12x M10 nut
- 12x M10 washer

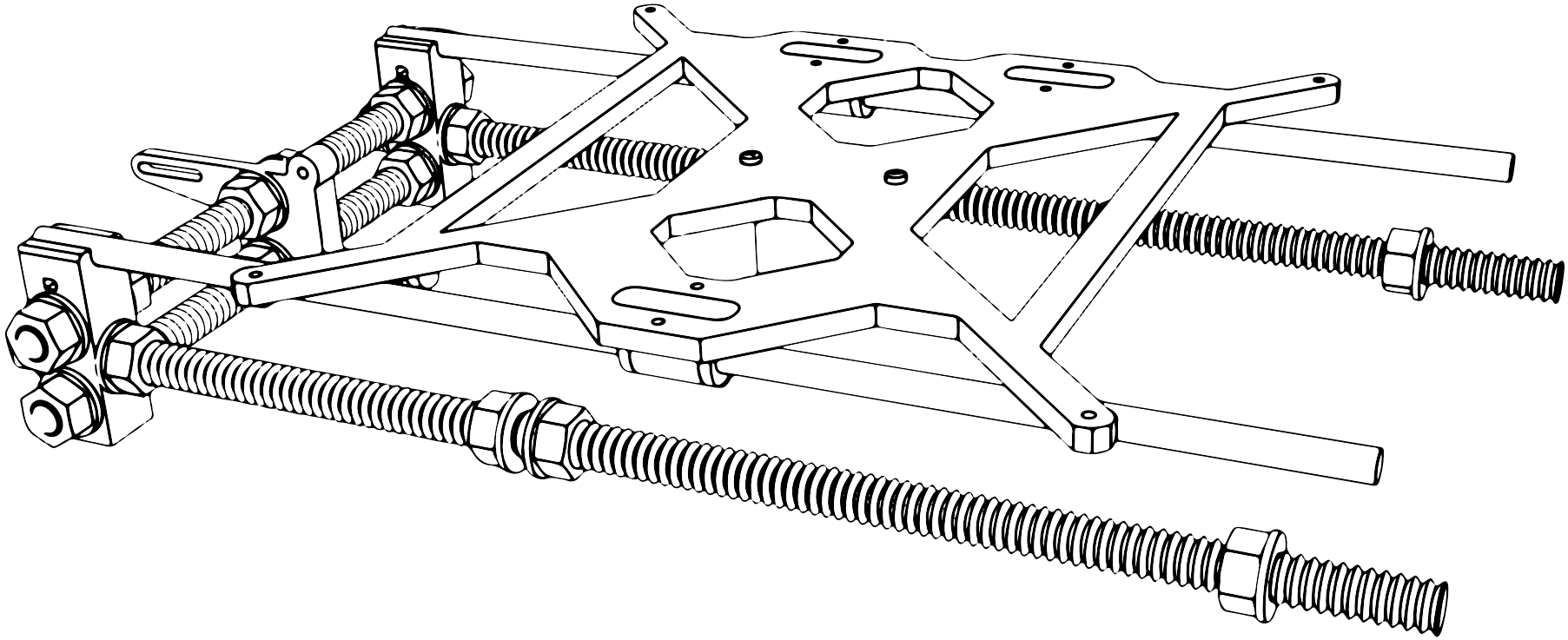
Preparing threaded rod

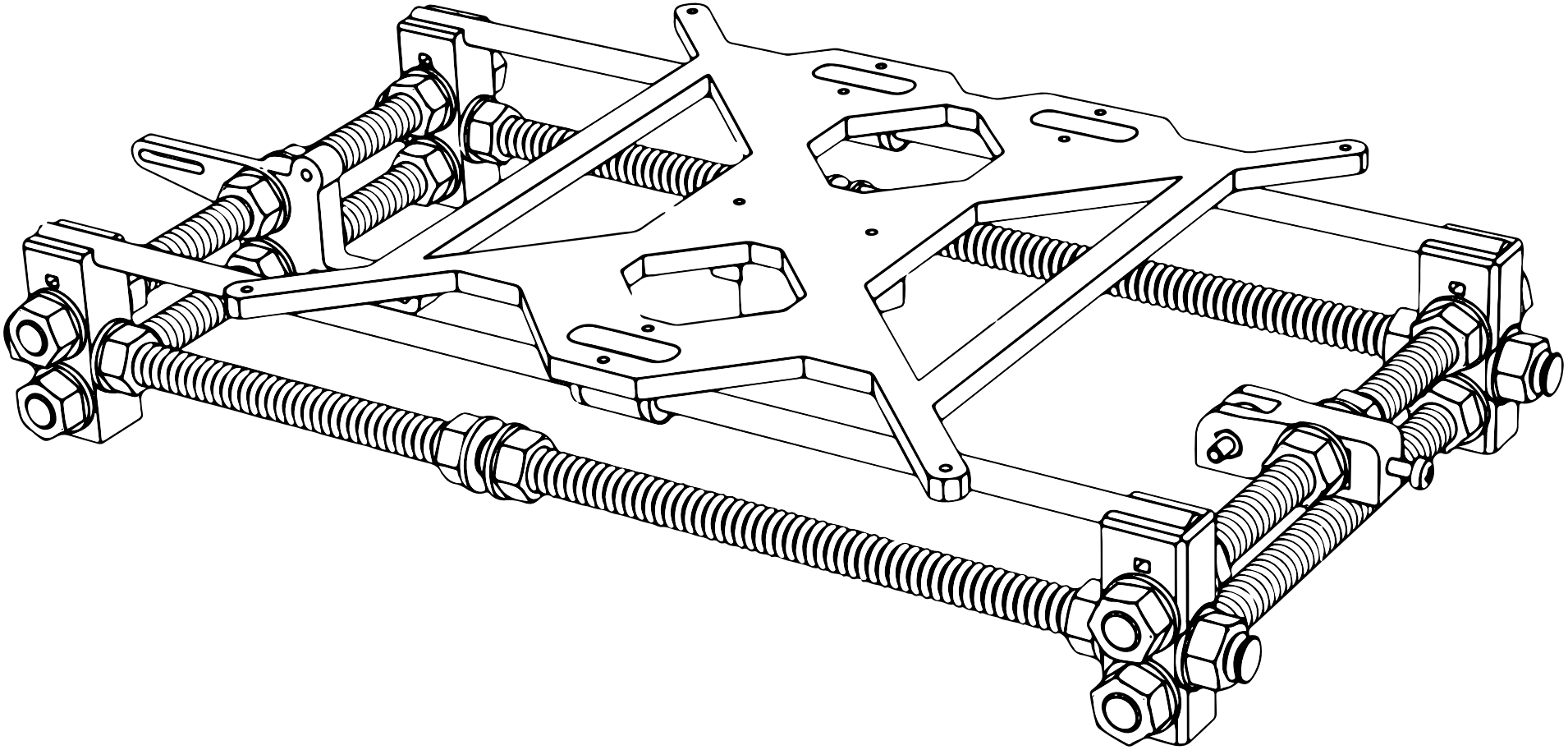


Note (*) : the following indicated sizes don't need to be precise right now, it's only usefull for the next step of the assembly.


M10 nut
M10 washer


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.



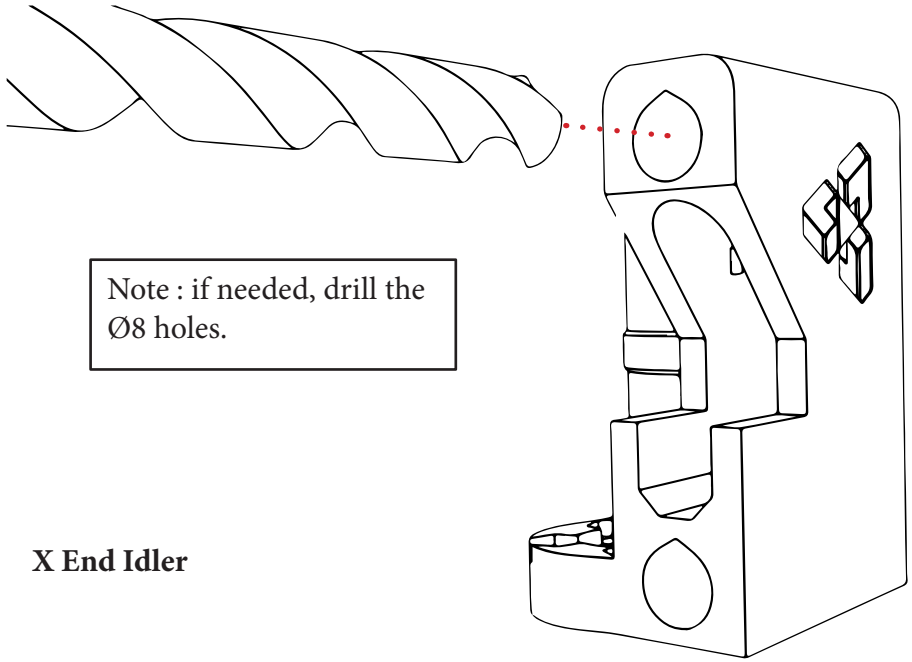


X-Axis assembly

X End Idler & X End Motor

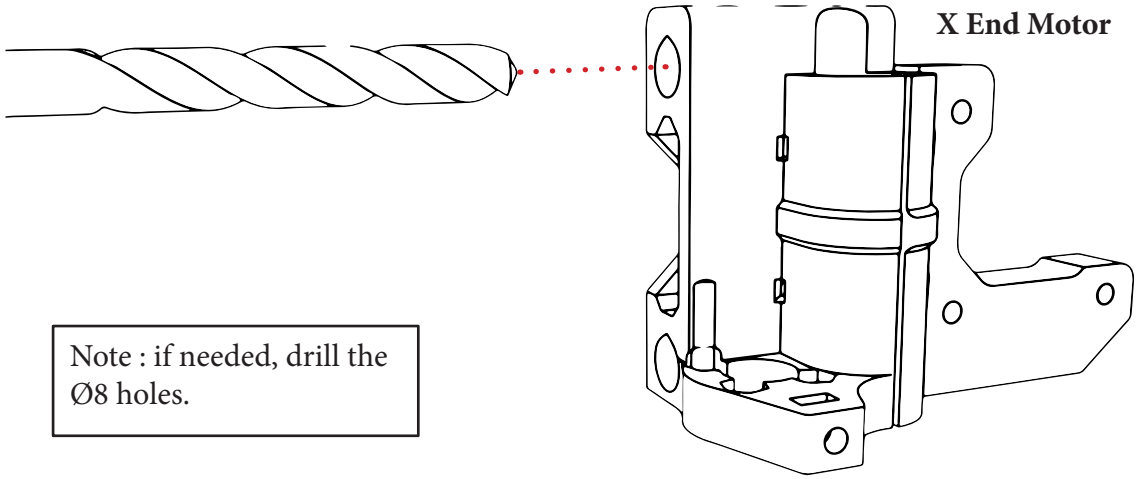
Needed parts :

- 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.

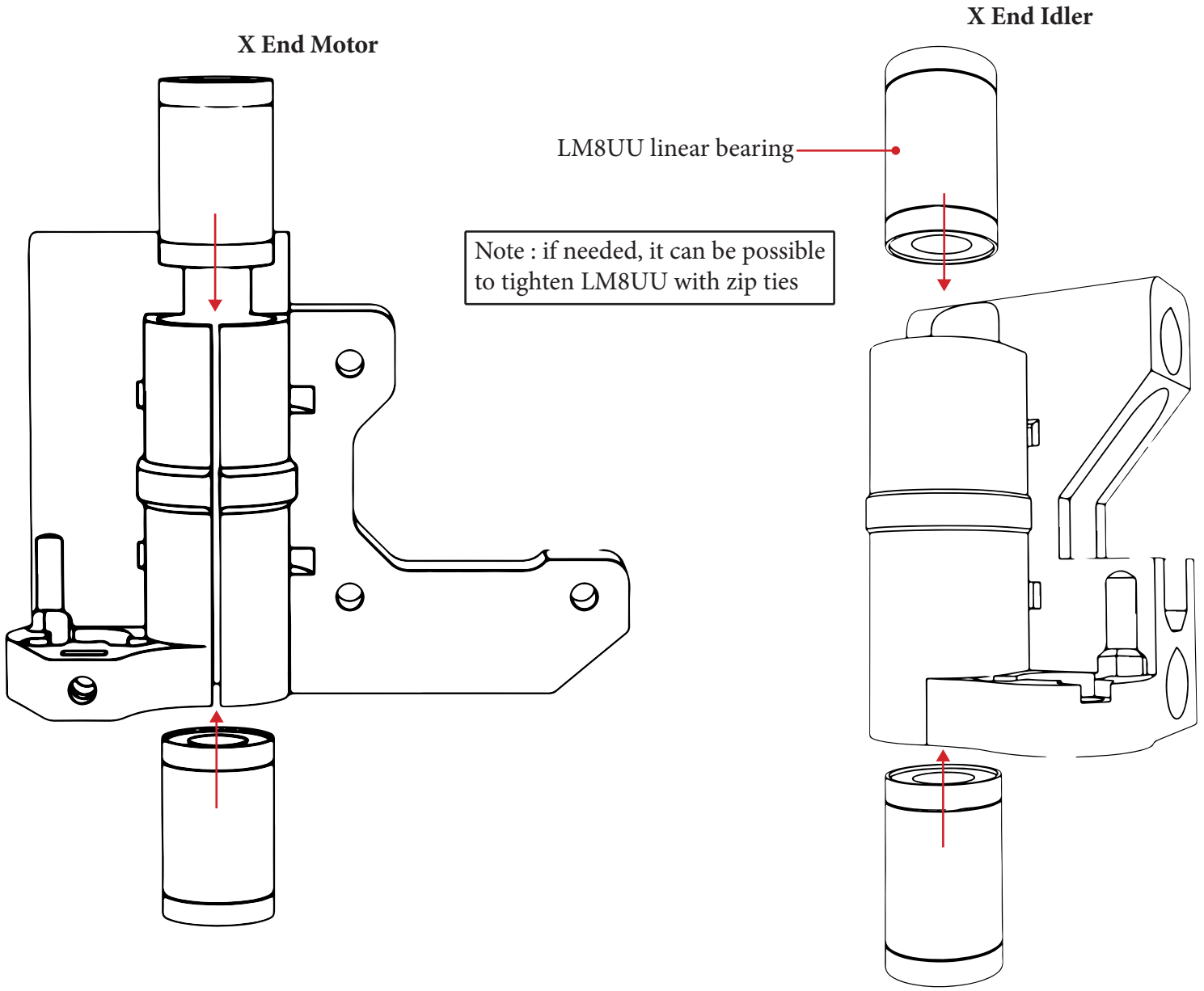
X End Idler



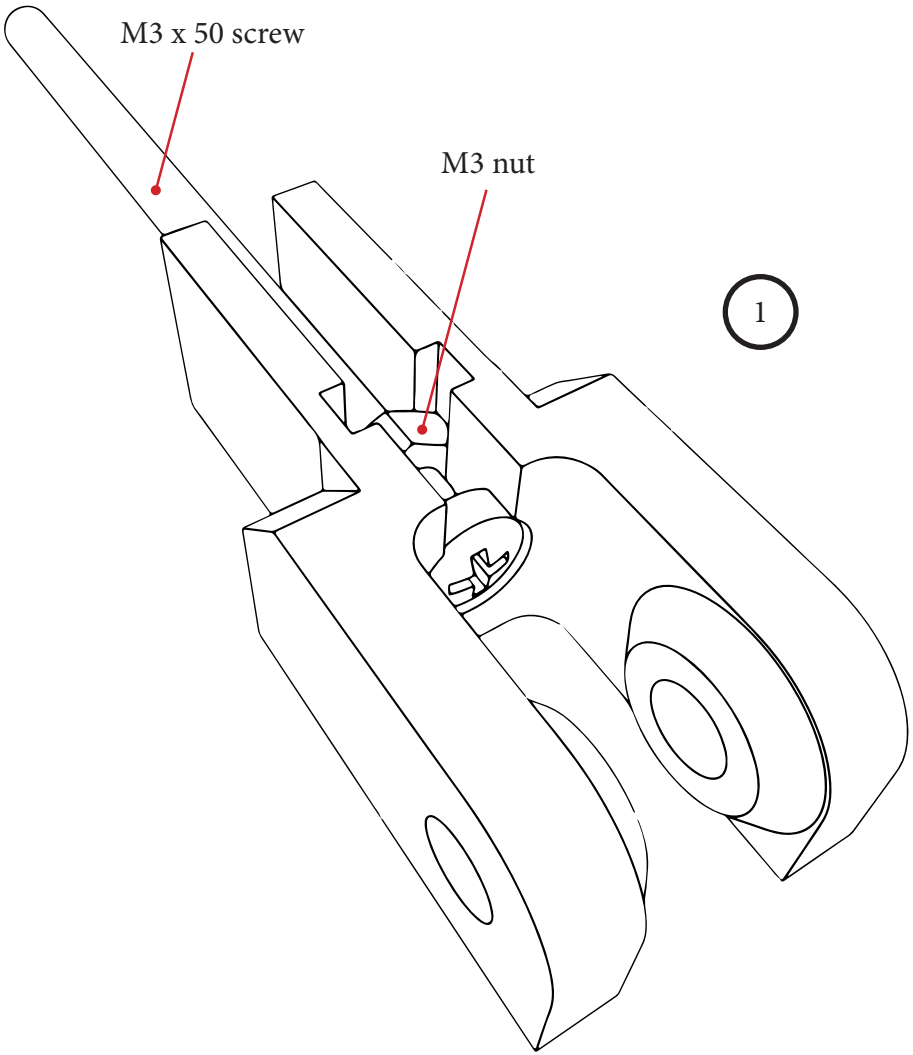
Note : if needed, drill the Ø8 holes.

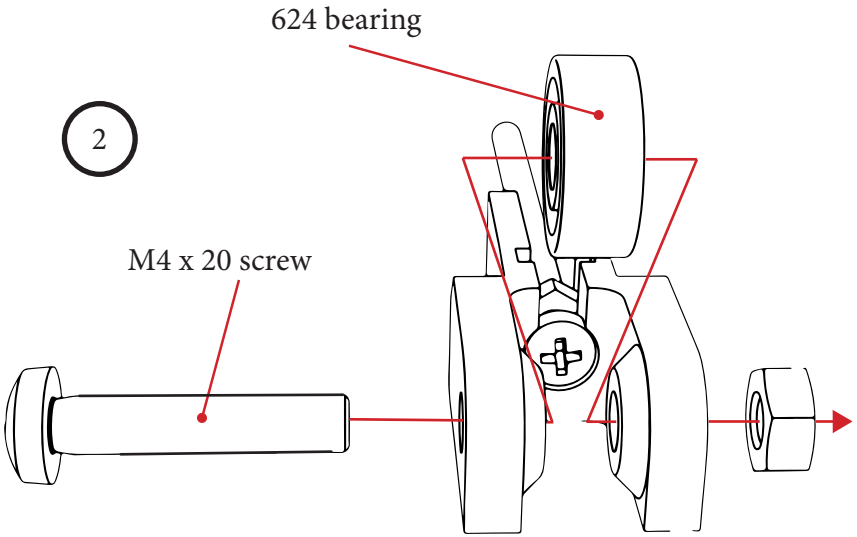
X End Motor

Mount the linear bearings on the X End Motor and X End Idler.

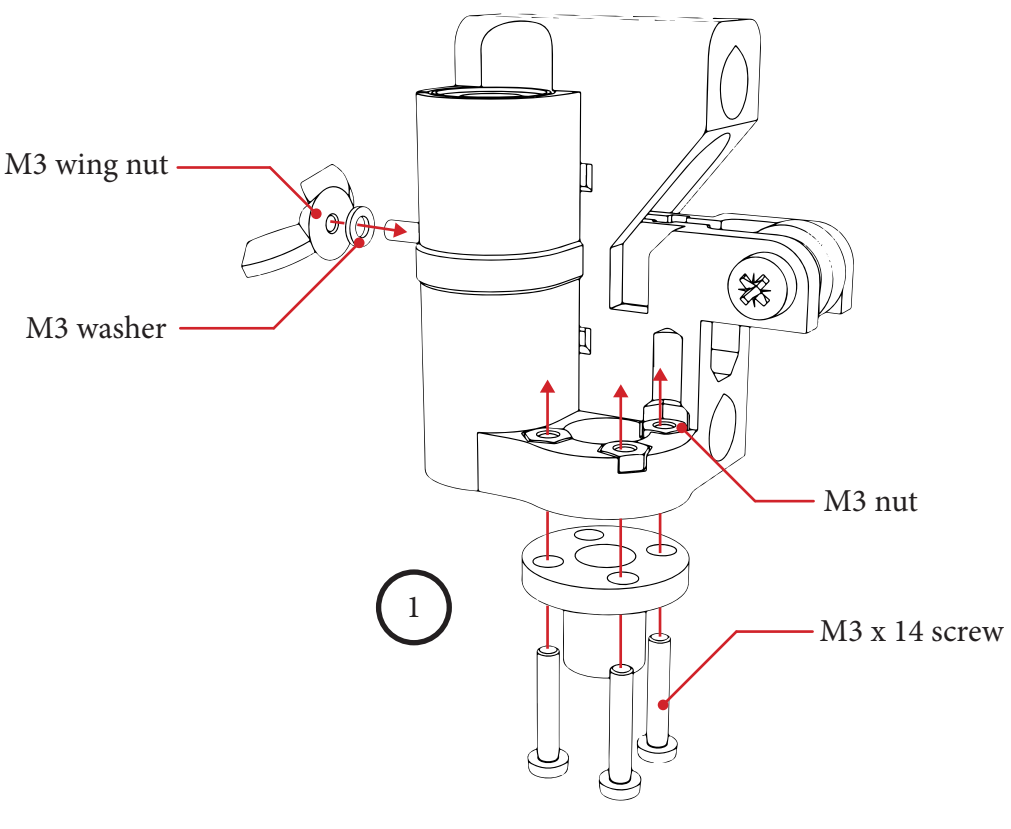


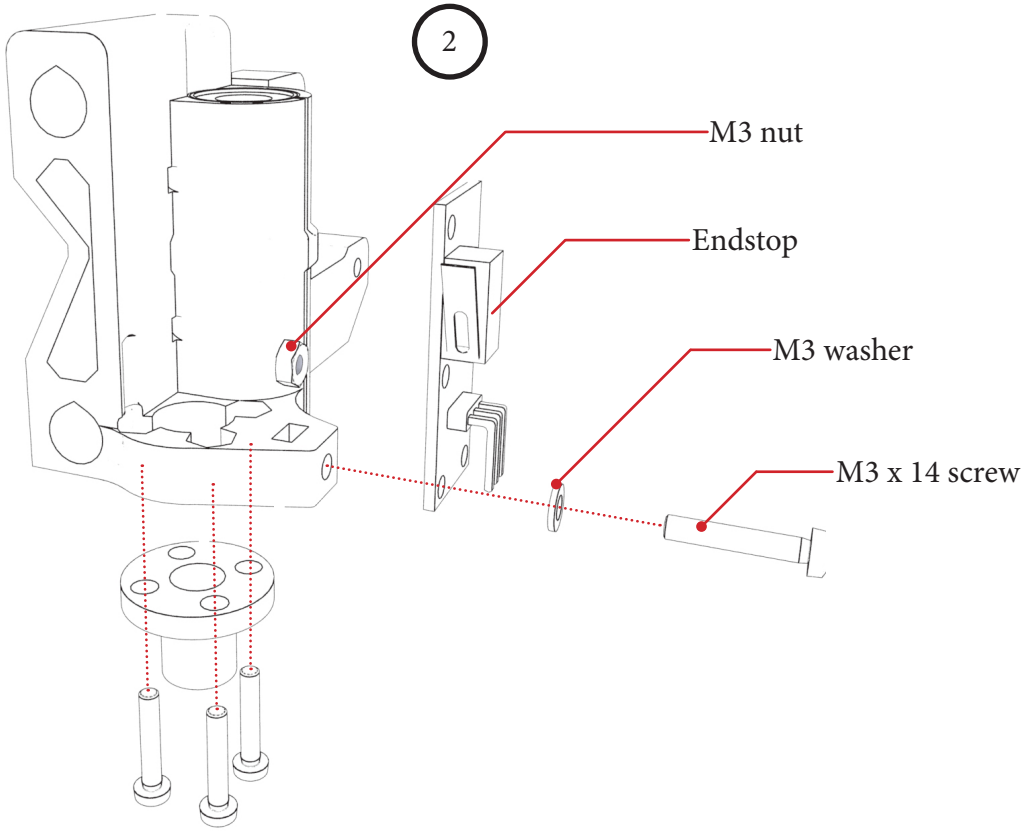
Mounting X Stretcher





Trapezoïdal nut drive mount



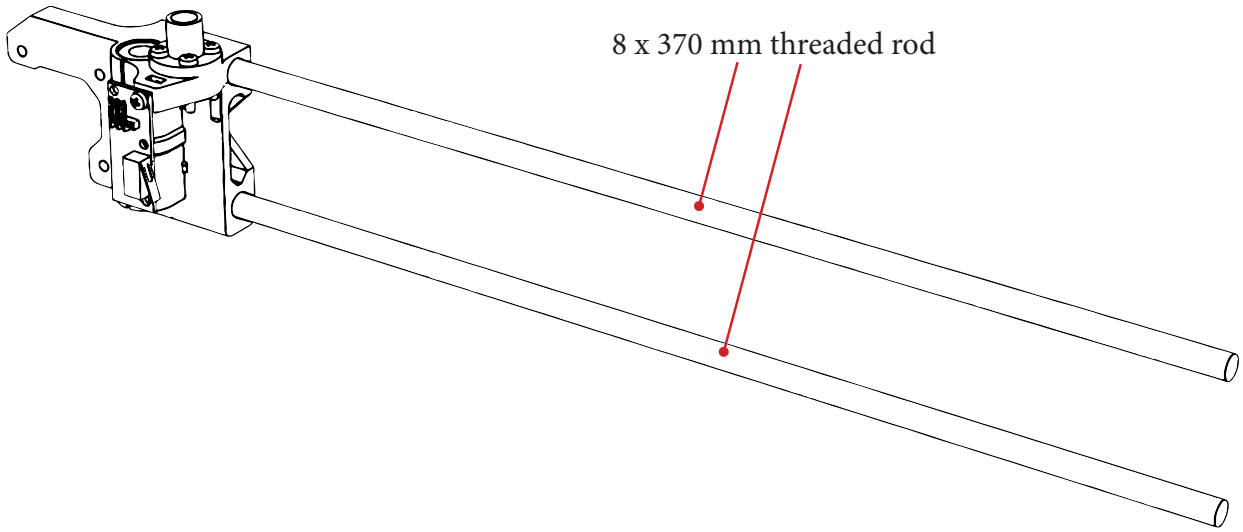


X-Axis assembly

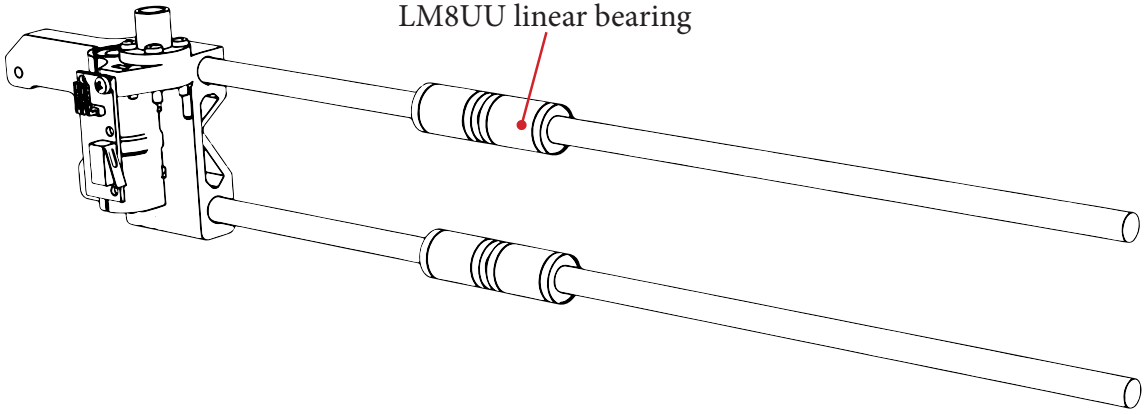
Needed parts :

- X mounted End Idler
- X mounted End Motor
- X Carriage
- 2x 8 x 370 mm smooth rod
- 4x LM8UU linear bearing
- 8x zip ties

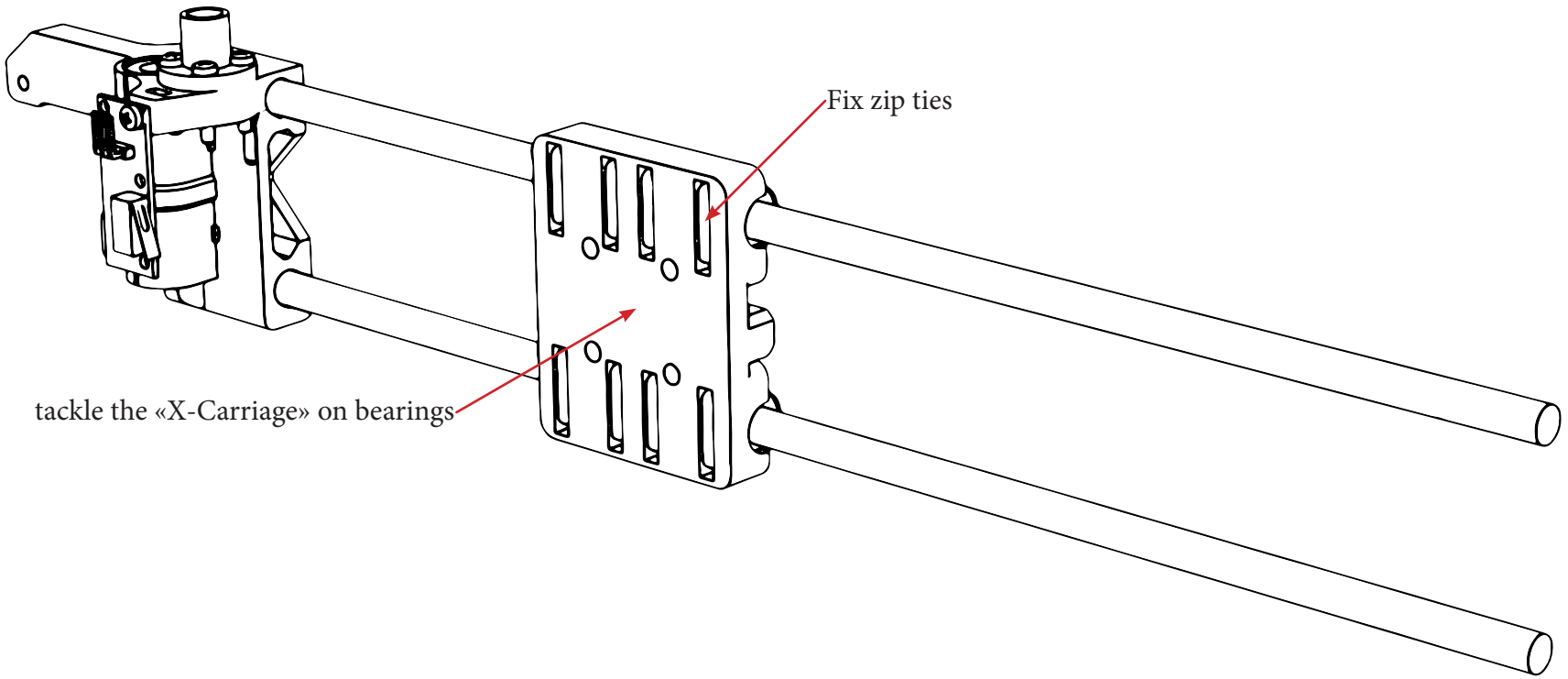
1

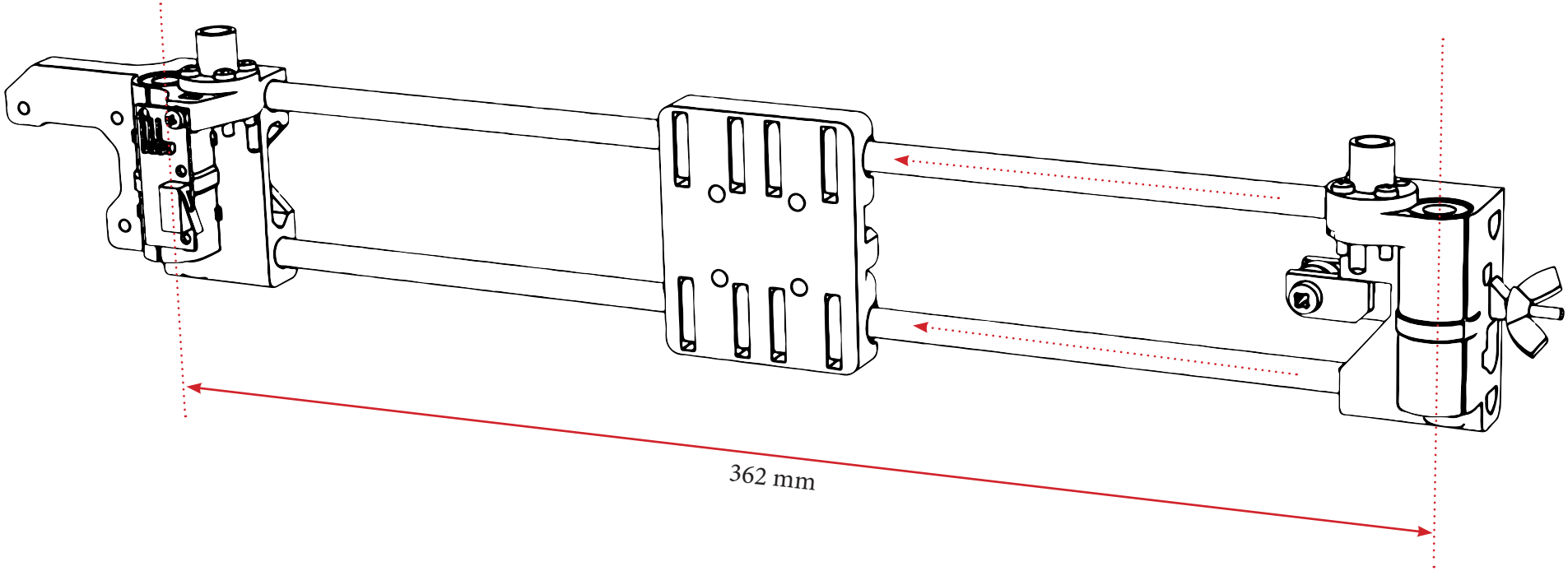


2



«X-Carriage» on X-Axis Mount

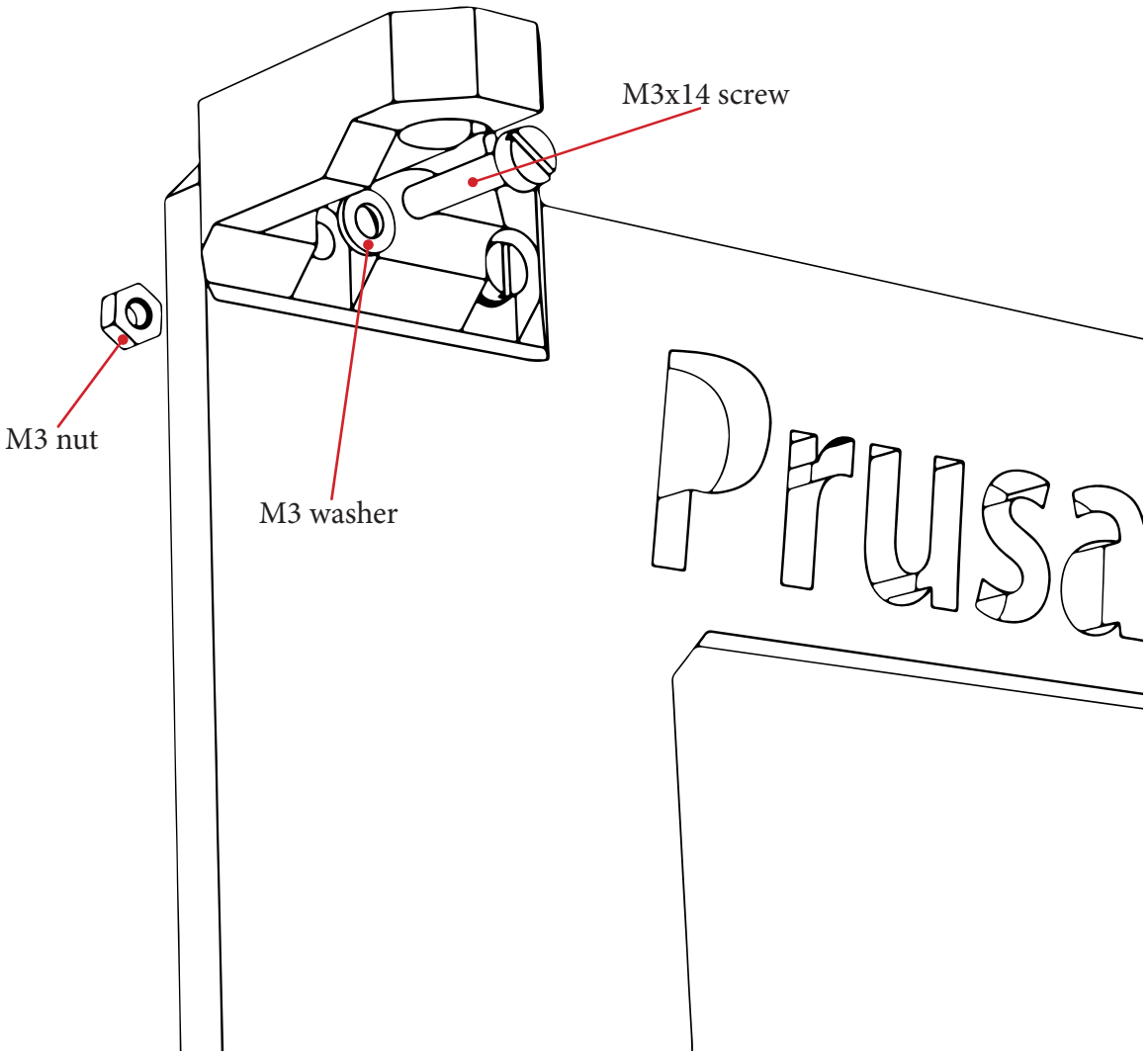


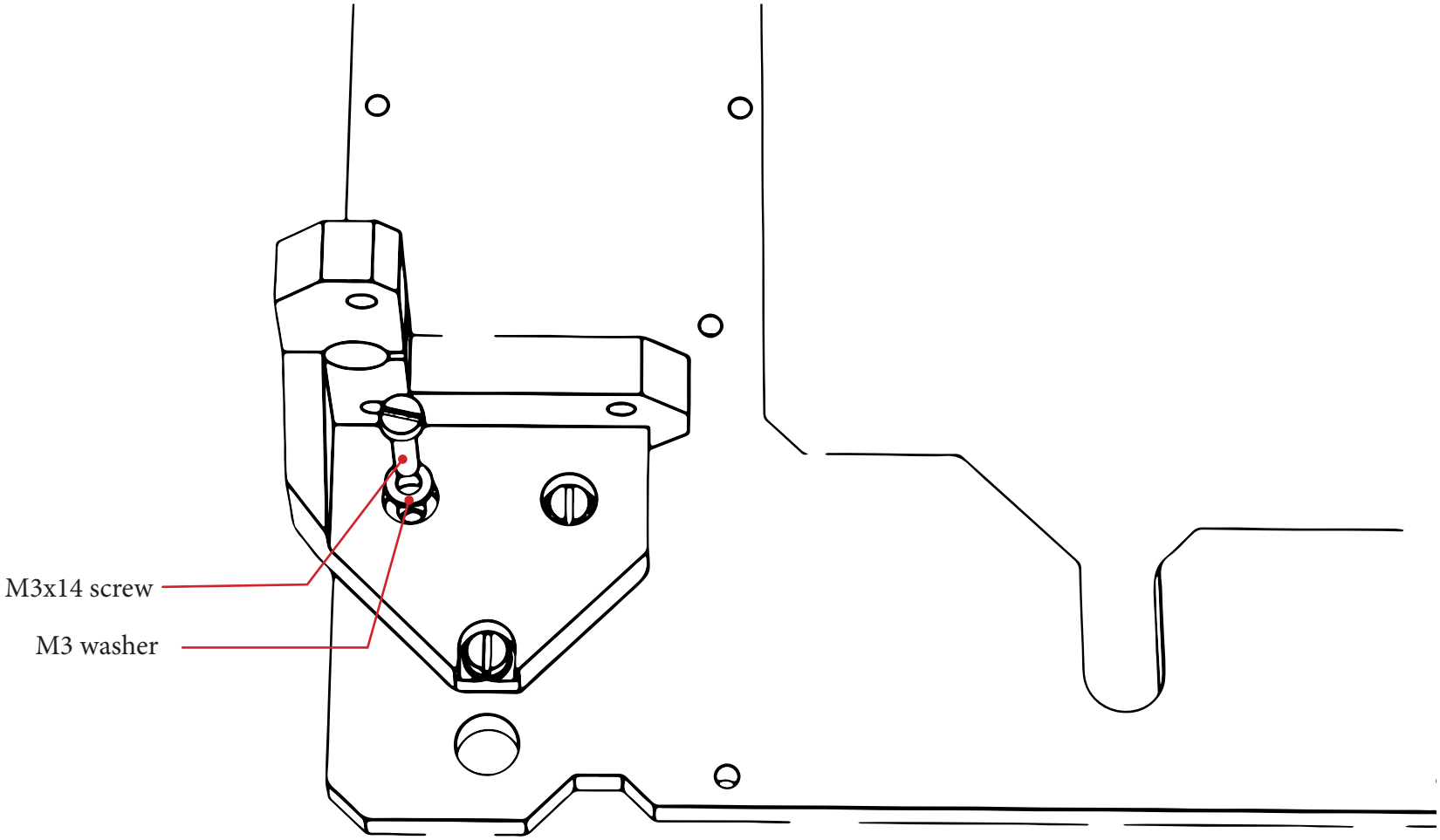

362 mm

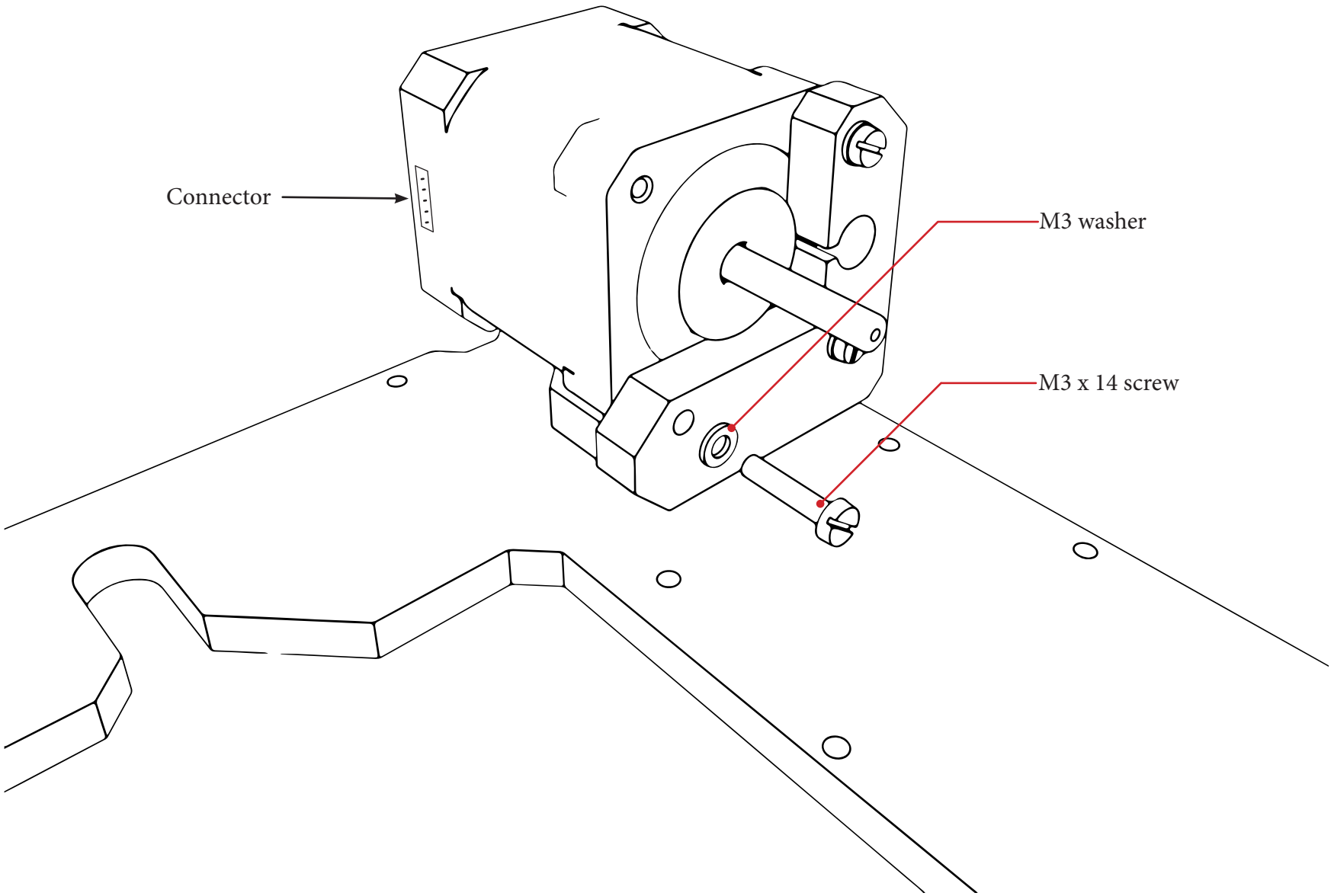
Z and X-Axis assembly

Needed parts :

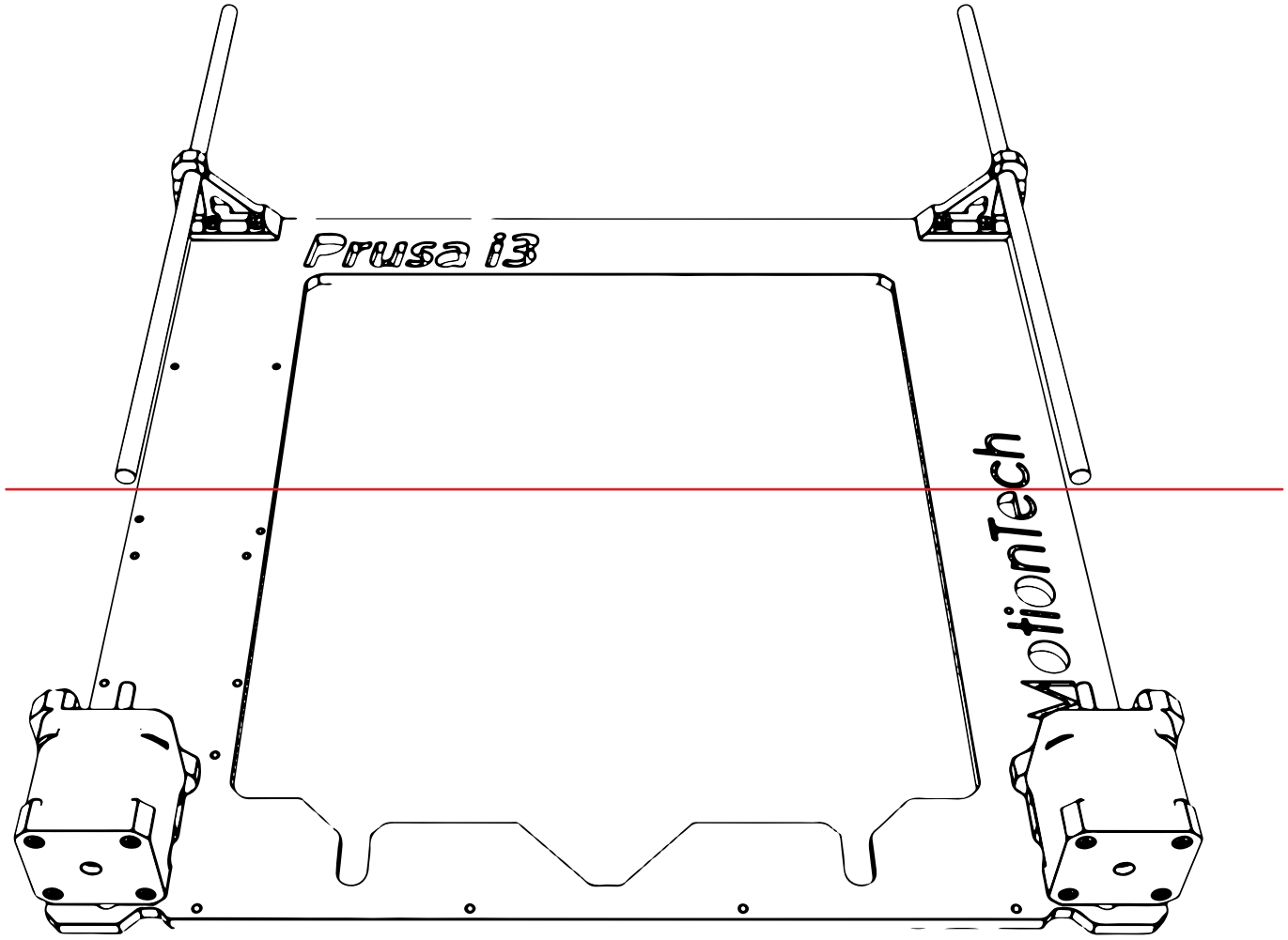
- main frame
- Mounted X-Axis
- Z Axis Top Left
- Z Axis Top Right
- Z Axis Bottom Left
- Z Axis Bottom Right
- 2x 8 x 320 mm smooth rod
- 2x 8 x 300 mm threaded rod
- 16x M3 x 14 mm screw
- 10x M3 nut
- 16x M3 washer
- 2x 5 x 8 coupling
- 2x NEMA 17 motor

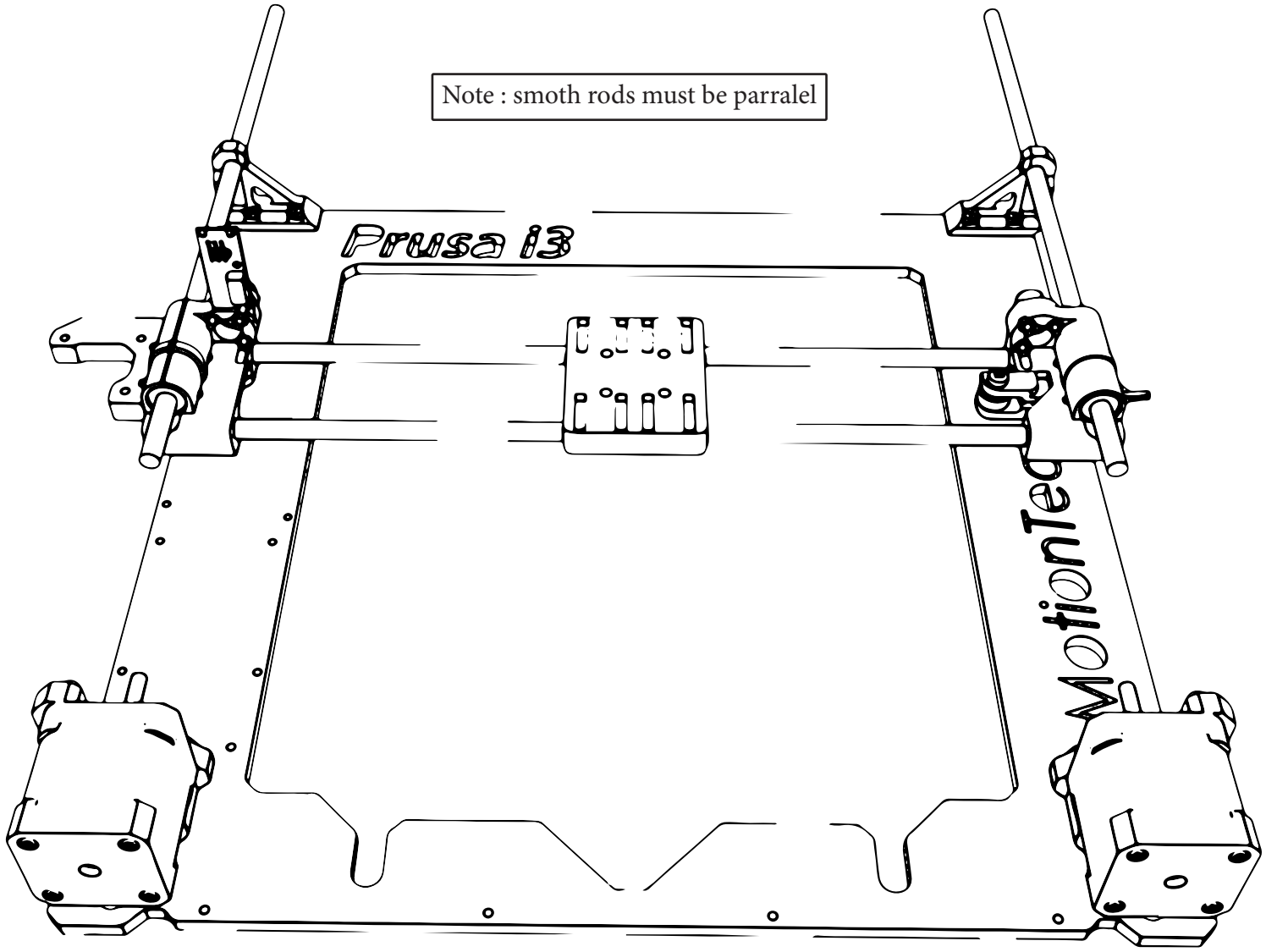


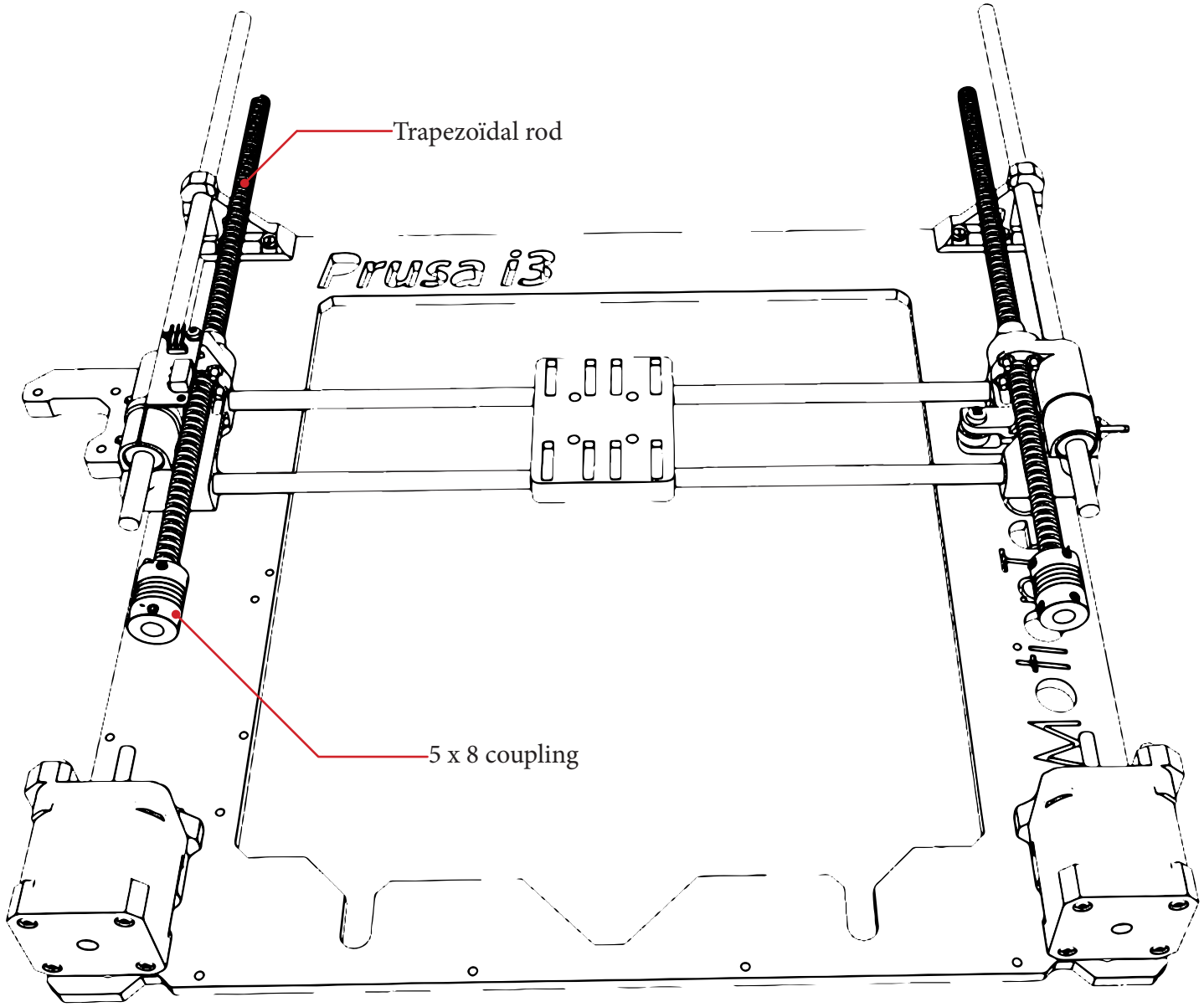

M3x14 screw
M3 washer


Connector
M3 washer
M3 x 14 screw

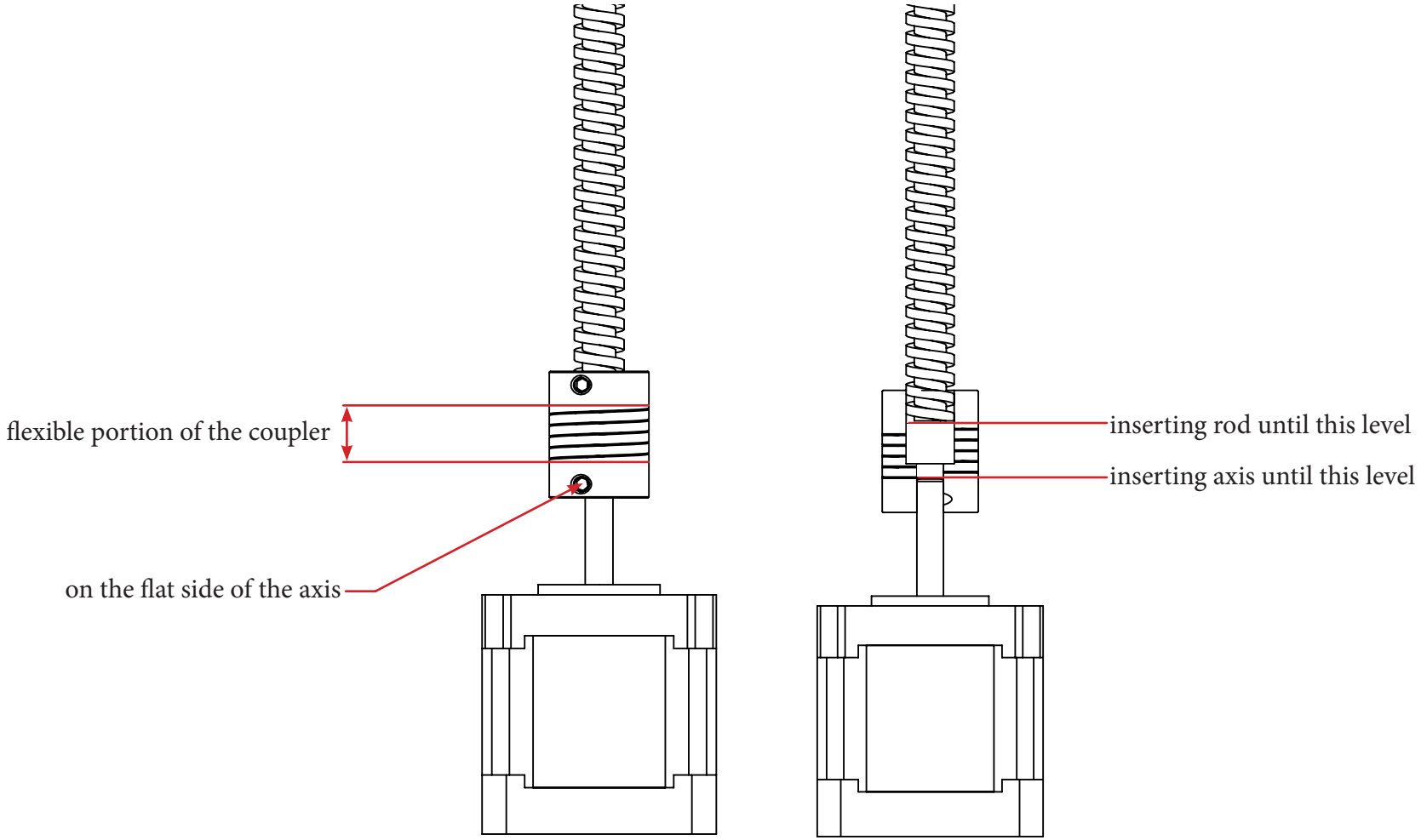
Slide the smooth rods through the «Z Axis Top» elements halfway of the main frame.




Note : smoth rods must be parralel
Prusa i3
MotionTech


Trapezoïdal rod
Prusa i3
5 x 8 coupling
Motion

Rod / axis coupling

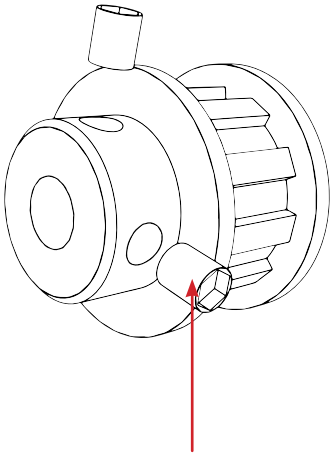


Motors assembly

Needed parts :

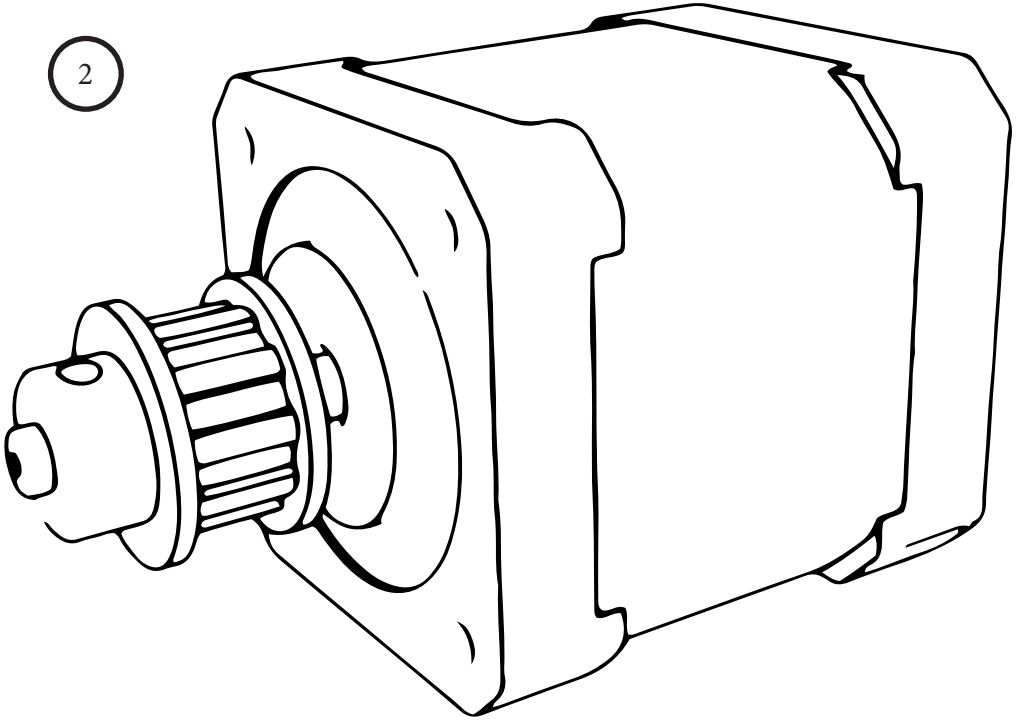
- 2x NEMA 17 motor
- 2x GT2 pulley
- 8x M3 x 14 mm screw
- 4x M3 pression screw
- 8x M3 washer
- 2x M3 nut

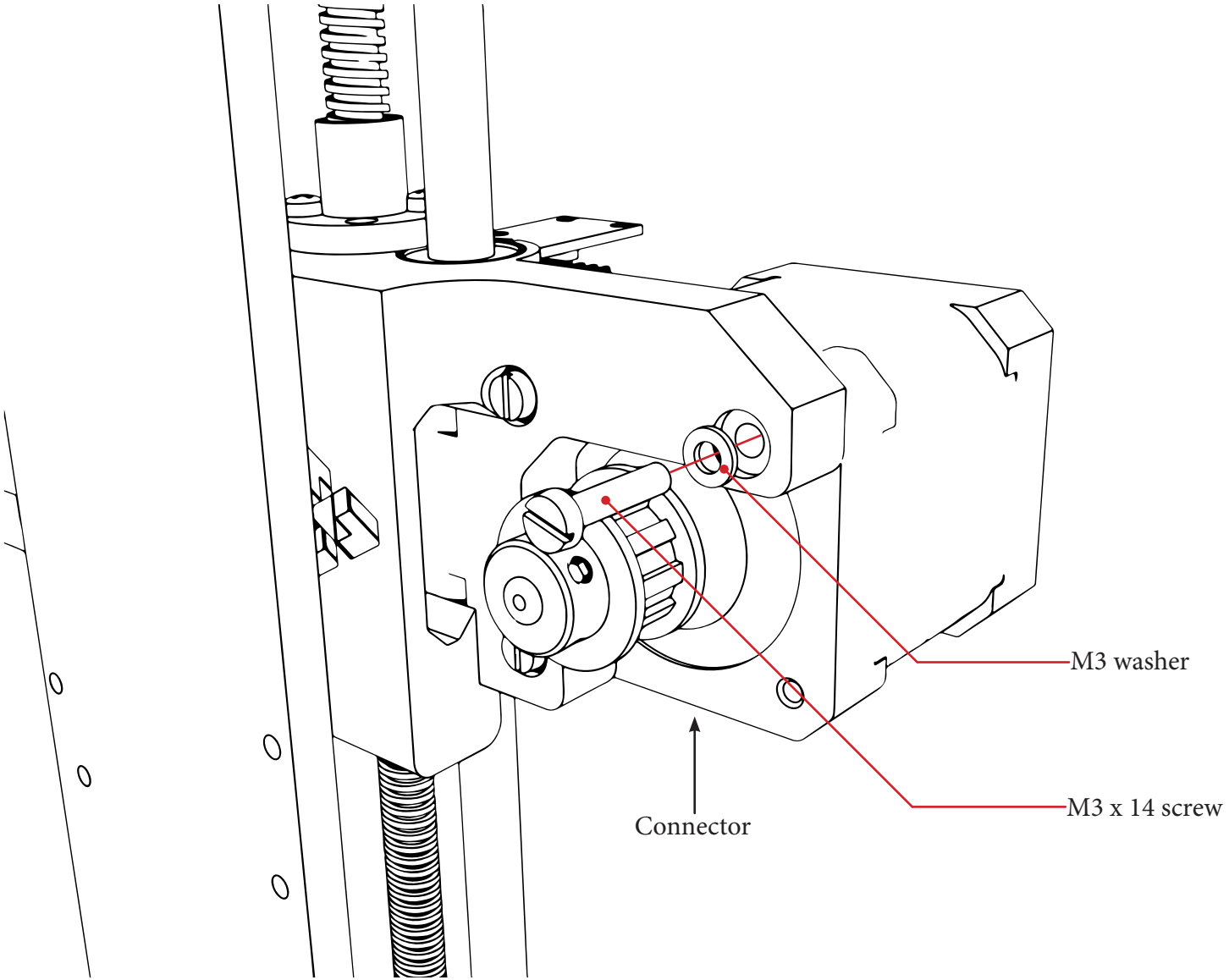
1

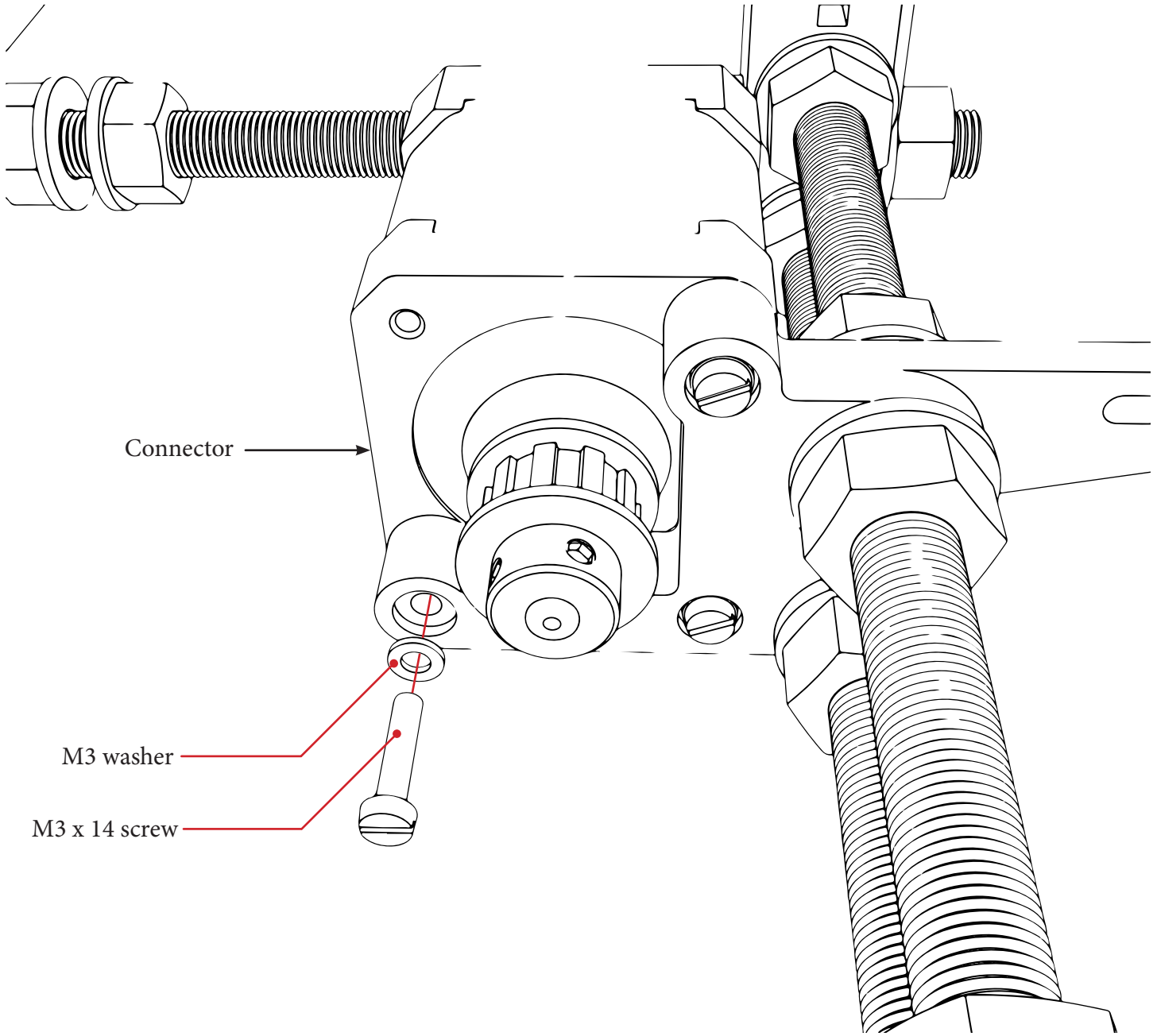


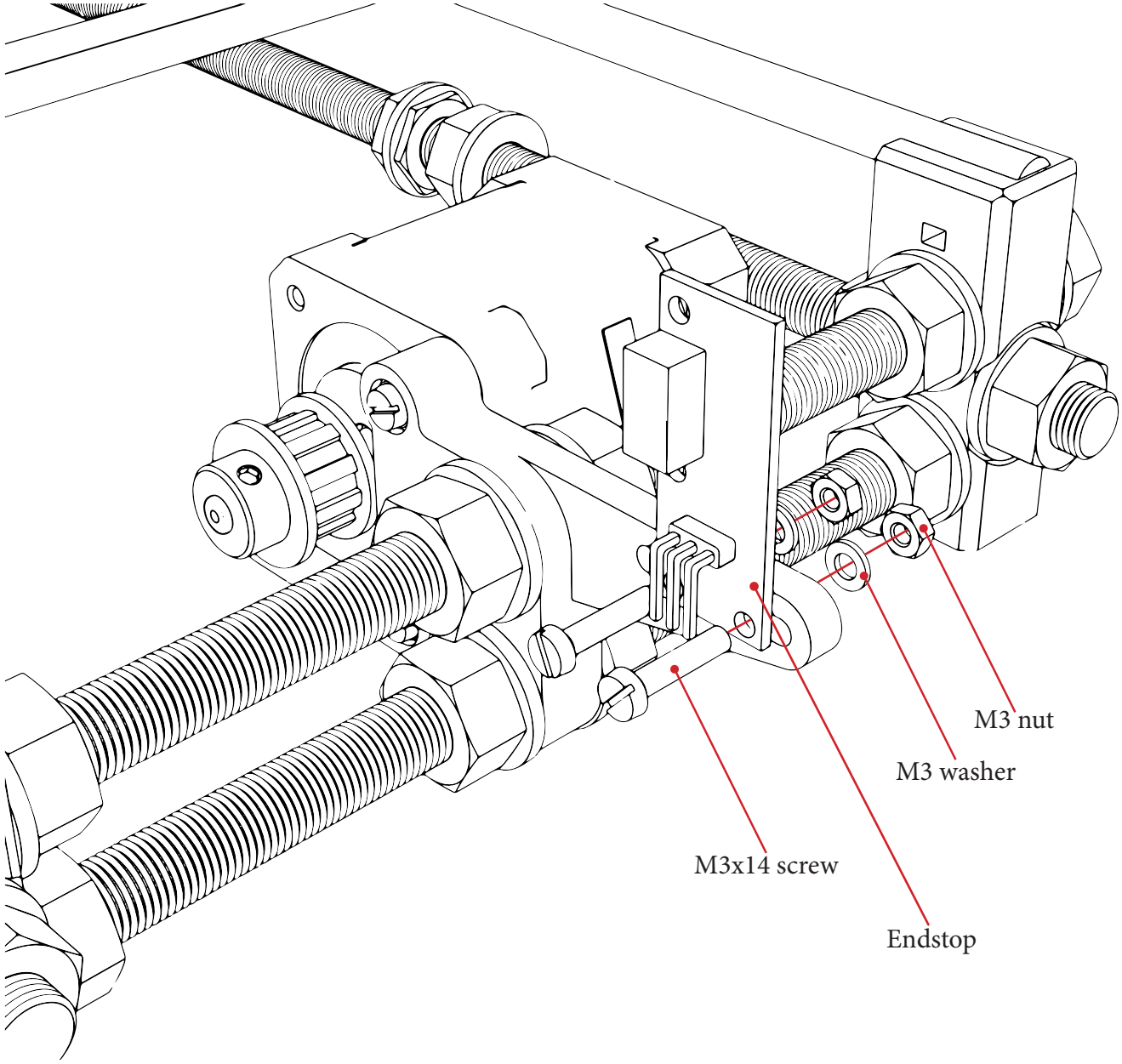
on the flat side of the axis

2




M3 washer
Connector
M3 x 14 screw

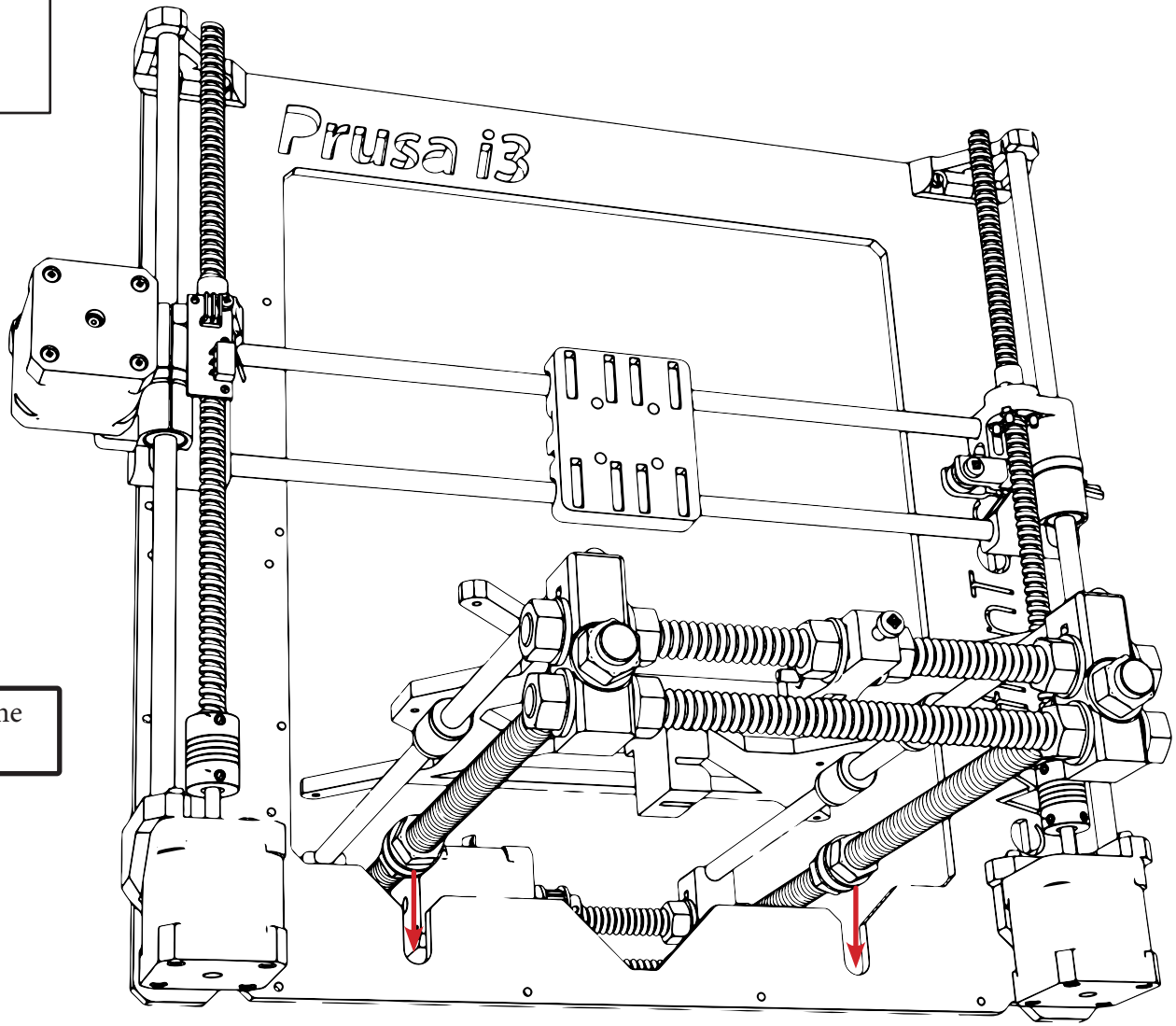

Connector
M3 washer
M3 x 14 screw


M3 nut
M3 washer
M3x14 screw
Endstop

Frame assembly

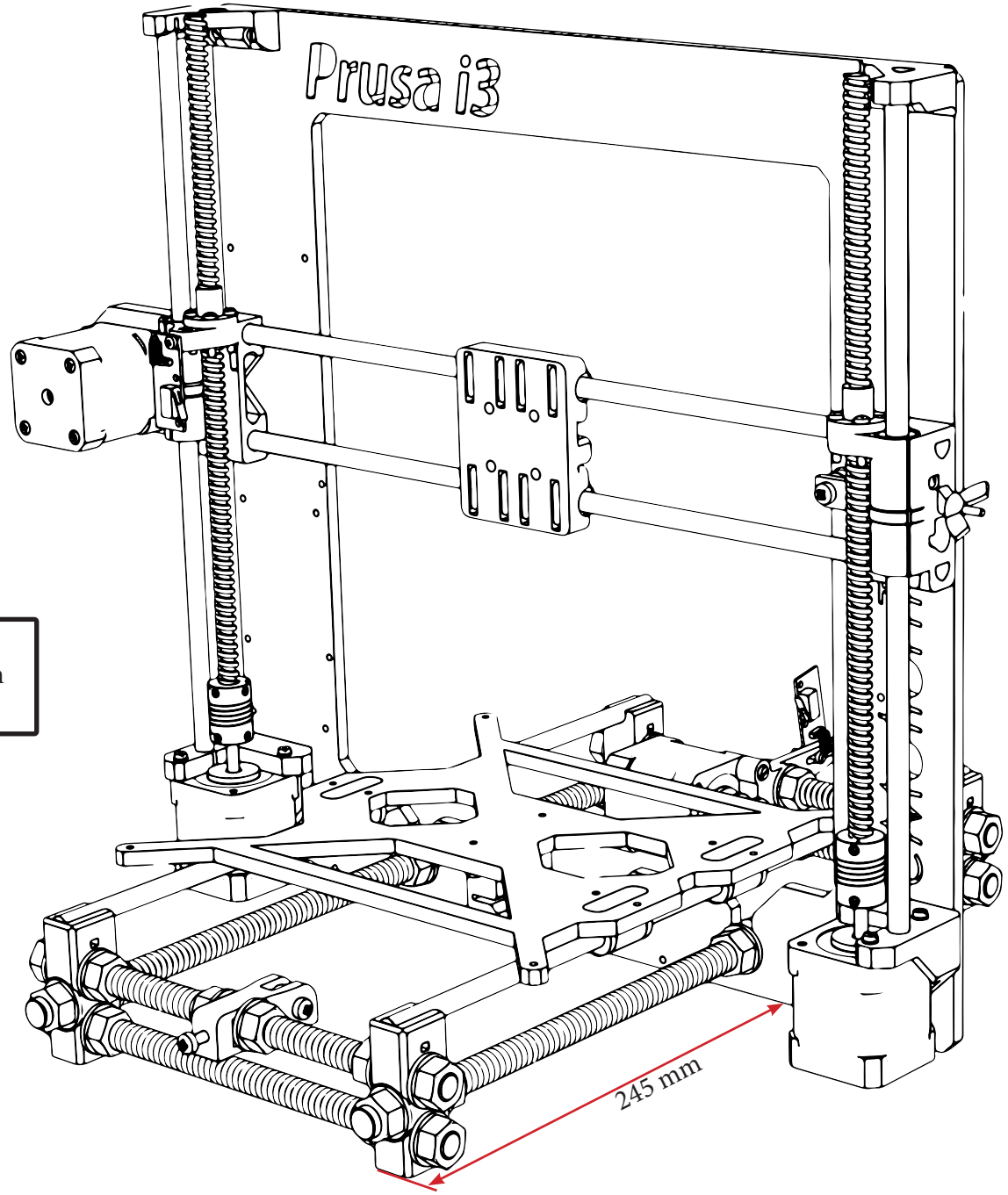
Needed parts :

- mounted Y frame
- mounted main frame



Fix loosely the Y frame on to the main frame

Adjut and tighten the Y frame on to the main frame.

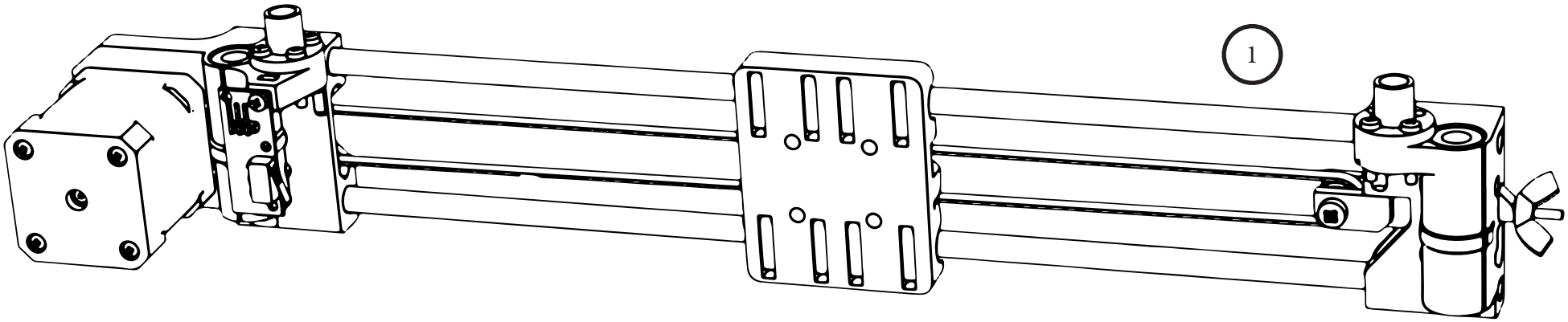


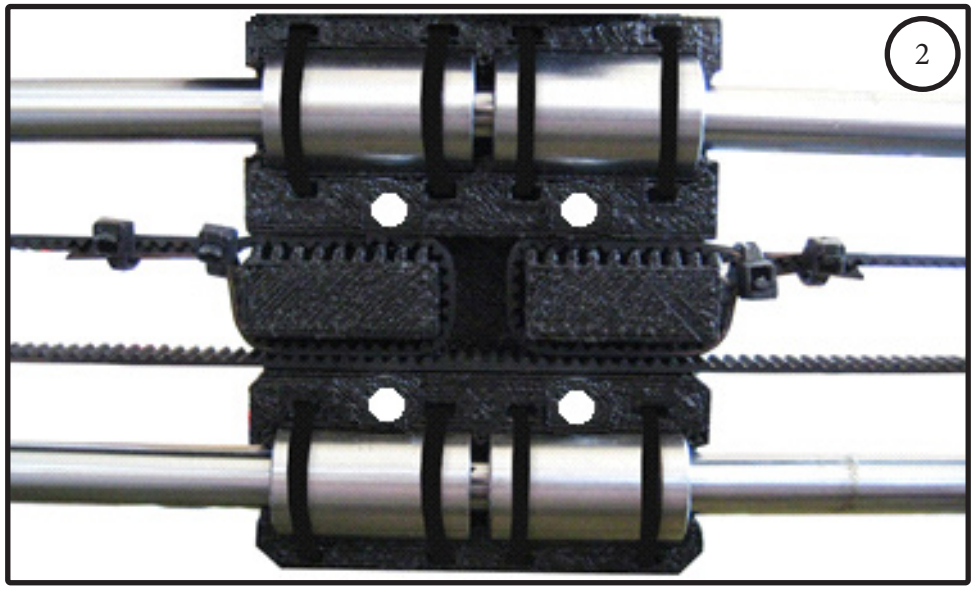
Belts assembly

X-Axis belt

Needed parts :

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



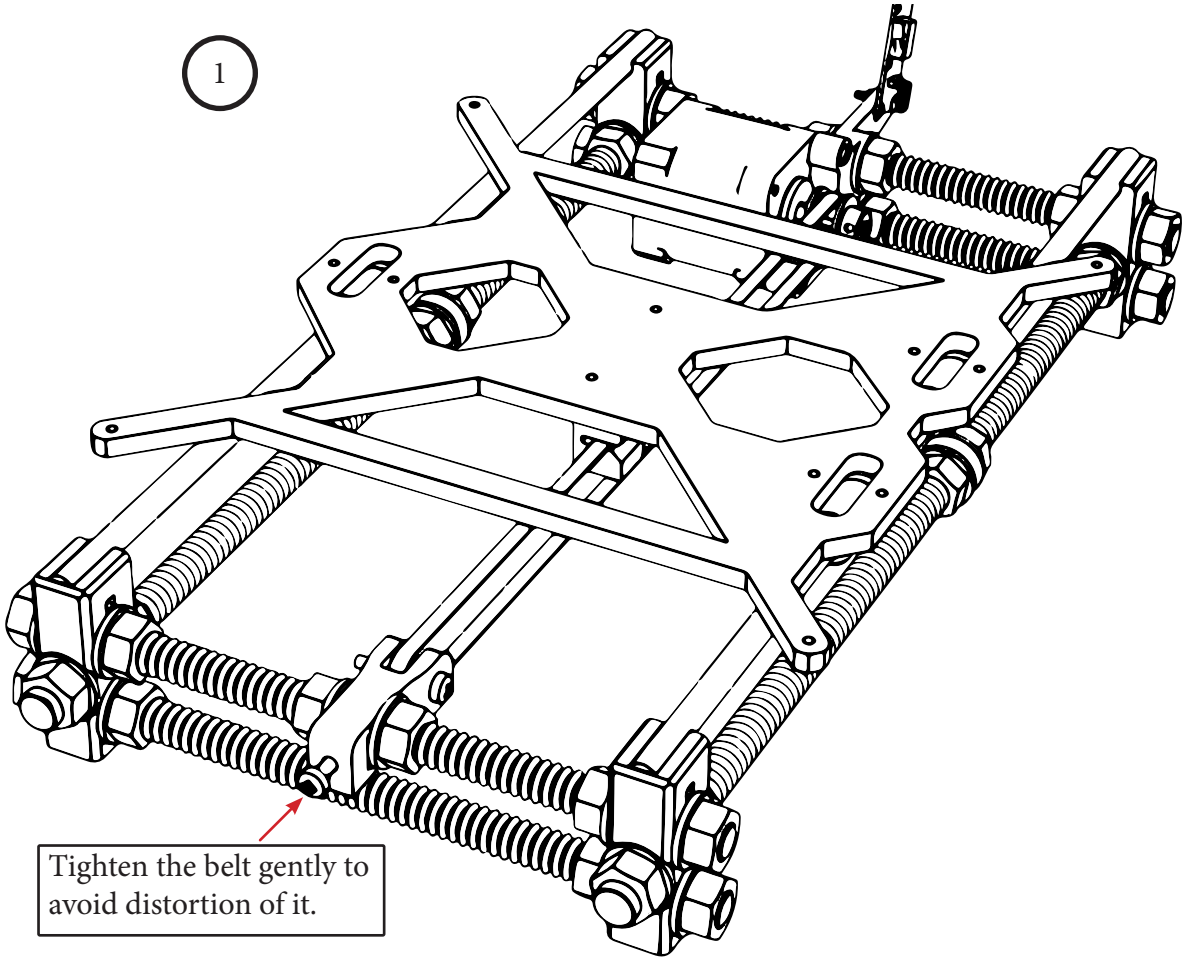


Y-Axis belt

Needed parts :

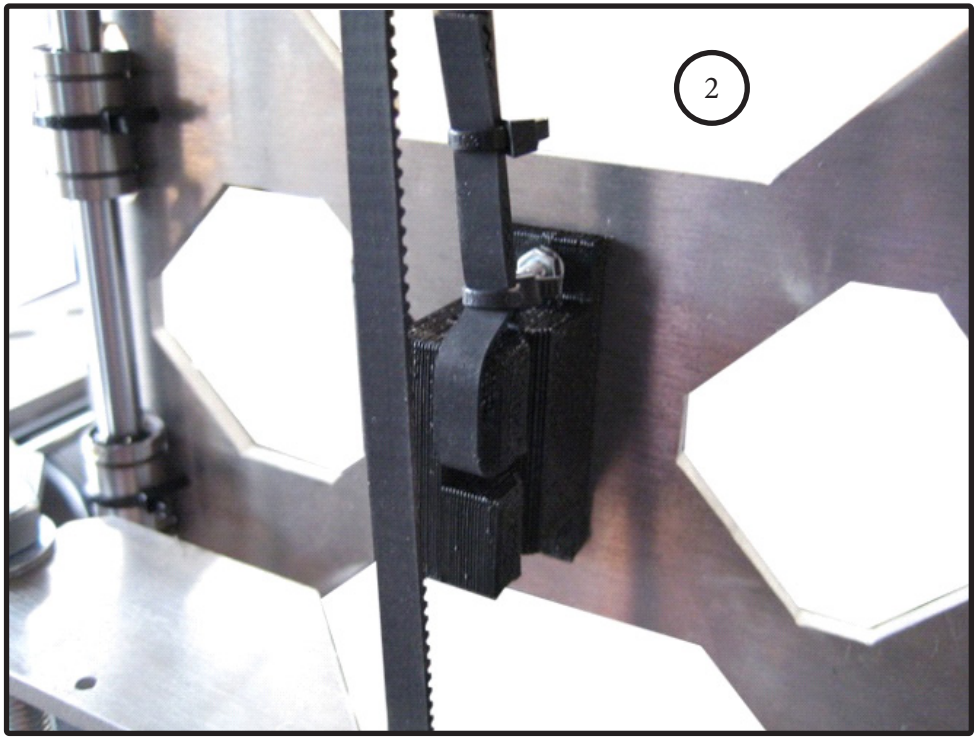
- 1x 760 mm GT2 belt
- 4x zip ties

1



Tighten the belt gently to avoid distortion of it.

2

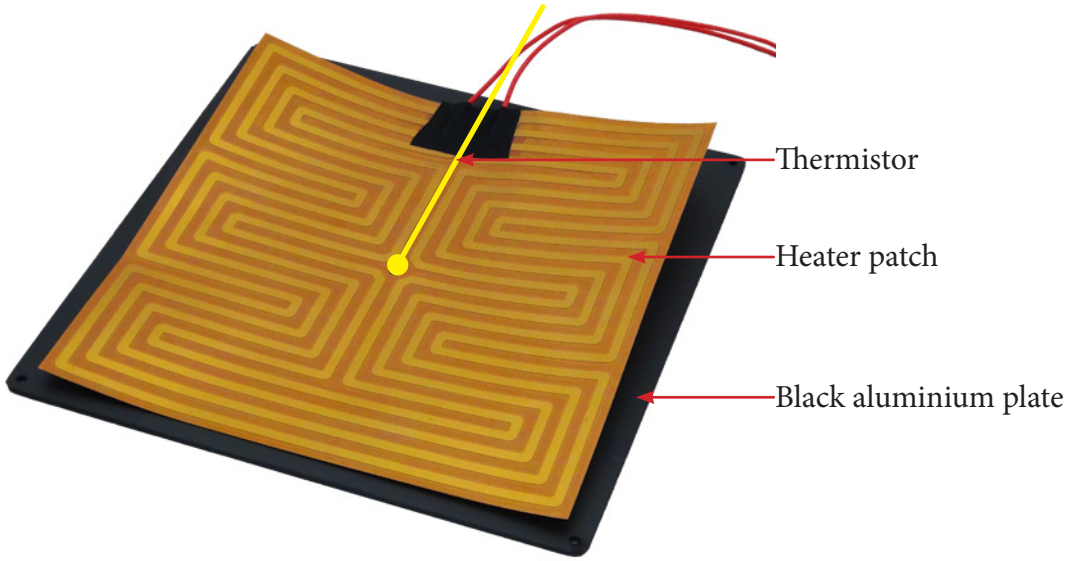


Heated bed assembly

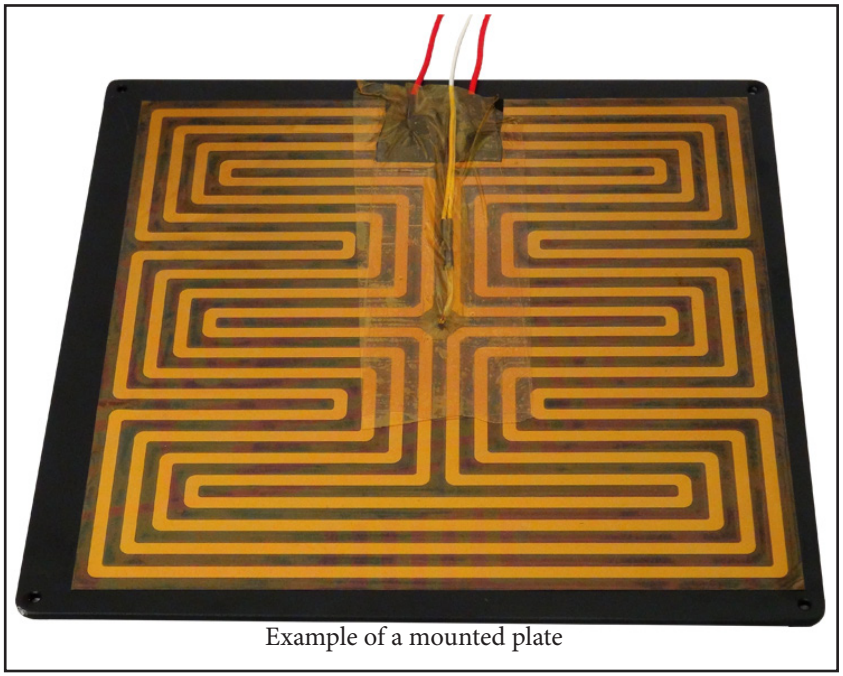
Needed parts :

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

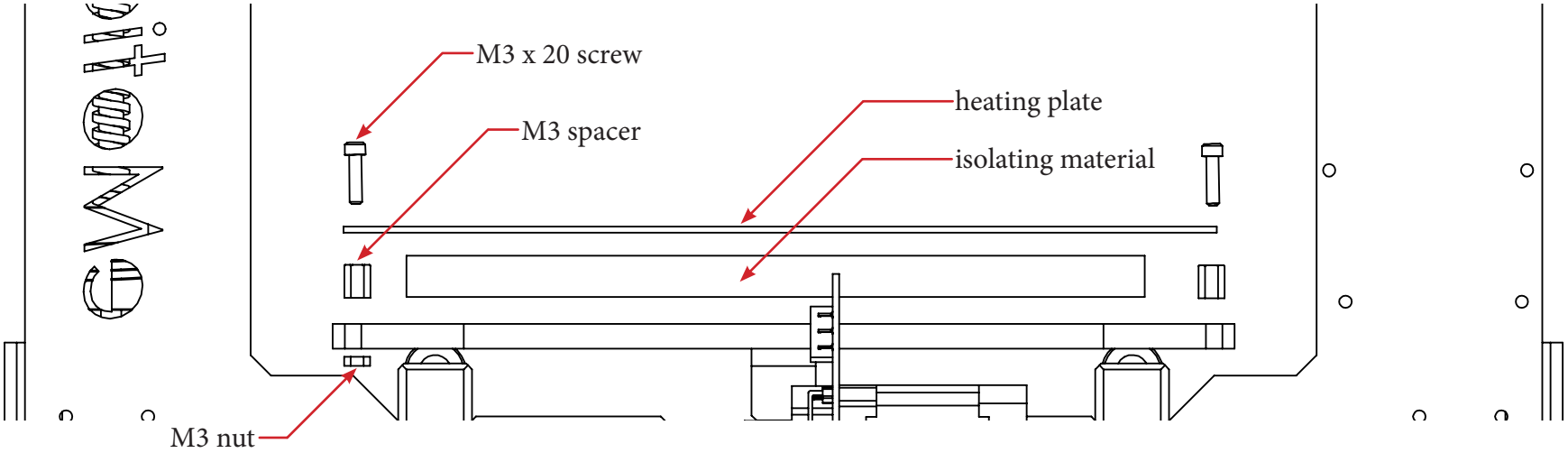


Example of a mounted plate

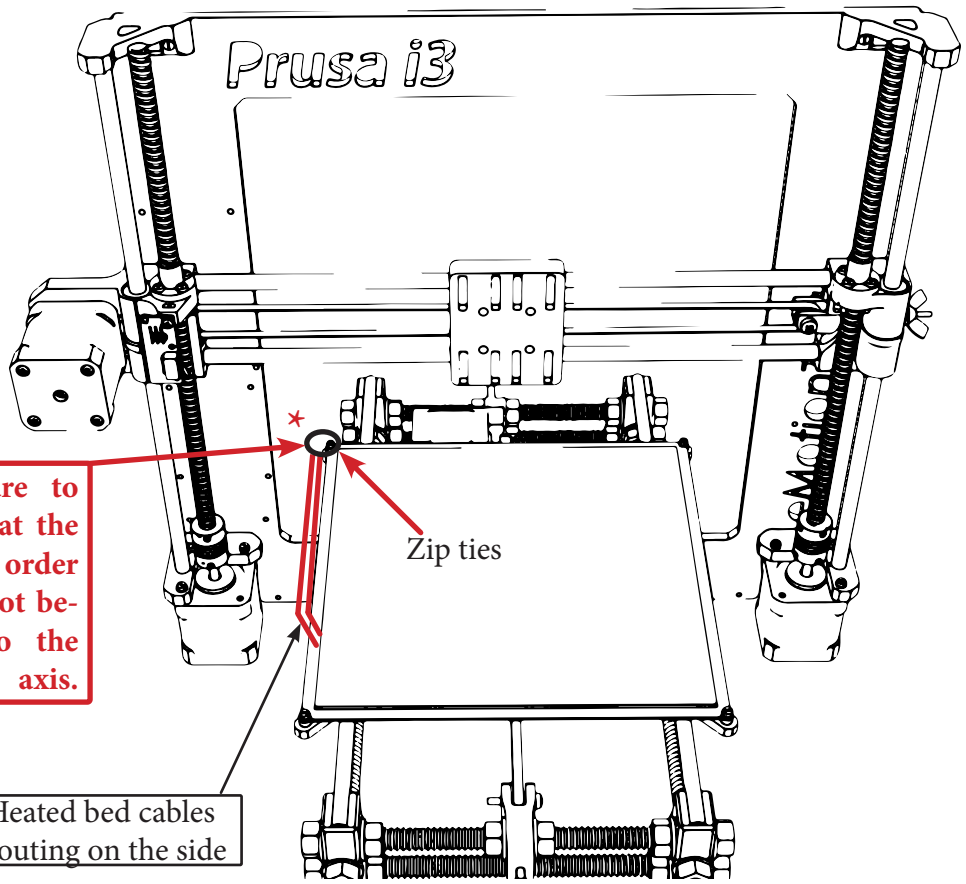
2

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

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



3



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.

*

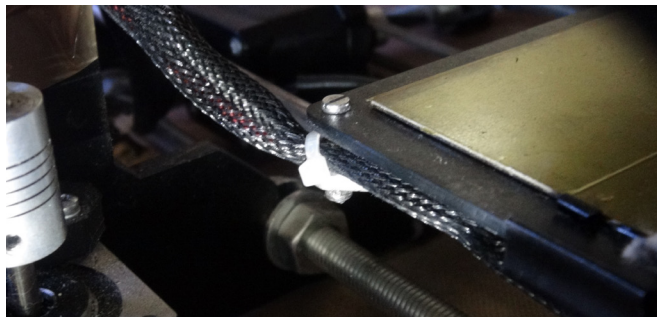


Illustration of the cable's fixing

Note : fix cables without blocking Y-Axis motion

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

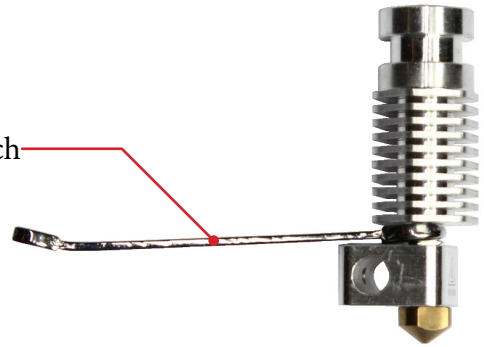
Hexagon assembly

Needed parts :

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

Assembling and dismantling operations must be carried out hot !

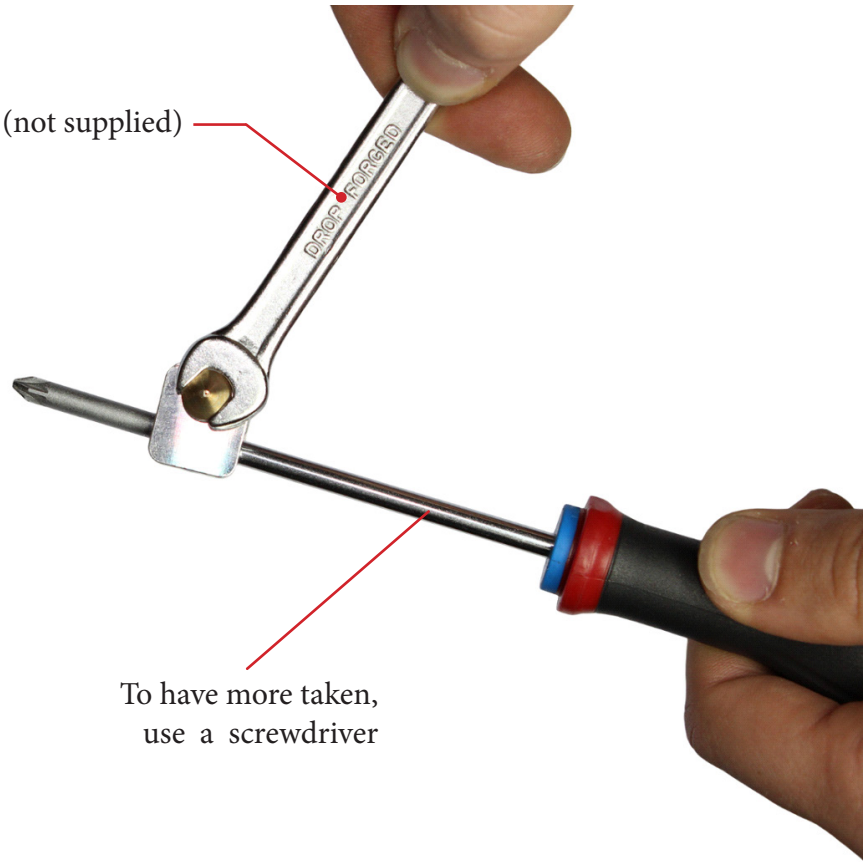
1 Loosen the central tube



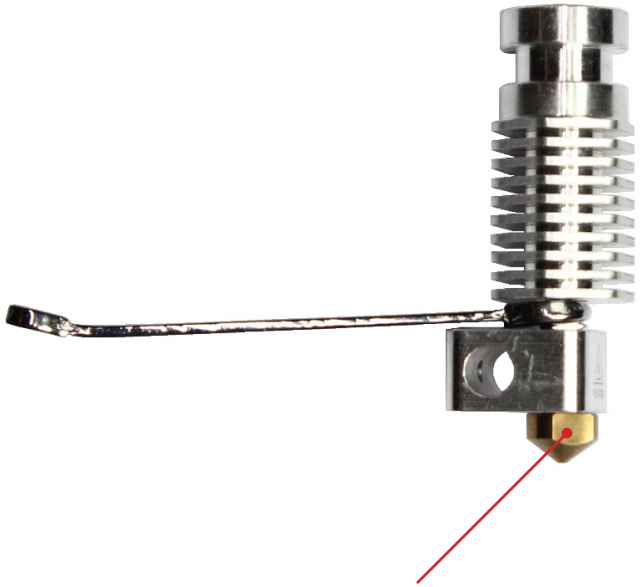
2

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

1 Tighten the nozzle



2 Tighten the central tube



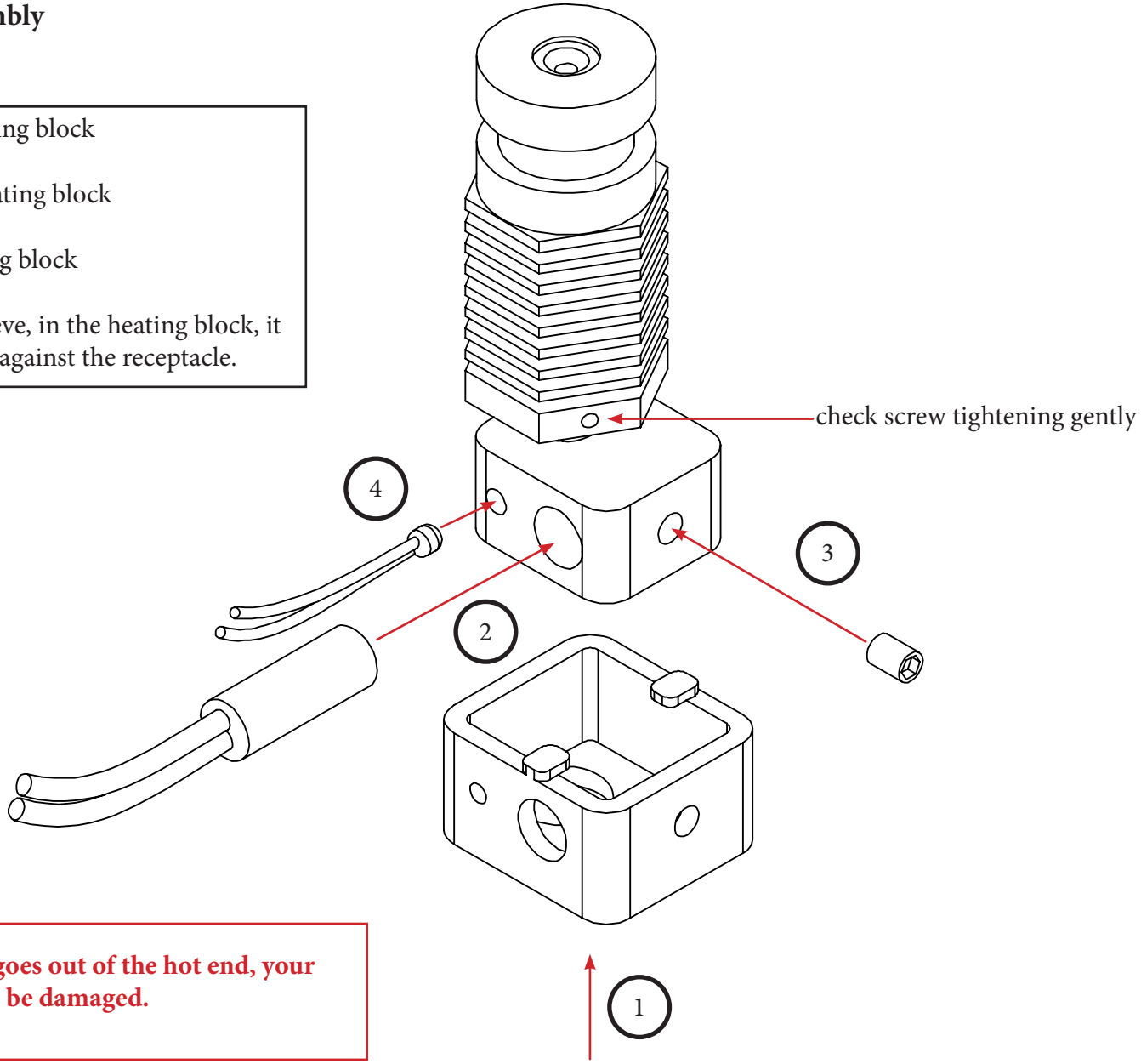
Print head : direction of assembly

1°) silicon sleeve on to the heating block

2°) heater cartridge into the heating block

3°) headless screw in the heating block

4°) thermistor throught the sleeve, in the heating block, it must be pressed into abutment against the receptacle.



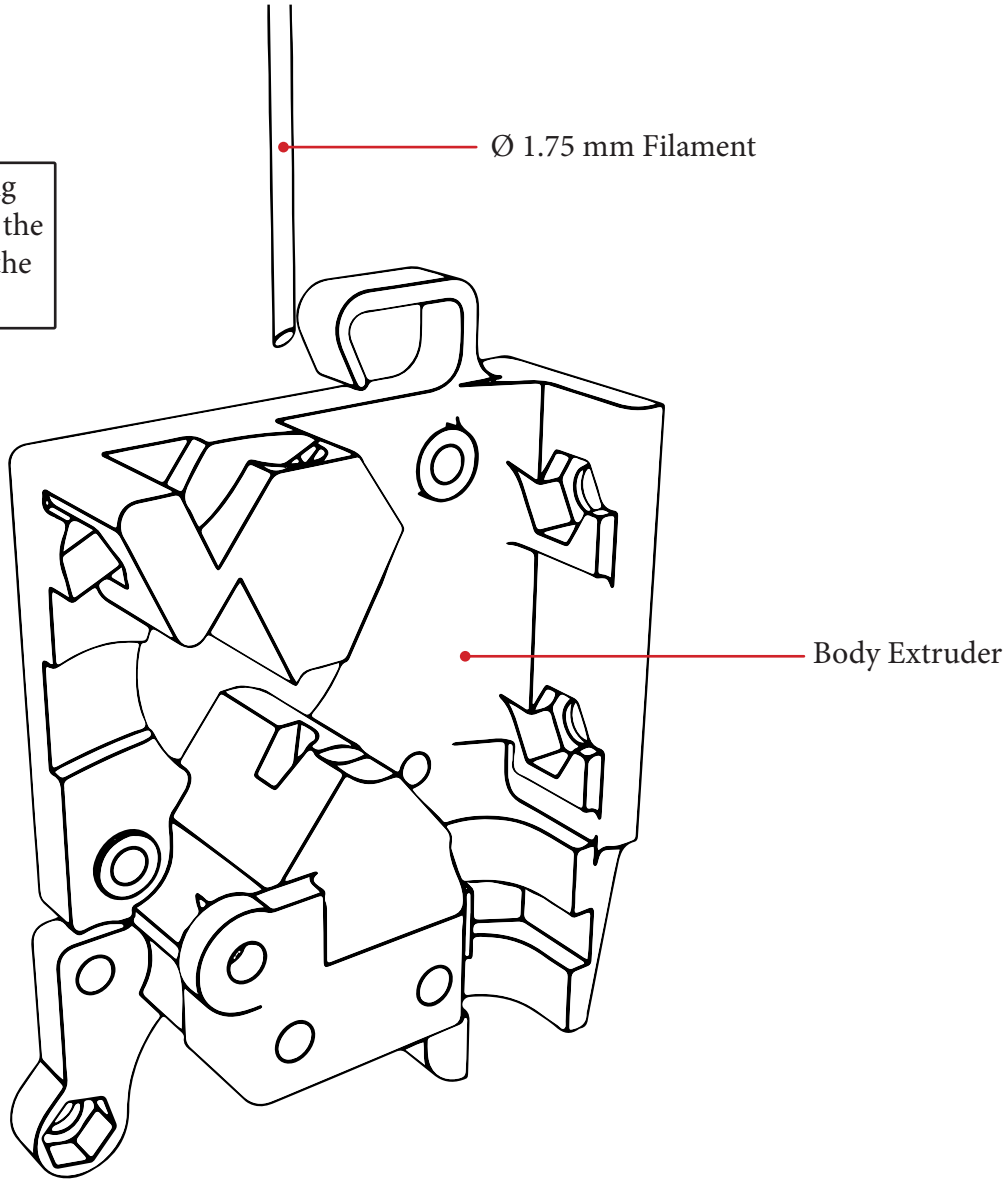
Caution ! If the thermistor goes out of the hot end, your printer could be damaged.

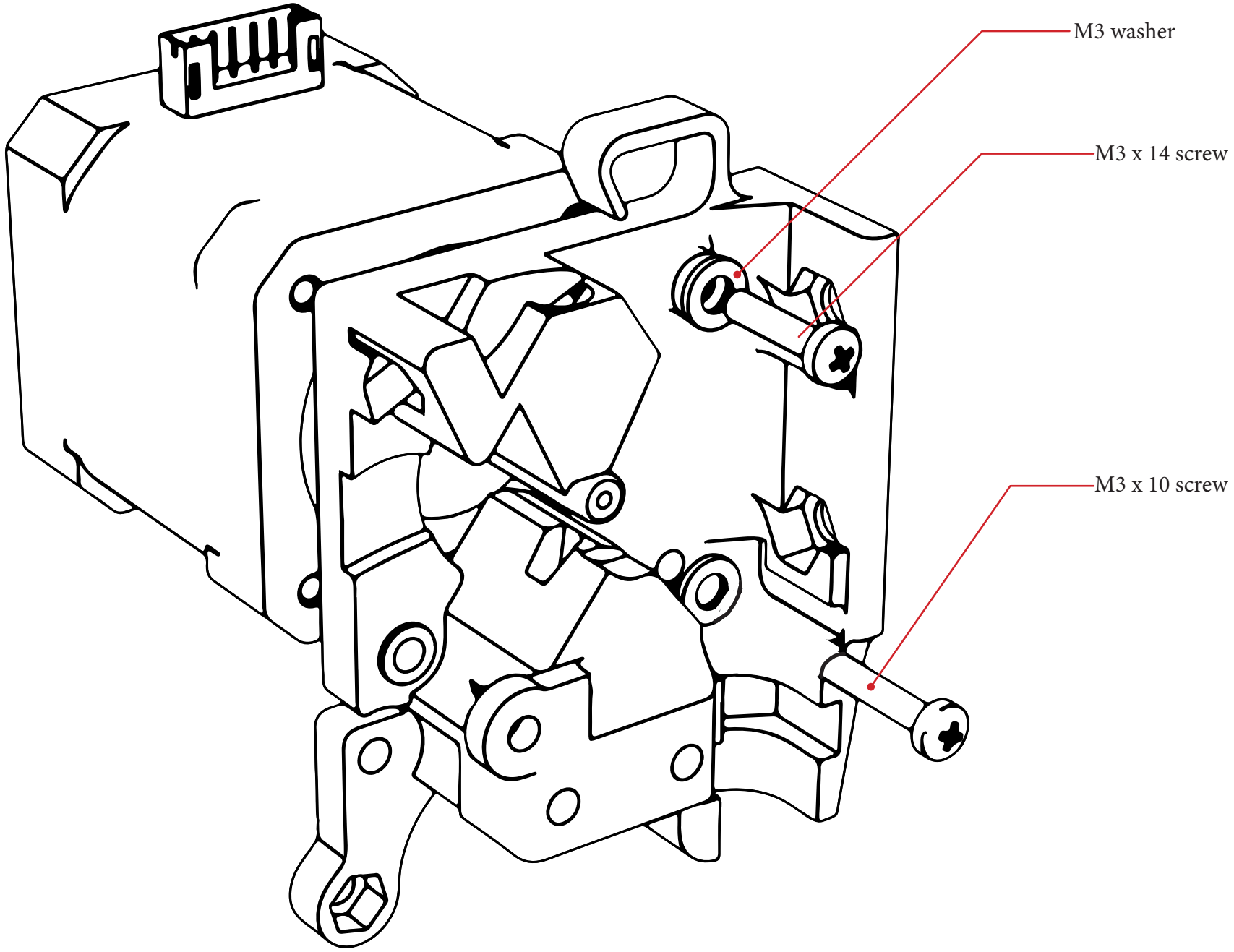
Extruder assembly

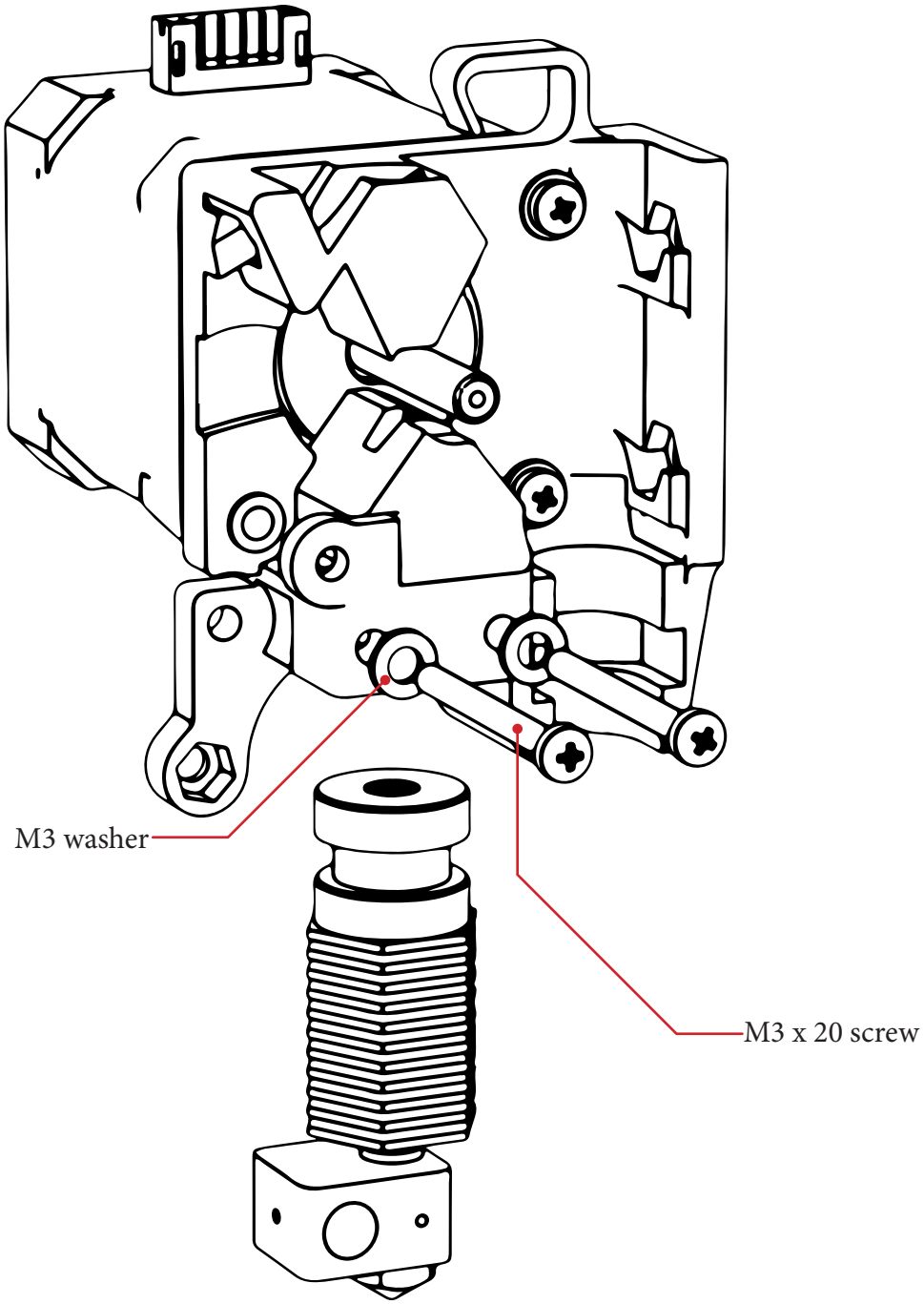
Needed parts :

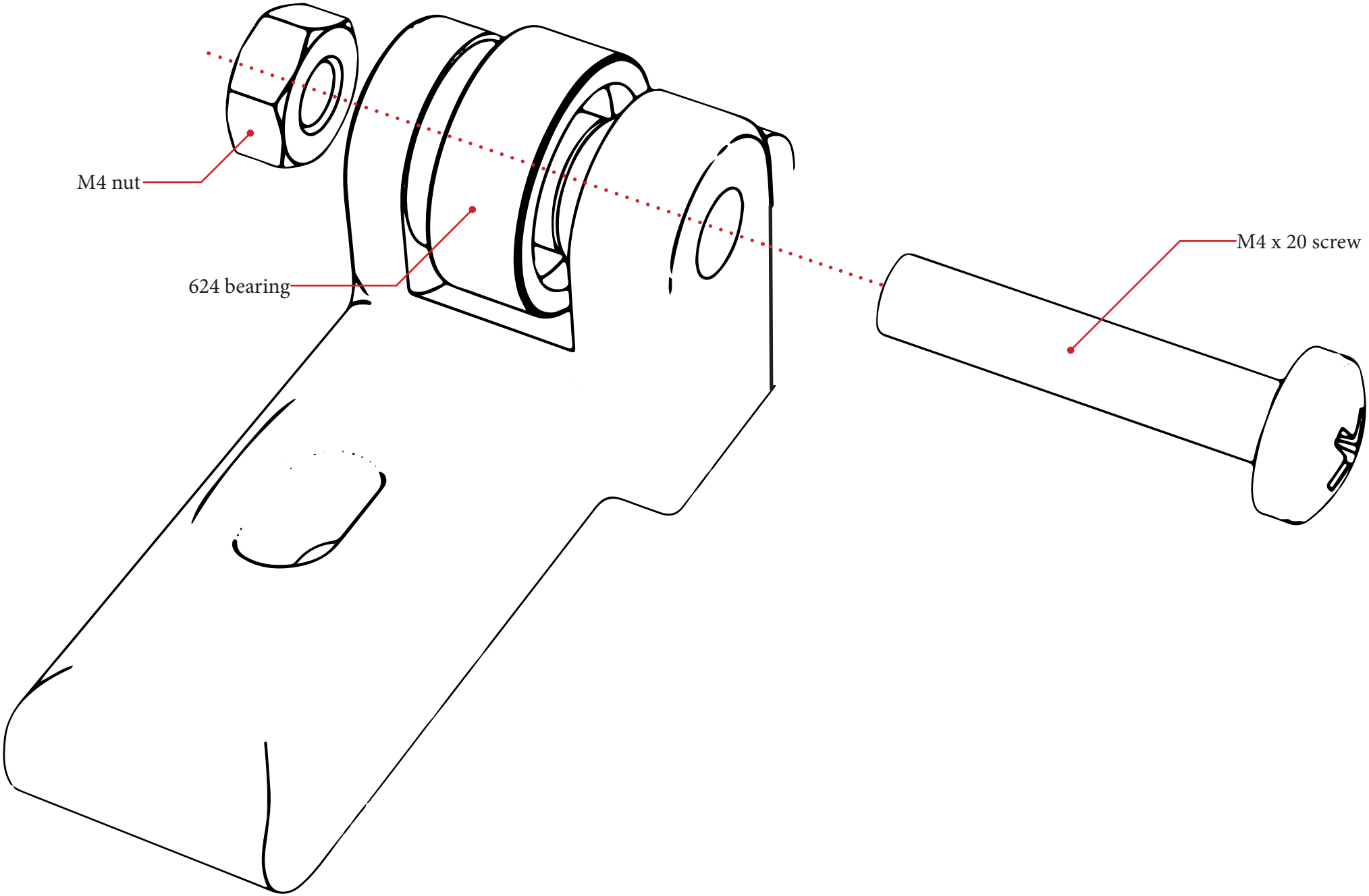
- body extruder
- extruder idler
- fan duct
- 1x Hexagon hotend
- 1x drive wheel
- 2x 3x3cm fan
- 1x spring
- 1x 624 bearing
- 1x inductive sensor
- 3x M4 x 20 mm screw
- 1x M3 x 50 mm screw (or 60)
- 4x M3 x 14 mm screw
- 1x M3 x 10 mm screw
- 3x M3 x 20 mm screw
- 4x M3 nut
- 3x M4 nut
- 10x Ø3 mm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

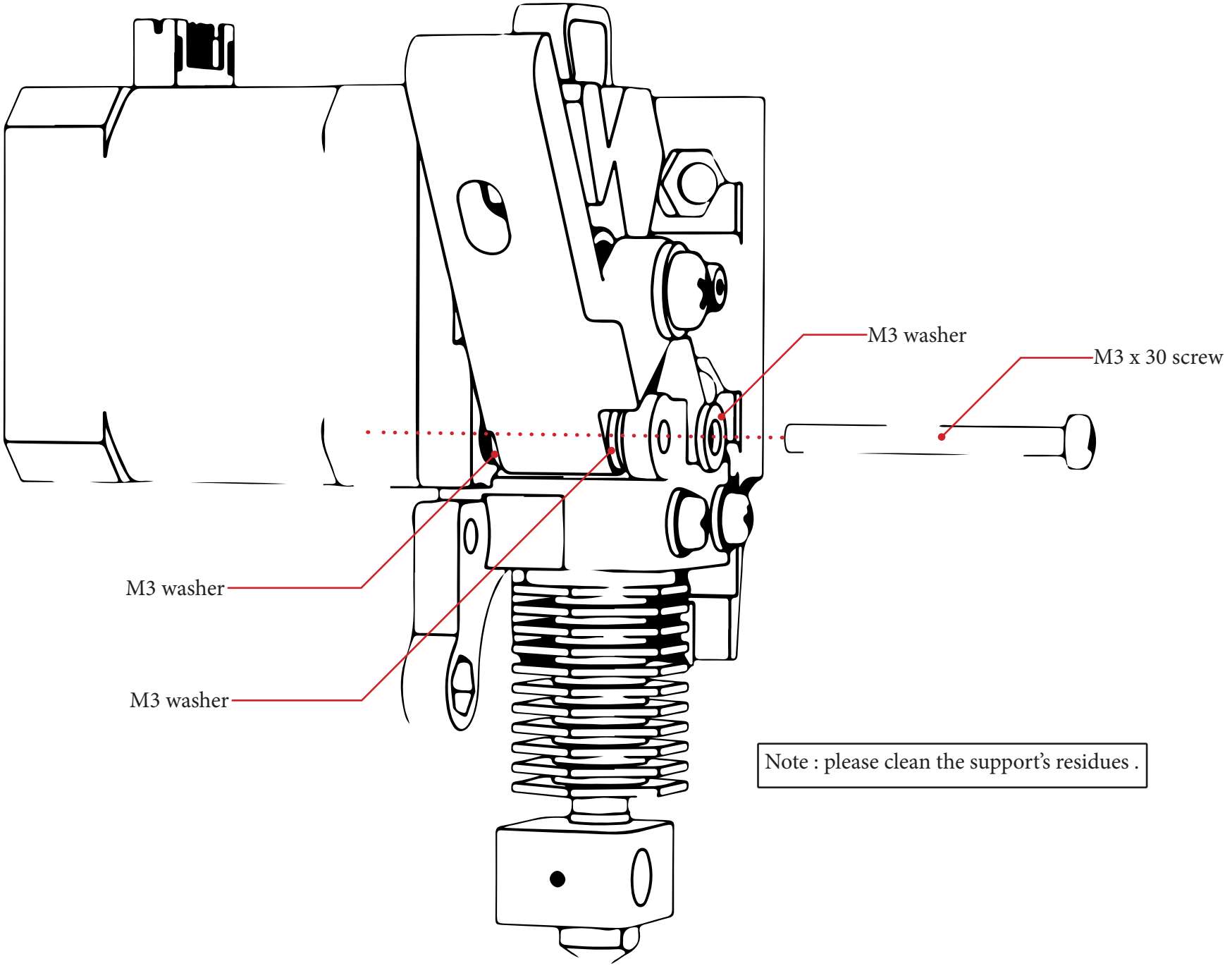
Note : check that nothing obstructs the passage of the filament in the body of the extruder.



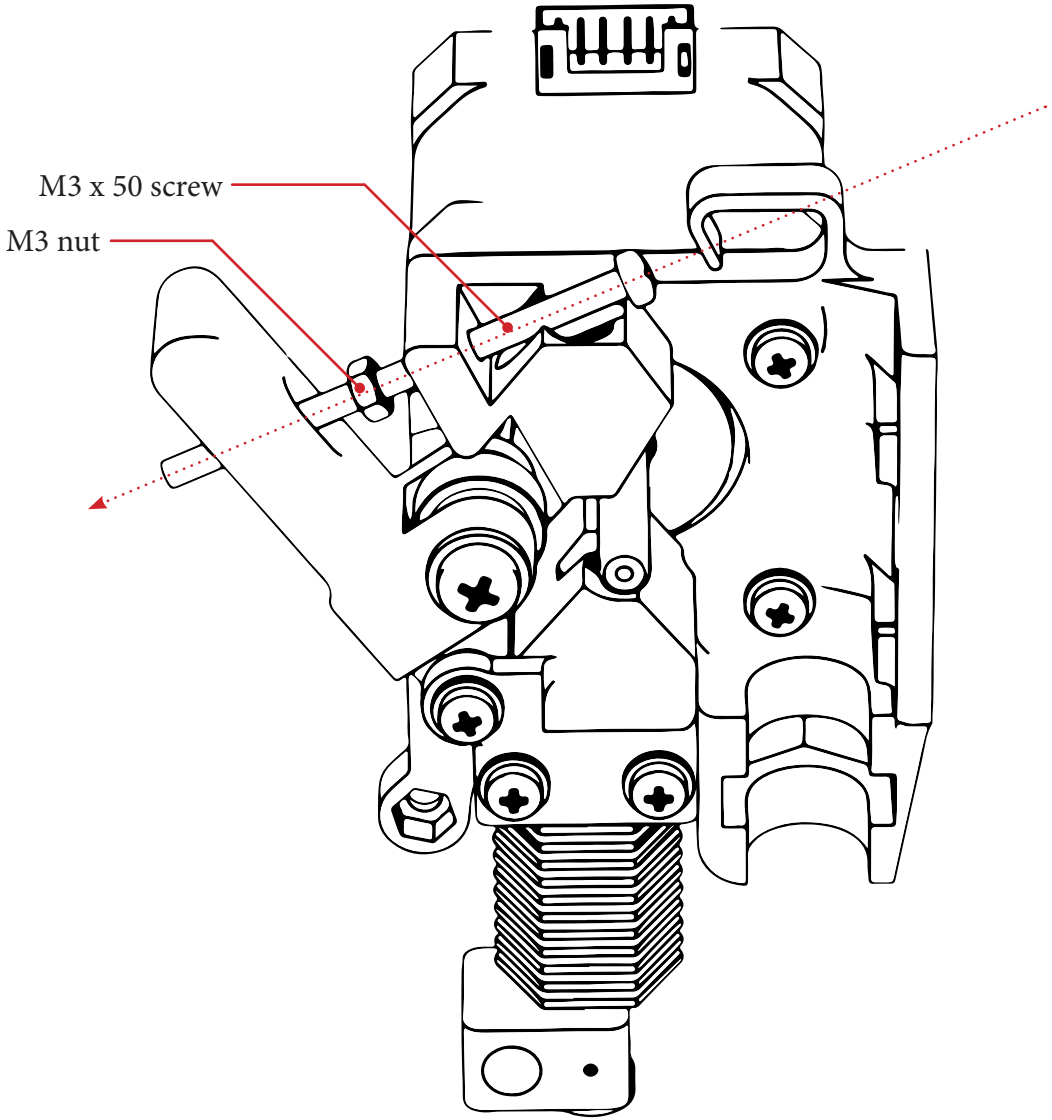

M3 washer
M3 x 14 screw
M3 x 10 screw

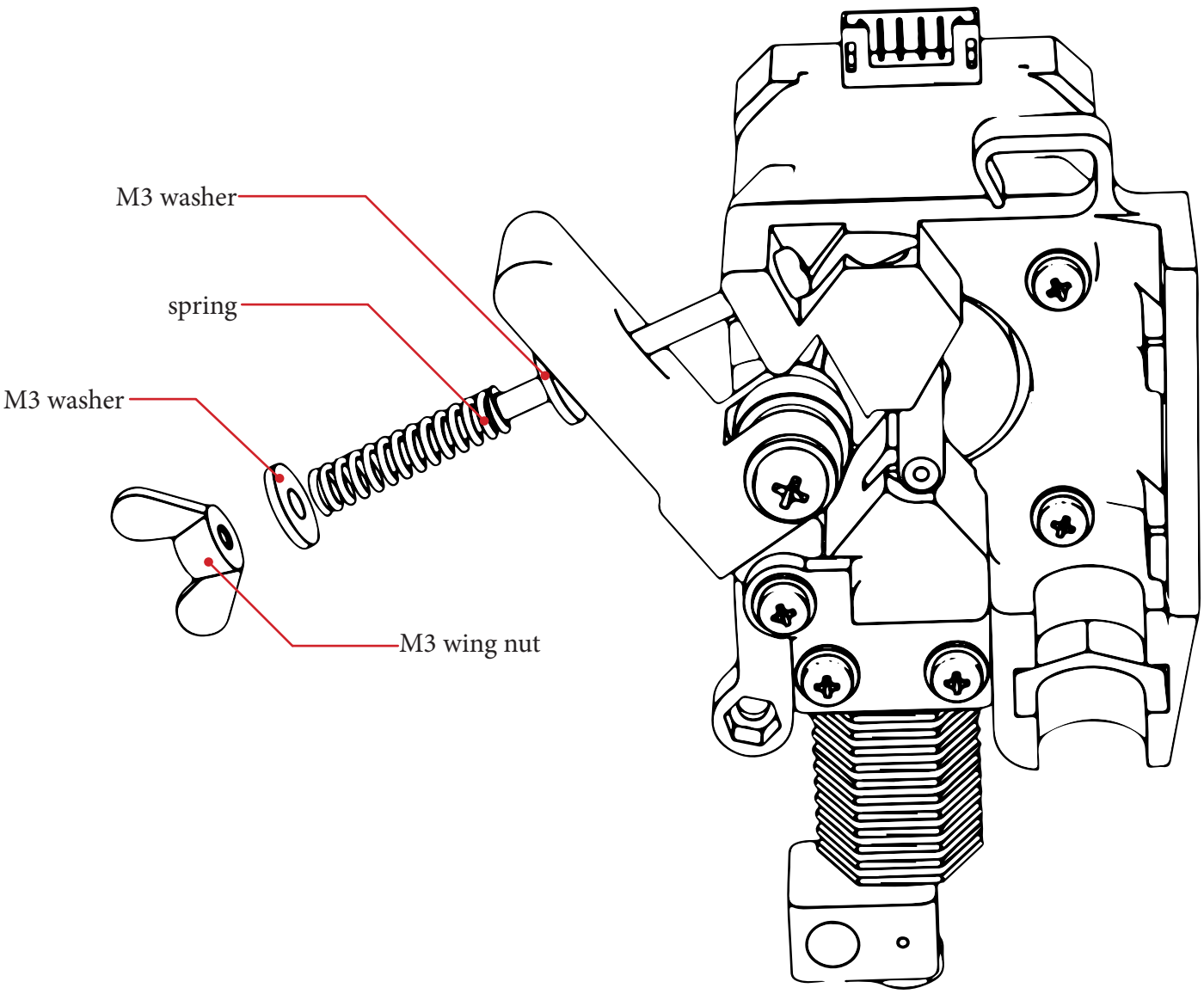

M3 washer
M3 x 20 screw

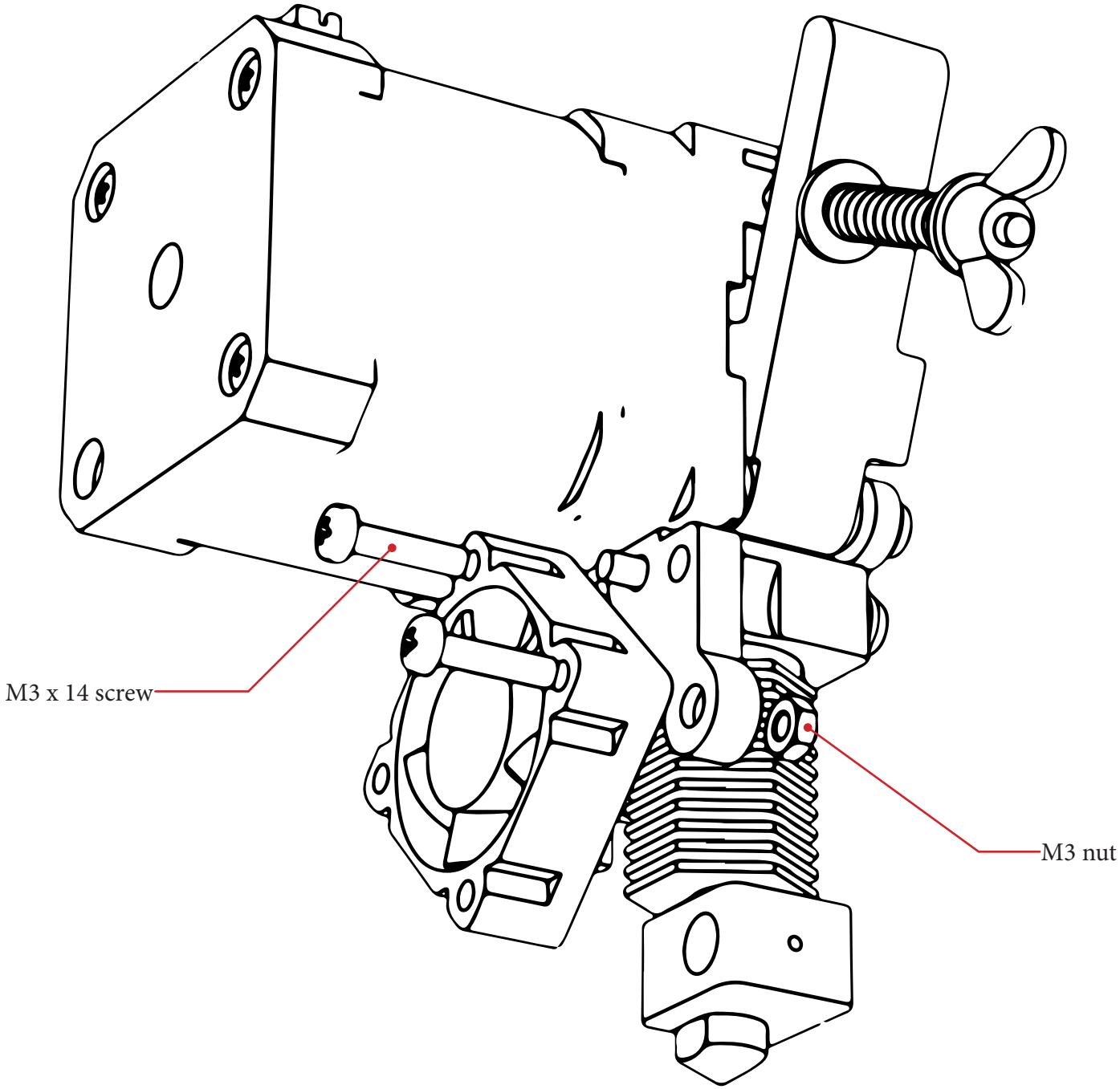

M4 nut
624 bearing
M4 x 20 screw



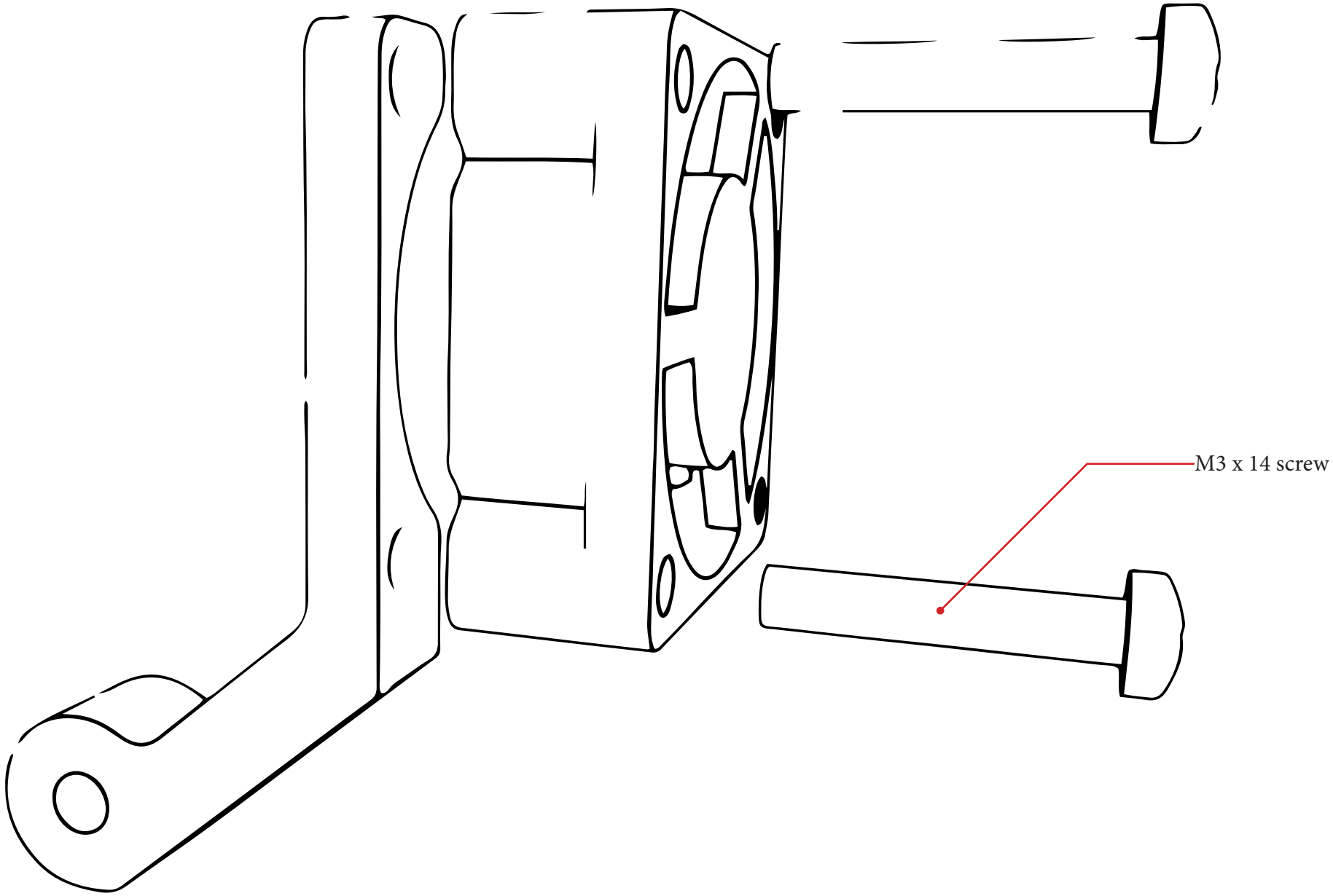
Note : please clean the support's residues .


M3 x 50 screw
M3 nut

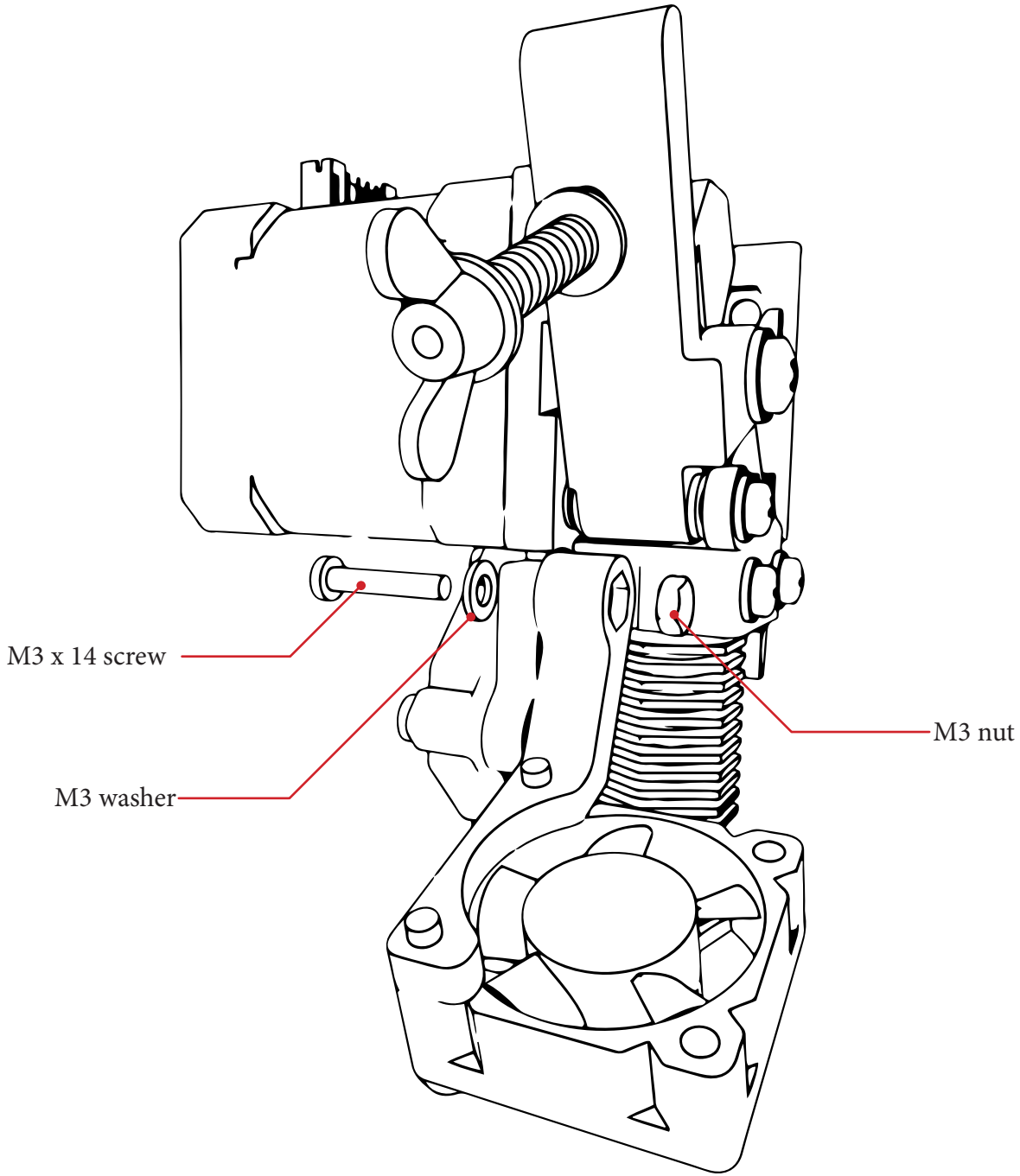

M3 washer
spring
M3 washer
M3 wing nut

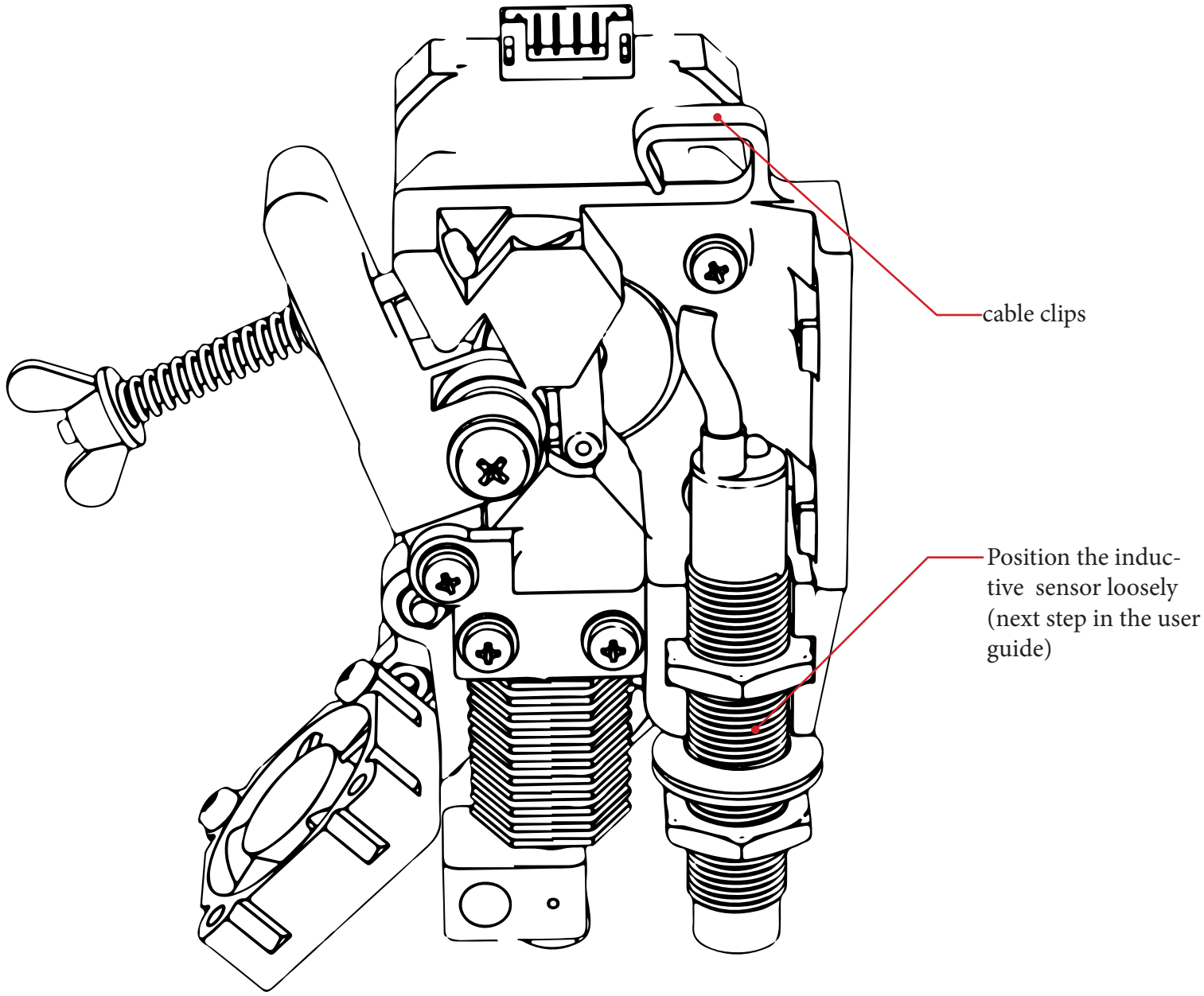


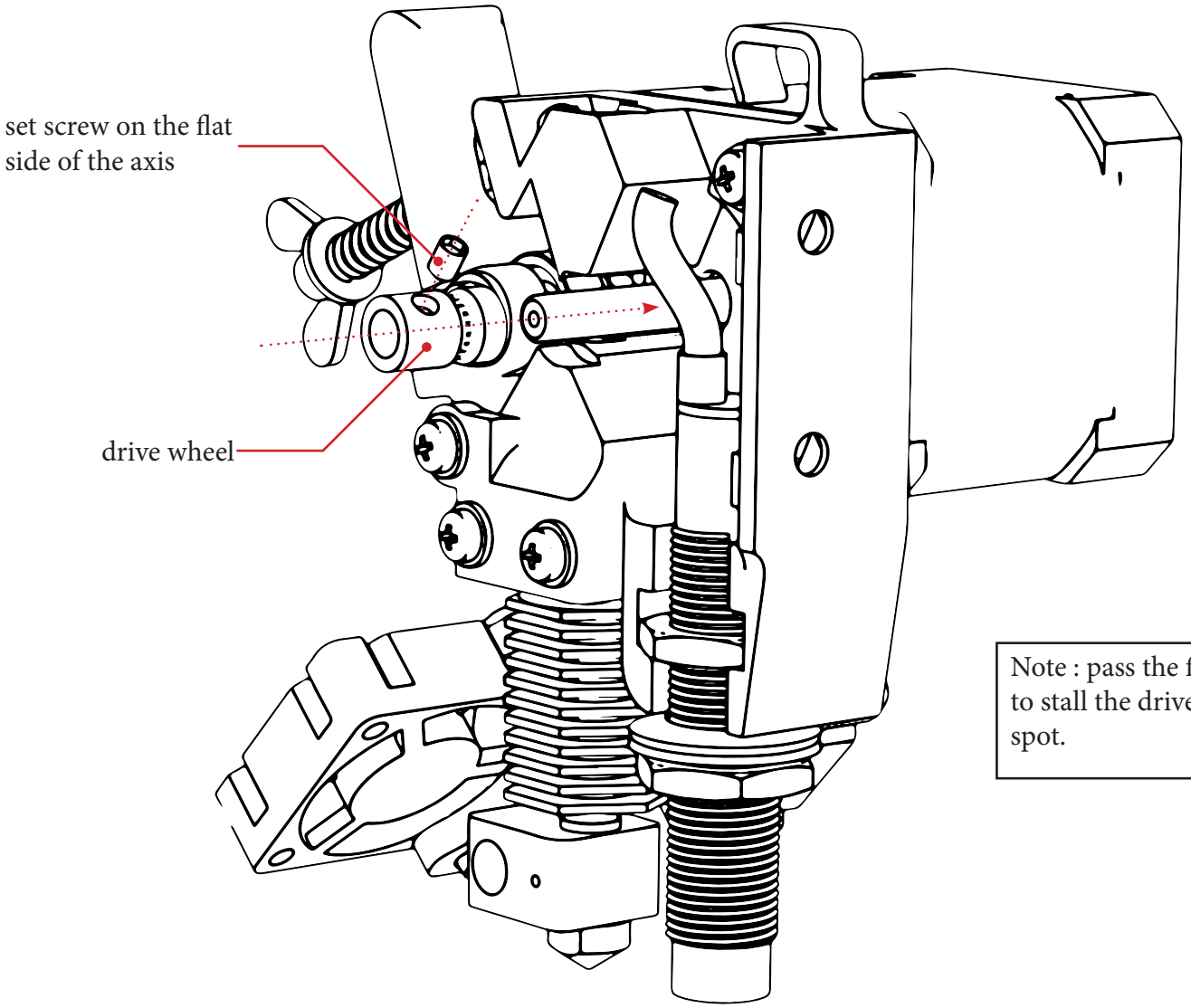
Note : the fan must have the sticker facing the Hexagon noozle



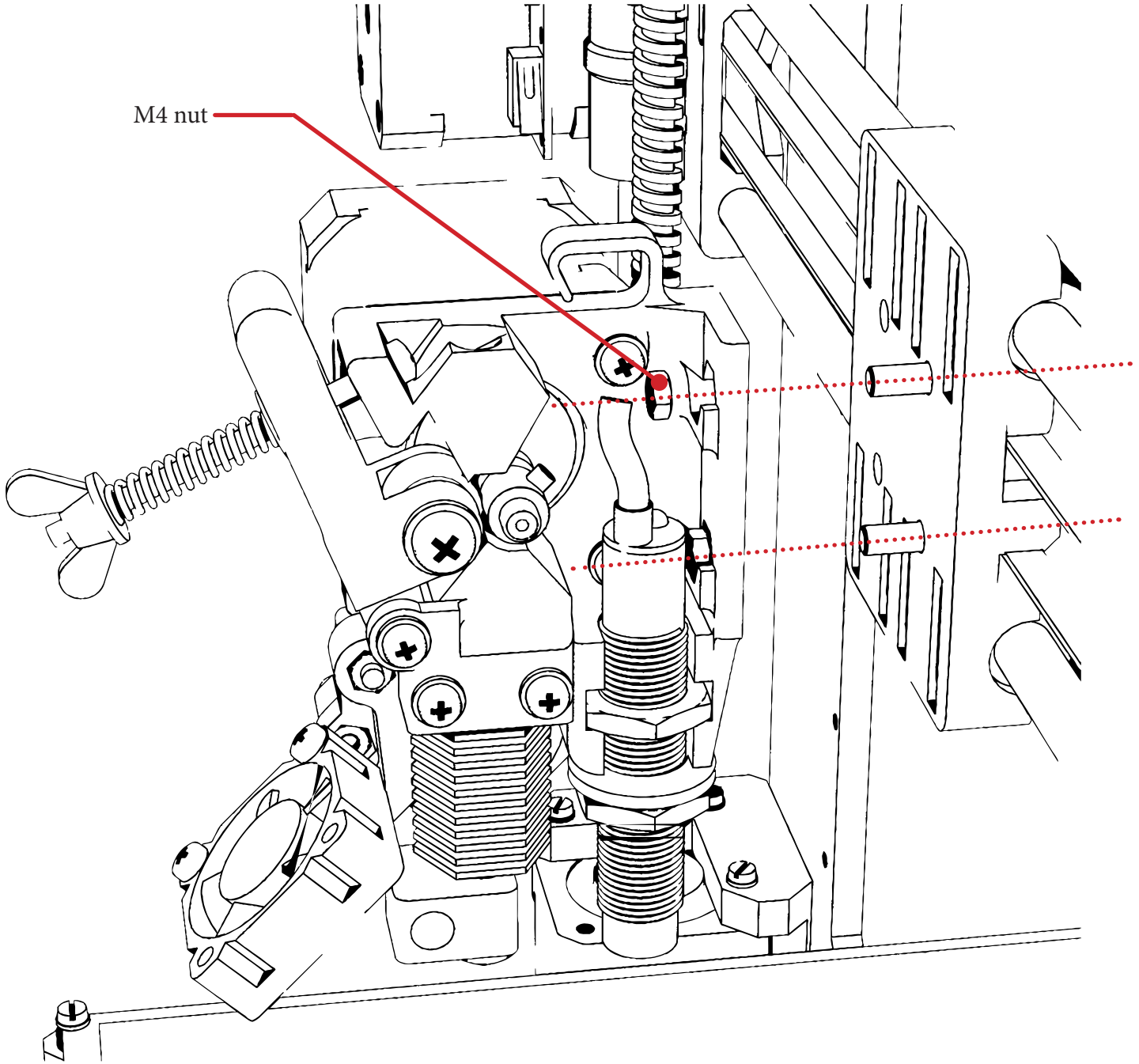
Note : the fan must have the sticker facing the Hexagon noozle


M3 x 14 screw
M3 washer
M3 nut


cable clips
Position the induc-
tive sensor loosely
(next step in the user
guide)



Note : pass the filament in the guide to stall the drive wheel to its optimum spot.


M4 nut

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 additionnal board that allow to drive differents components and also receive informations from all sensors.

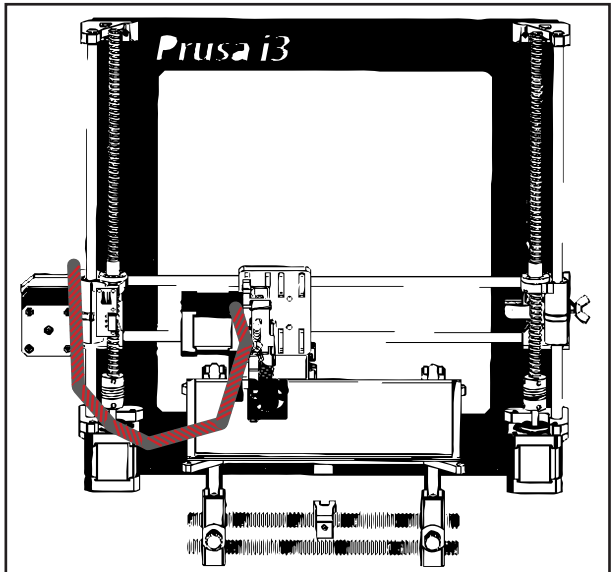
Organization of cables and sleeves

The various connections will be detailed later in this document.

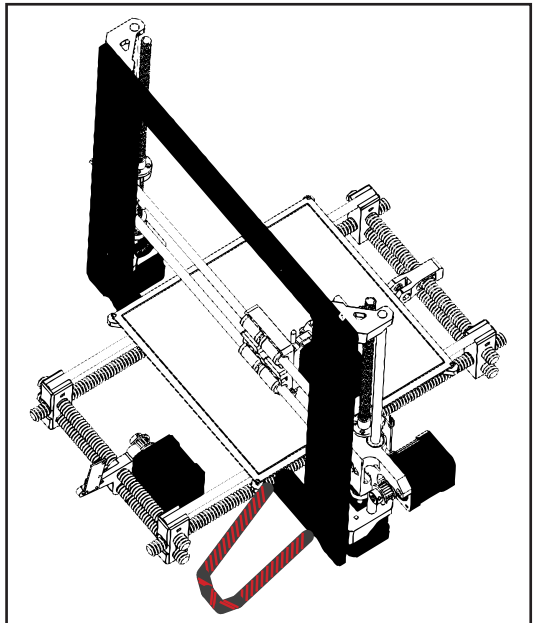
It is preferred to connect cables of each axis set within the same sleeve. Each sleeve should include a loop with sufficient clearance that will allow its axis to move freely.

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.

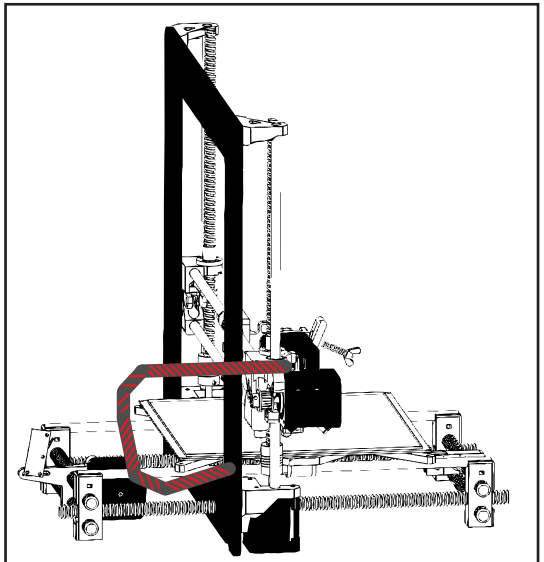
You will find below some illustrations to understand where to make these loops.



X axis loop



Y axis loop



Z axis loop

Electronic mount

Needed parts :

- RAMPS
- Arduino
- 4x stepstick
- 3x Arduino washer
- 3x M3 x 30 mm screw
- 3x M3 nut
- 3x M3 washer

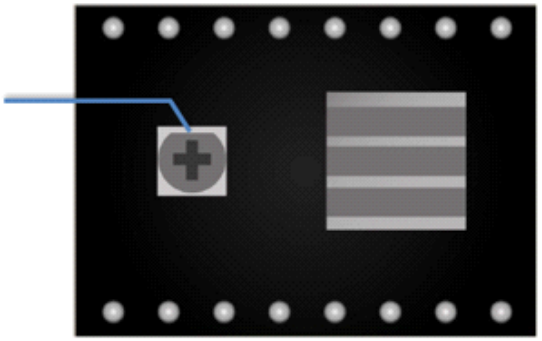
1°) Fit the RAMPS card on the Arduino board carefully.

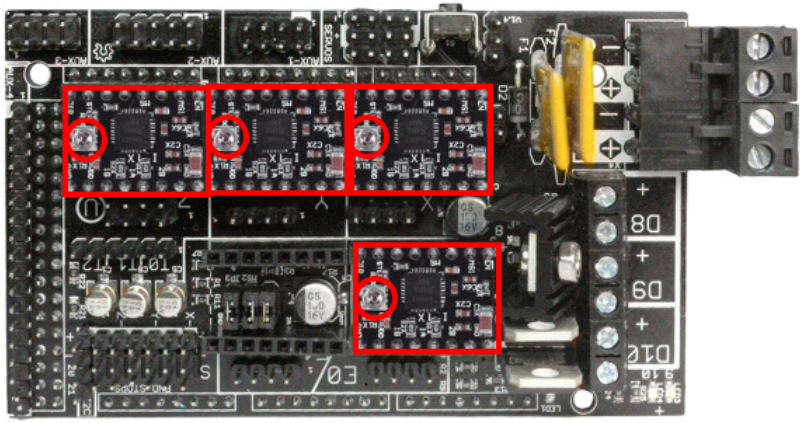
2°) Connect each motor driver on the RAMPS, please pay attention to orientation of the board.

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

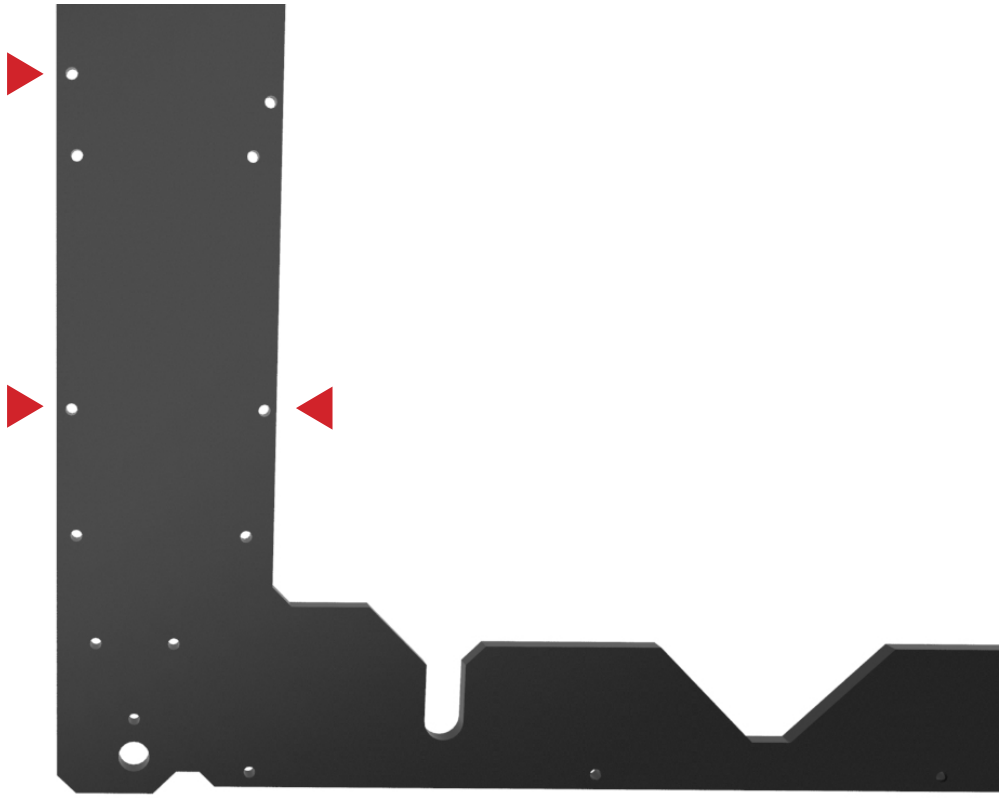
Do not inverse stepstick's wiring to avoid damaging electronic equipment.

Adjustment screw to the left





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.

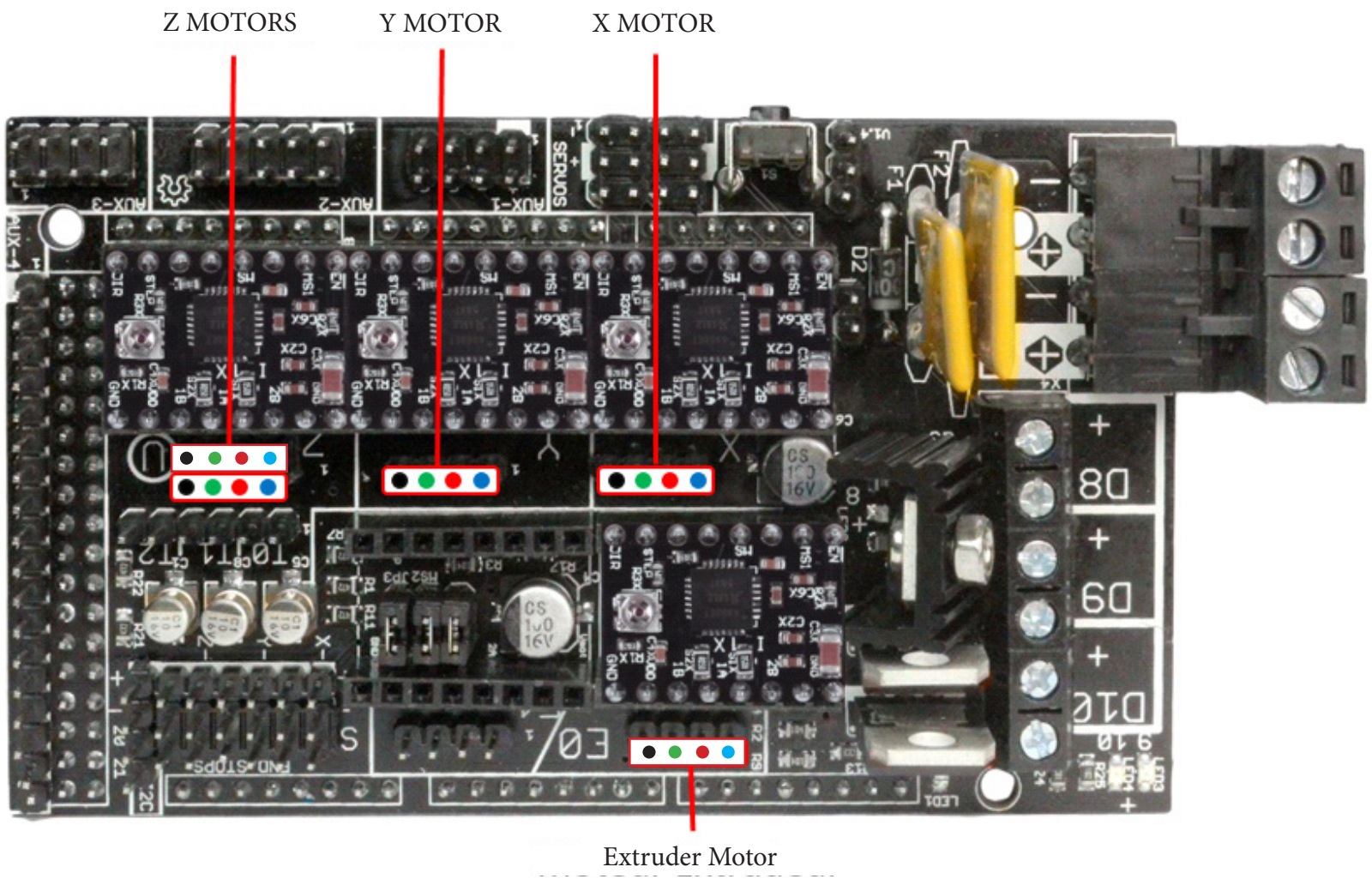


Wiring

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.

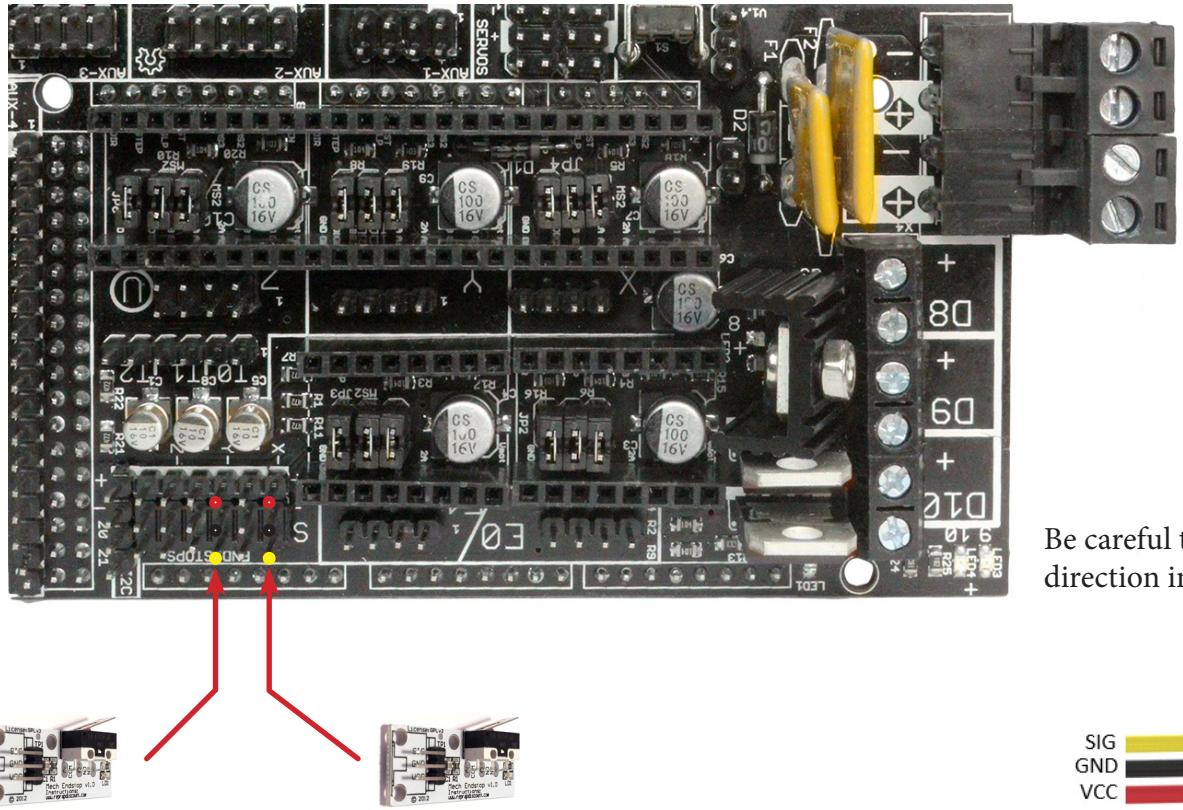


Endstops wiring

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 :

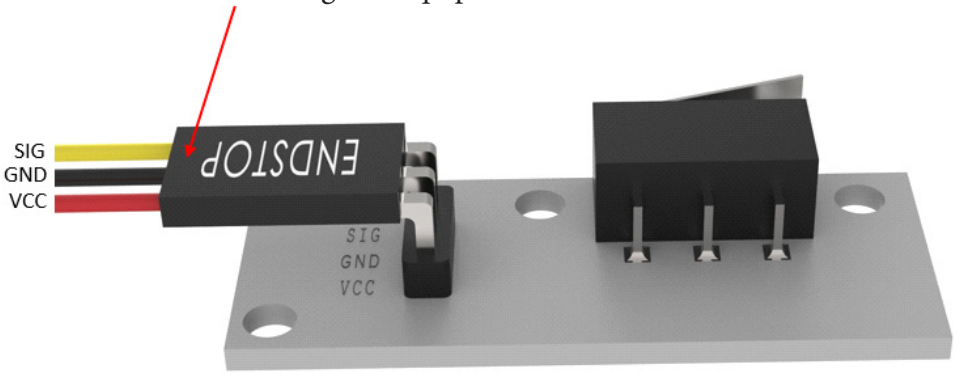


Y Endstop

X Endstop

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

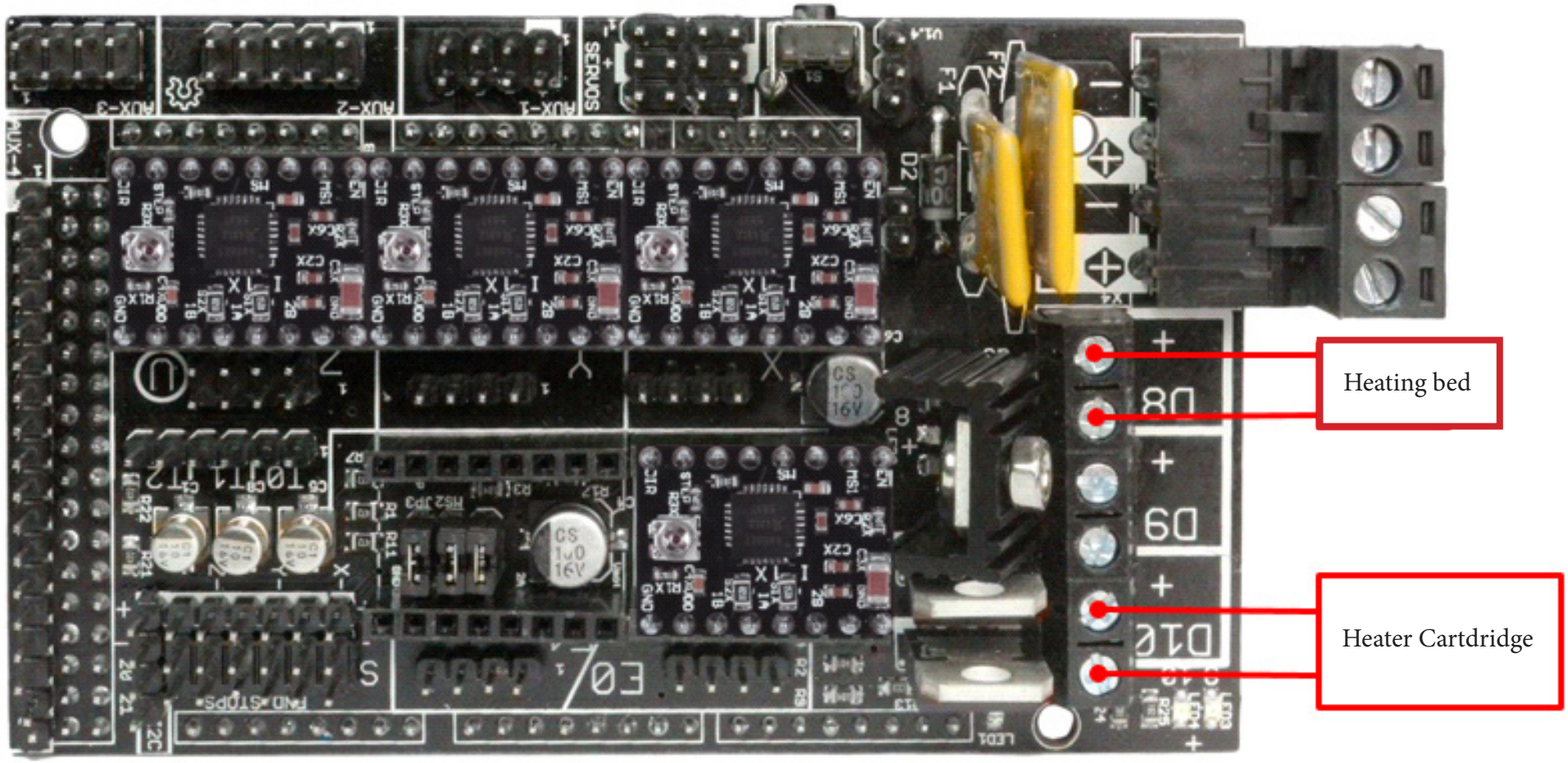
Be careful to plug in the endstop's connector in this direction in order to not degrade equipment



Cartridge heater and PCB wiring

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

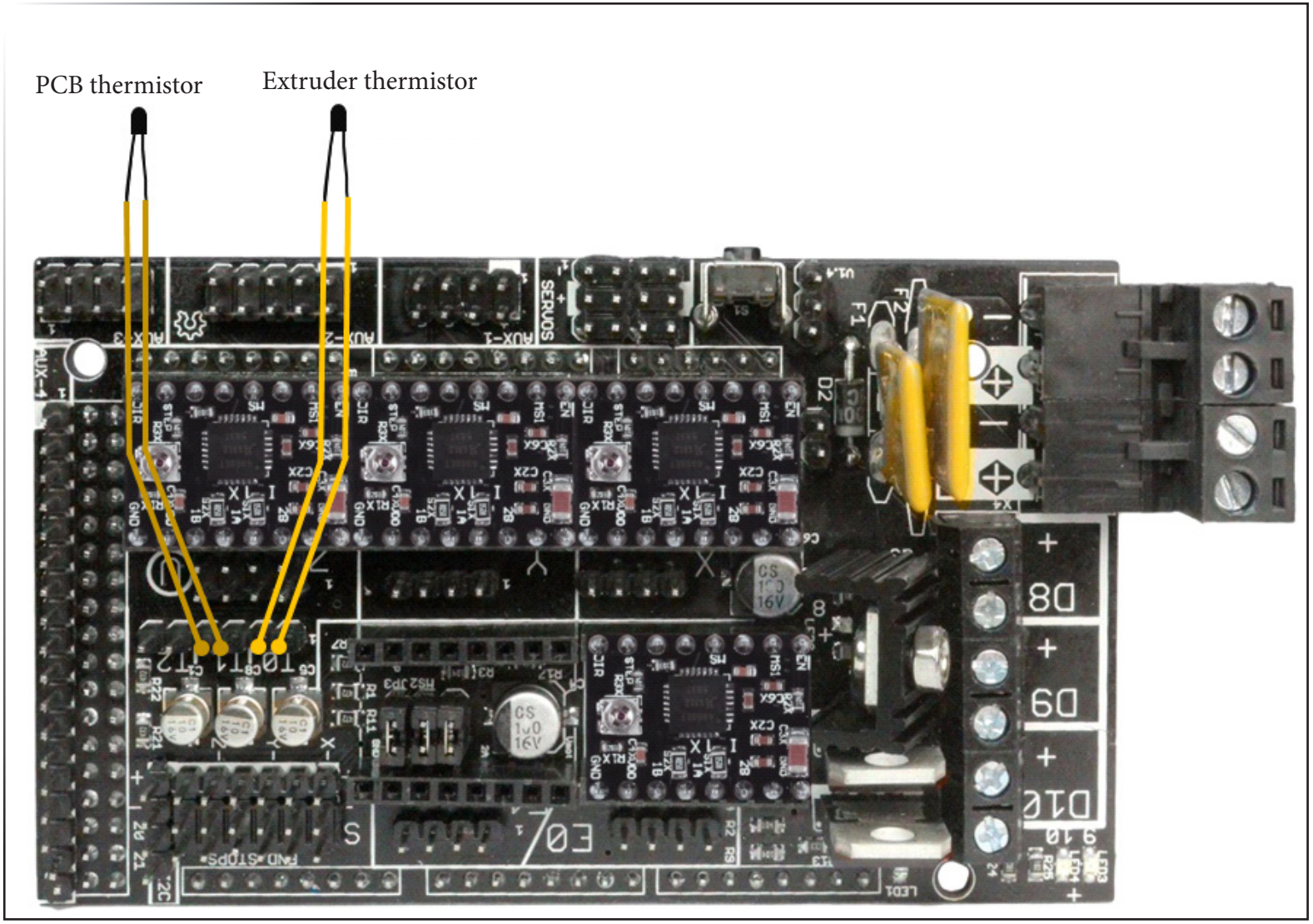
PCB heating plate is not polarized either and can be plugged on the D8 connector (close to the MOSFET with the heat sink).



Thermistors wiring

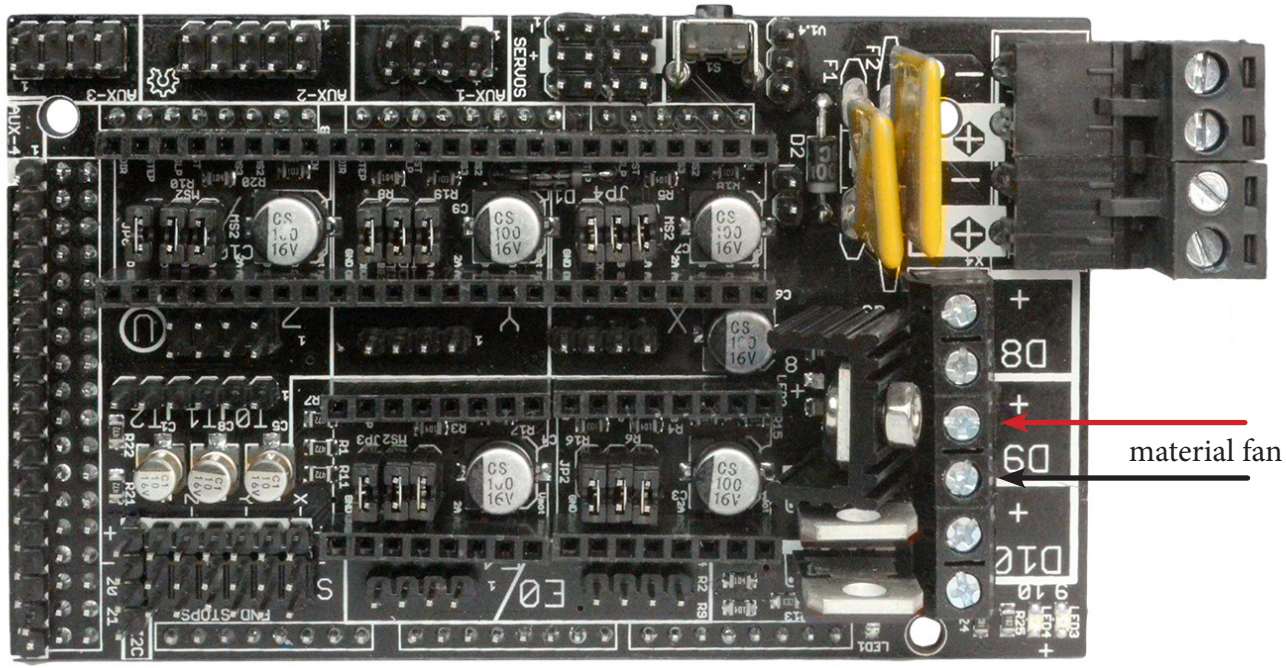
Thermistors are not polarized so there is no risk of mis-connection.

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 direclty from the software.

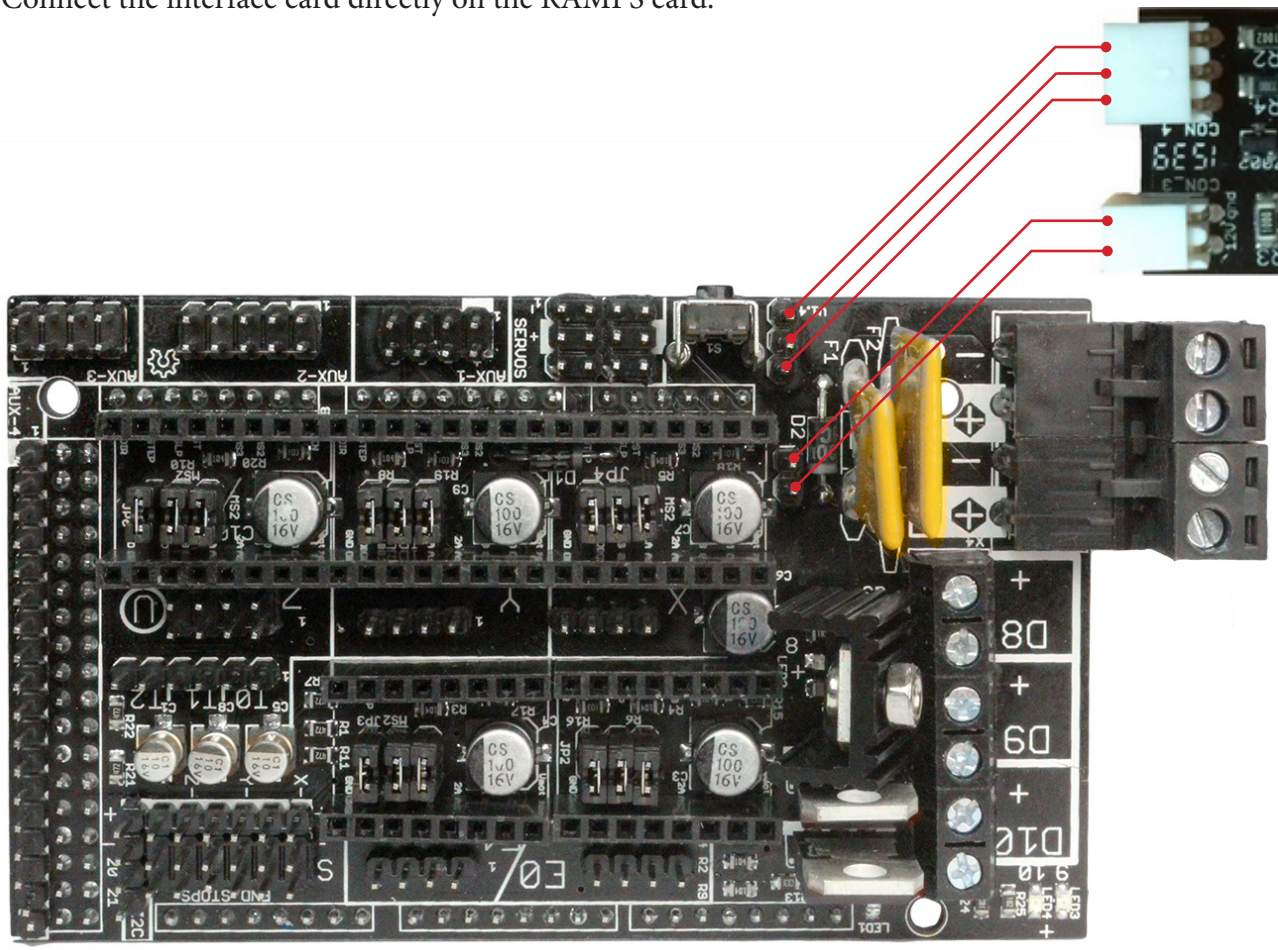


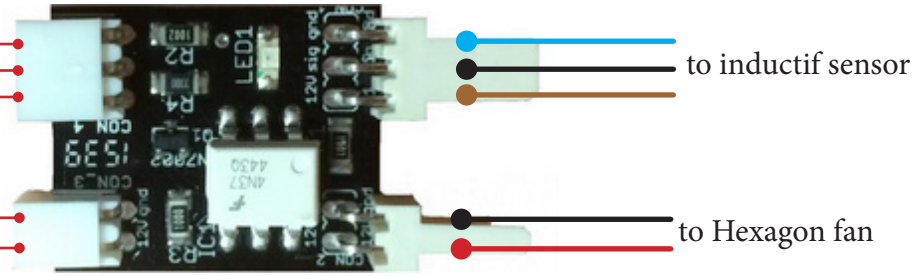
WARNING : the fan is a polarized component, the direction of the connection must be correct as this may cause damage to the material.

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.

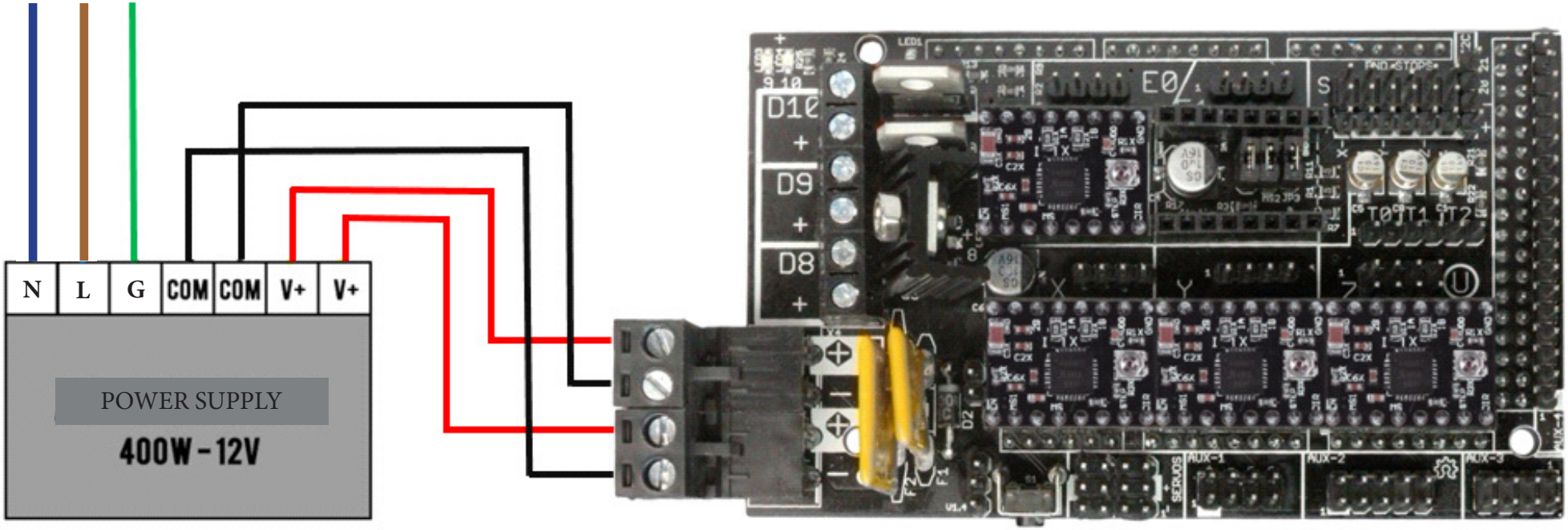
Strip the power supply wire properly to obtain a clean and safety connection .

The wire between the power supply and the RAMPS board is made with additionnal 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.

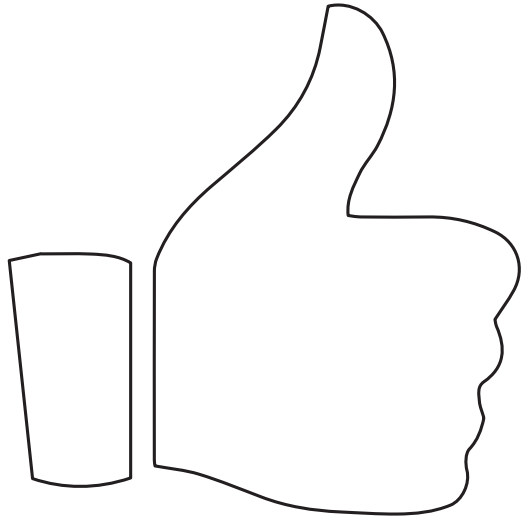
Now you can read the next notice to run your 3D printer.

220V OUTLET



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 web site, in the «support» section :
link to the first use instructions

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