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idbox!
3D PRINTER

Pack 08
Anything you can imagine, you can make!
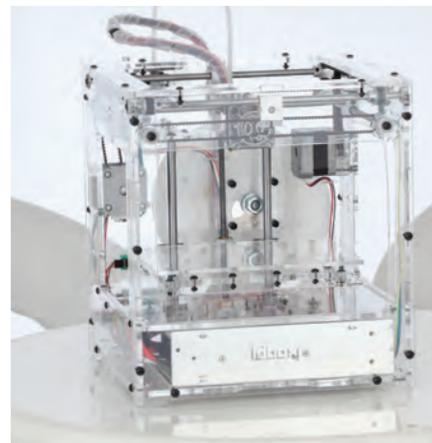
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BUILD YOUR OWN idbox! 3D PRINTER

CONTENTS

WARNING: Not suitable for children under the age of 14. This product is not a toy and is not designed or intended for use in play. Items may vary from those shown.

## DeAGOSTINI MODEL SPACE™

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Stage 31: Attach the thermistor to the head block assembly

In this stage, you will attach the thermistor (which monitors temperature) to the heater block on the head block assembly. After that, you bind the cables together using spiral tubing, which you then fix to the head block.

You last worked on the head block assembly in Stage 30, when you inserted the heater cartridge into the heater block. Now you must insert the thermistor, which measures the temperature of the heater block, into its hole, which is adjacent to that for the heater cartridge. The thermistor is fragile, so take care when you handle it. After this, wind spiral tubing around the wires for the thermistor, heater and cooling fan so they are kept neat and safe. Then secure the wrapped wires to the heater block with a clamp, screwed into position with a truss head screw.
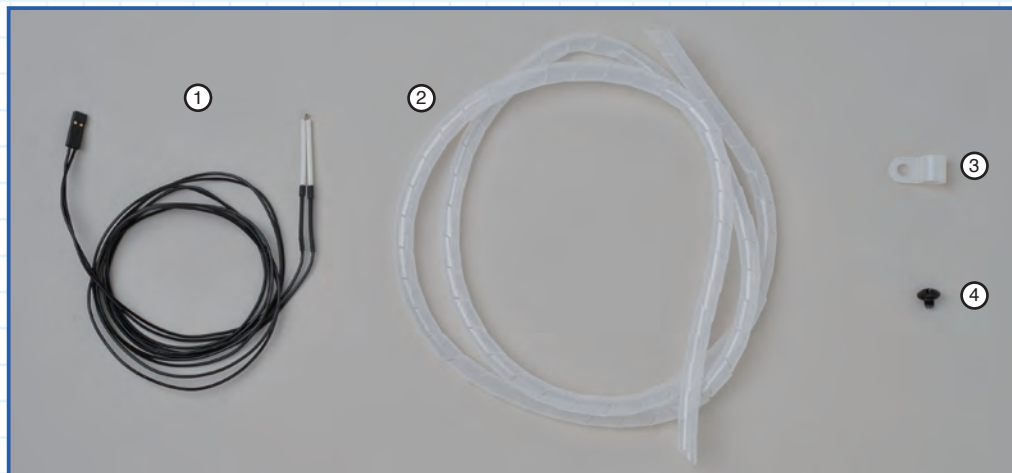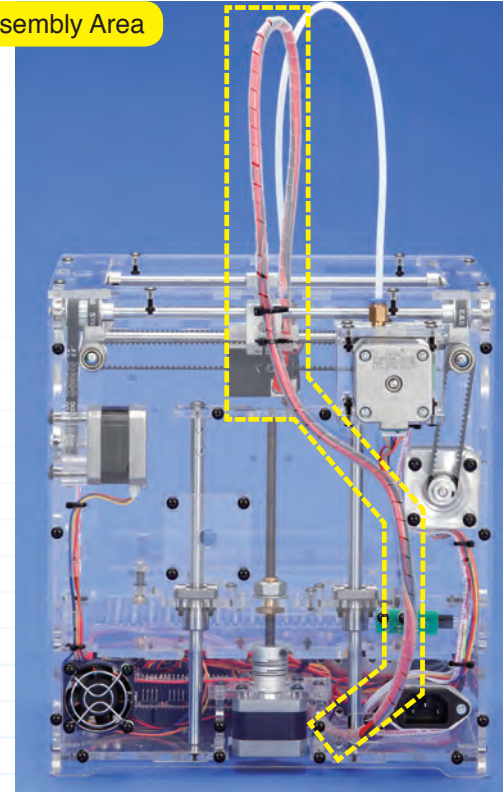
Stage 31 Components

1: Thermistor x 1
2: Spiral wire wrap tube x 1
3: Cable clamp x 1
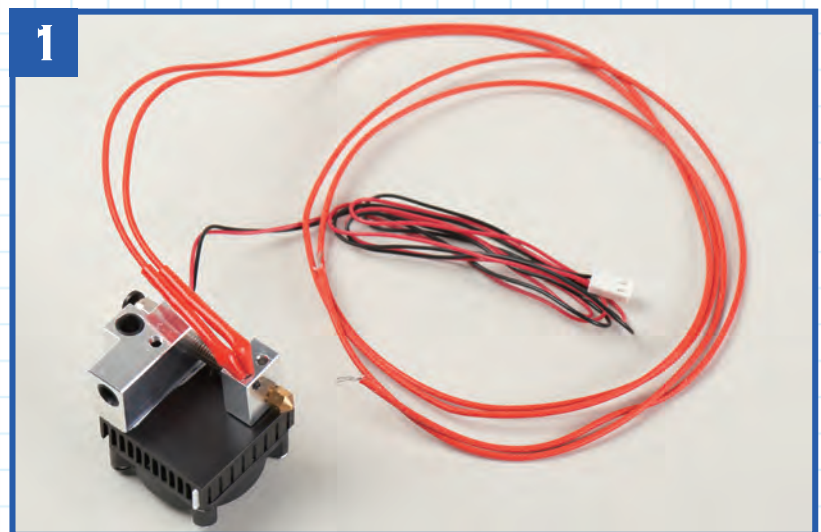**4:** M4 truss head screw (5mm) x 1

Tools you will need

Phillips screwdriver size 2
Ruler
Marker pen
Allen key (1.5mm) supplied with Stage 11

Useful items

Cocktail sticks

Parts to have ready

Get ready the head block assembly that you last worked on in Stage 30.

115

Insert the thermistor into the heater block

2

POINT

The thermistor – especially the tip – is fairly delicate, so take care when handling it. Do not touch the tip where delicate components are encapsulated in a bead of glass.

The hole for the thermistor is about 11mm deep, so use a ruler to measure 11mm from the end of the thermistor and make a mark on the thermistor at that point with a marker.

3
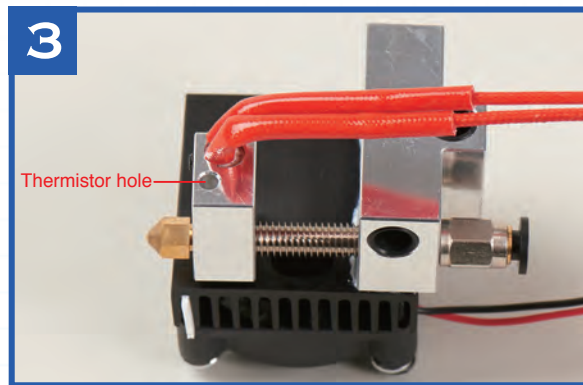
Thermistor hole

Position the head block assembly as shown so the fan is at the bottom and the nozzle is on the left. The hole for the thermistor can be seen to the left of the hole for the heater cartridge.
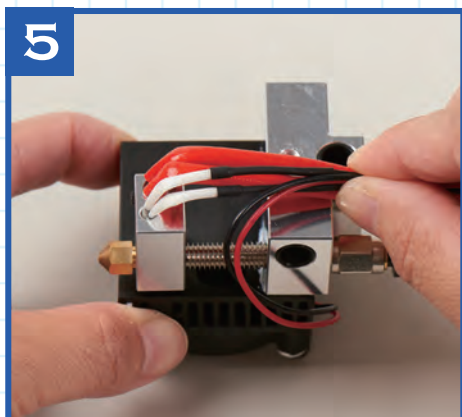
4
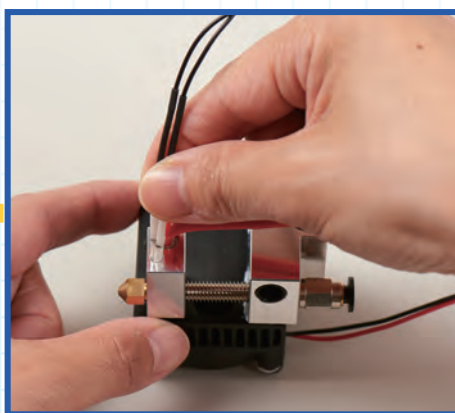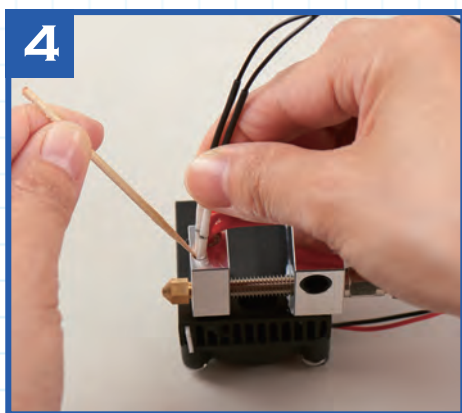
CAUTION! If you use too much force when inserting the thermistor, you might beak its delicate glass end. Make sure you insert it gently.

Make sure the end of the thermistor does not catch on or get damaged by the rim of the hole as you insert it. Do this by easing or guiding it in using a cocktail stick. Slowly insert the thermistor into the hole until the mark you made on it is level with the rim of the hole. This way you will not push the thermistor too far into the hole and damage it. When it's up to the mark, gently push in until you can just feel some resistance.

Bind the cables with spiral tube

5

POINT

The wire inside the thermistor is thin and might be damaged if bent. To avoid this, align it (inside its white cable housing) with the cable to the heater (red housing) in a gentle upwards curve. Do not let the cooling fan wires touch the cylinder or heater block, and keep the fan wires clear of the head rod hole.

Correct

Gentle curve in white cable housing
No slack in cooling fan wires

Incorrect

Sharp bend where white cable housing exits heater block
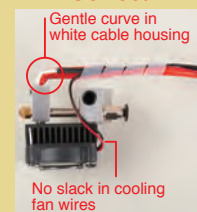Head rod hole is covered

Gather together the three sets of wires as shown above and wind the spiral tube around them for about 5cm. Do not apply excessive force to the thermistor or its wires.
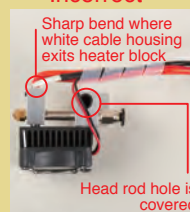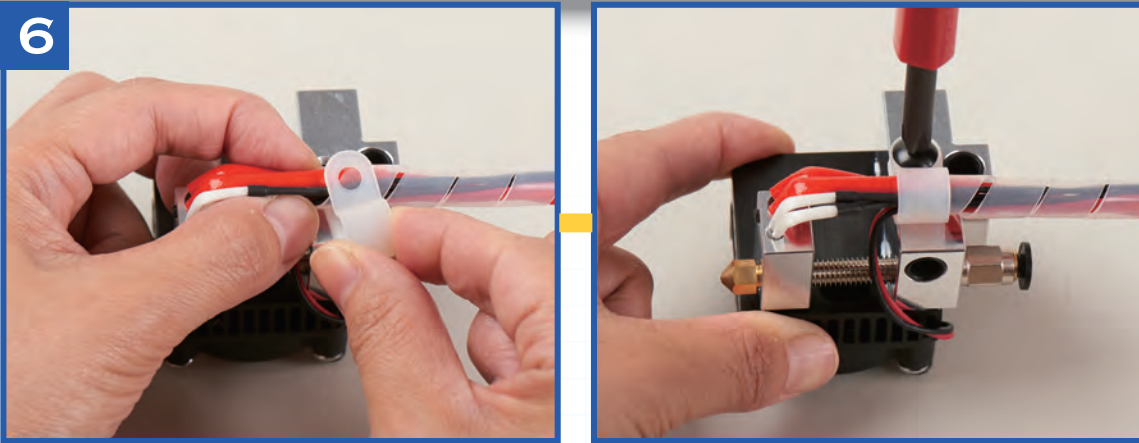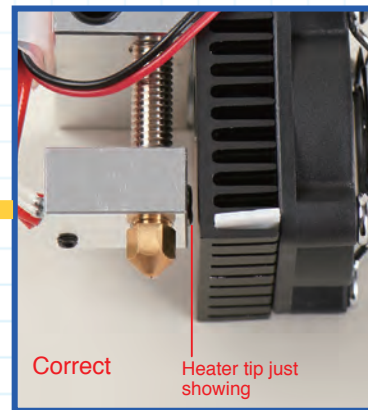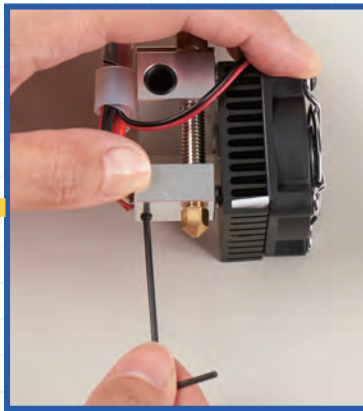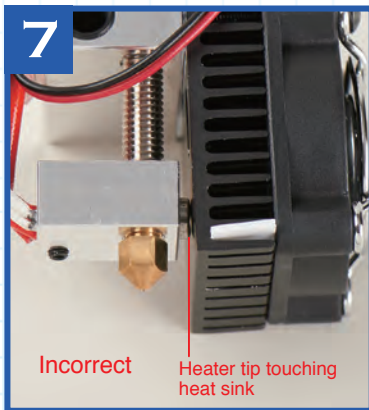
6

Put the wires in the spiral wrap tube into the cable clamp as shown, then screw the clamp into the head block using the 5mm M4 truss head screw. Do not screw the screw too tight, but just enough so the cable clamp does not move.

Adjust the position of the cartridge heater and wrap the wires

7

Incorrect — Heater tip touching heat sink

Correct — Heater tip just showing

HINT If the end of the heater cartridge is touching the heat sink or is recessed within the heater block, the temperature might not get hot enough, so make sure you check its position as shown.

If the end of the cartridge is touching the heat sink, use the 1.5mm Allen key (Stage 30) to loosen the set screw holding it in position. Move the cartridge so that it only protrudes slightly from the heater block and does not touch the heat sink. When you have checked the position of the cartridge, tighten the set screw again.

8
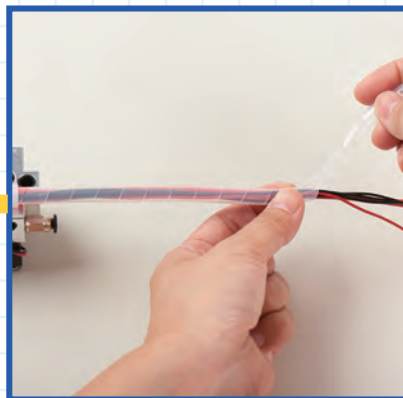
Stage finished

Wind the spiral wire wrap tube around the bundled wires until you reach the end of the cooling fan wires.

HINT When you've finished winding the spiral wrap around the wires, check that the thermistor is still in its correct position and has not come out. Also make sure the cooling fan cable is not touching the cylinder and that the head rod hole is clear.

The thermistor has now been added to the head block assembly and the wires neatly bundled together in the spiral wrap. Store this assembly carefully until you add it to the casing in a later stage.

117

Stage 32: Attach the timing pulley to the X-axis motor shaft

In this stage, you will work on the X-axis motor, the one that controls movement of the printer head from side to side. The assembly you will undertake to attach the timing pulley to the motor shaft is a simple job, but an important one.

The assembly of the timing pulley onto the X-axis motor shaft might seem like an easy procedure, but there are a couple of things to bear in mind when you do it. The first is that the flat section of the motor shaft should be on the same side as the screw hole in the pulley, so that when the set screw is tightened, it will not slip when the motor turns. The second is that the end of the shaft and the end of the pulley should align. The set screw is really tiny, so be careful you don't lose it.
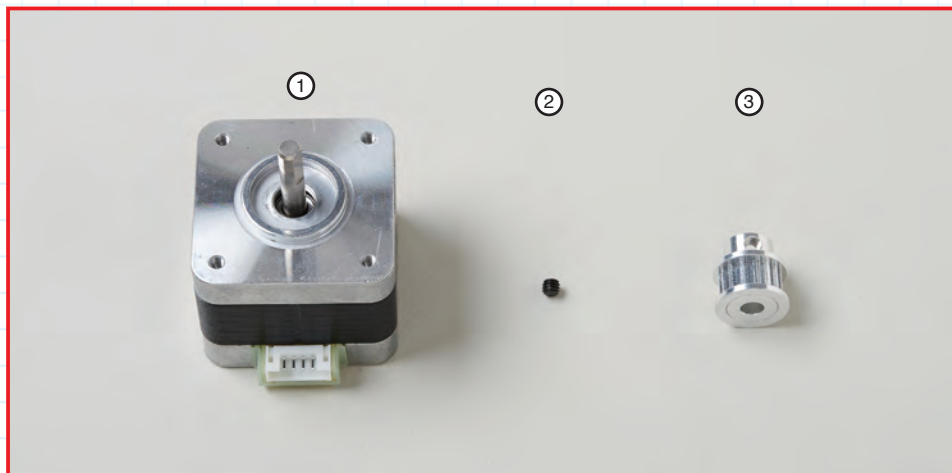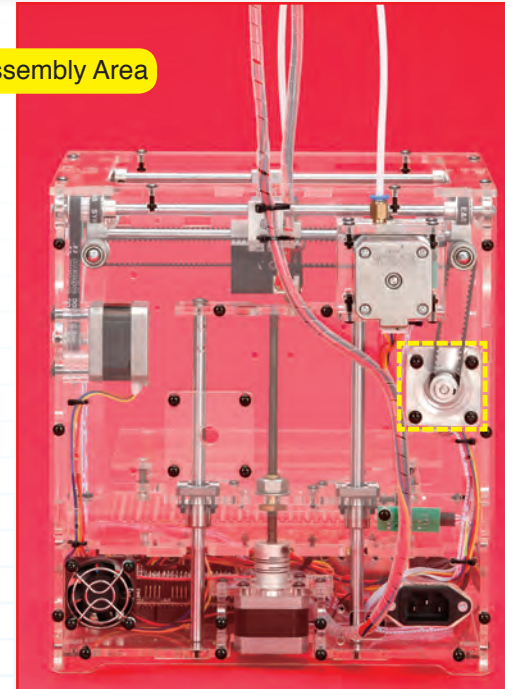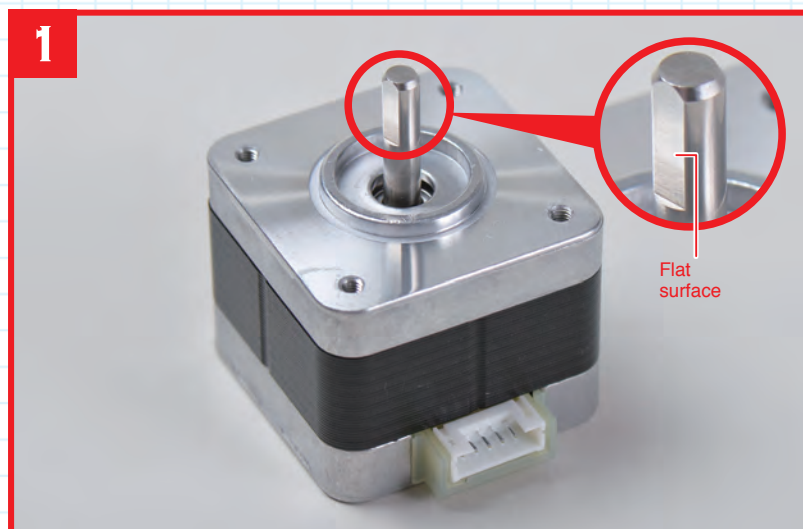
Stage 32 Components

1: X-axis motor
2: M4 set screw 3mm x 1
3: S3M timing pulley (15-5-7) x 1

### Tools you will need

Allen key (2mm) provided with Stage 11

Locate the flat section of the motor shaft

1

Flat surface

Before you start the assembly process, look carefully at the shaft of the motor. You will see that there is a flattened section machined into it. This gives the shaft the approximate shape of the letter D when viewed end on.
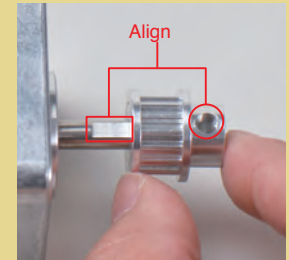
Secure the timing pulley to the motor shaft

2
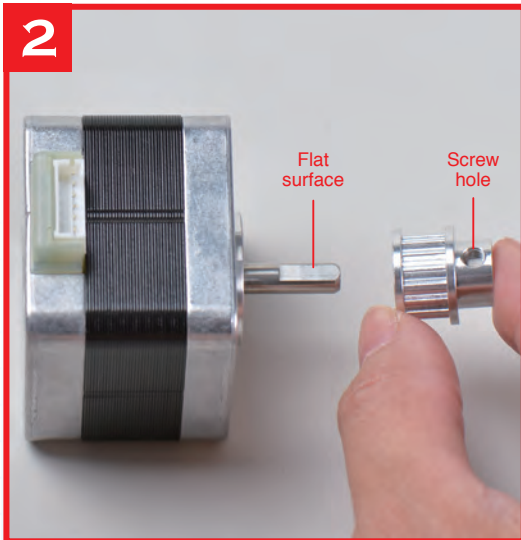
POINT

Align the flat section of the motor shaft and the screw hole in the pulley.
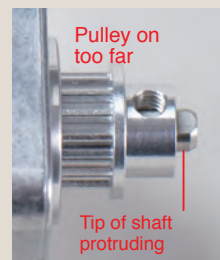
Flat surface

Screw hole

Align

Put the motor on your work surface with the shaft facing right. Insert the motor shaft into the hole in the pulley, so that the flat section of the shaft and the screw hole for the set screw in the pulley both face upwards.
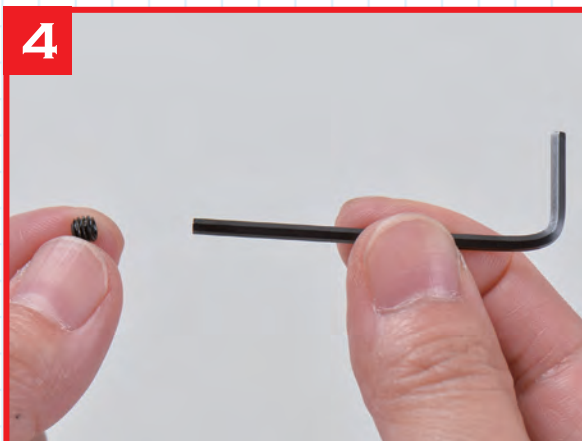
3

Aligned
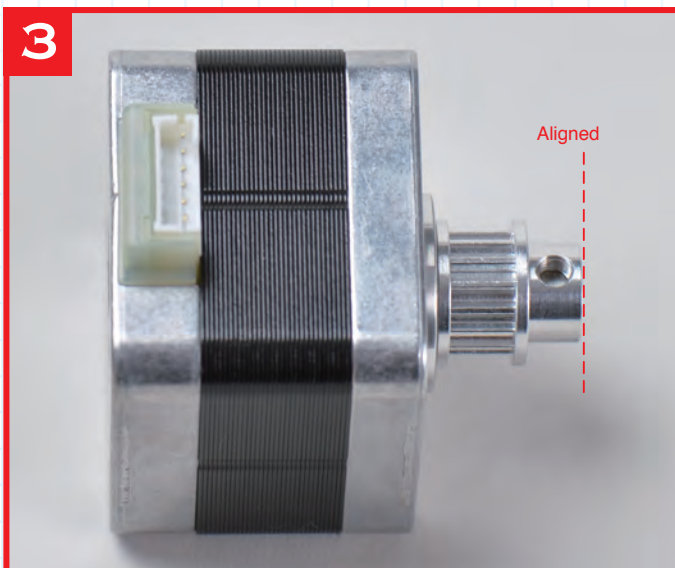
HINT

The pulley should be on neither too far nor too little. If it is on too far, the motor might not run smoothly. Make sure the end of the shaft and the end of the pulley align.

Pulley on too far

Not on far enough

Tip of shaft protruding

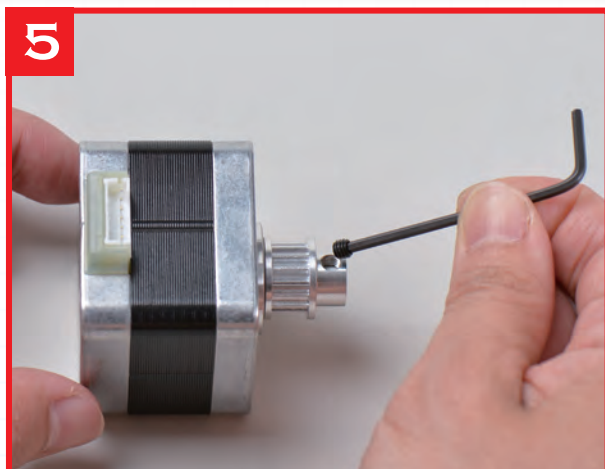Shaft visible next to motor housing

Align the end of the shaft with the end of the pulley.

4

Insert the long axis of the 2mm Allen key into the hexagonal hole in the head of the set screw.

5

Insert the set screw into the screw hole in the timing pulley, as shown, and then turn the Allen key clockwise to tighten it.

6


Set screw

Flat surface

Aligned

Check again that the end of the shaft is aligned with the end of the timing pulley, and that the set screw is tightened up against the flat section of the motor shaft.

How a motor moves the head   CLOSE-UP

The X-axis and Y-axis motors in your idbox! are identical and they work in the same way to move the head: the X-axis motor controlling side-to-side movement and the Y-axis motor controlling front-to-back movement. In both cases the motor shaft rotates and turns the timing pulley attached to it. This moves the timing belt that loops over the large timing pulley at the top of the housing. Another pair of belts loop over the large and small pulleys, and these are attached to the sliders (and loop over pulleys at the other side of the housing). The sliders move back and forwards depending which way the motor shaft turns.
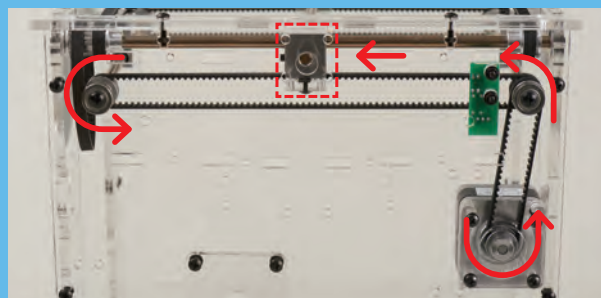
Stage finished

The timing pulley has been attached to the shaft of the X-axis motor. In the next stage, the motor is attached to the housing.

Stage 33: Attach the X-axis motor to the rear of the housing

Stage 33 Assembly Area

In this stage, you will attach the X-axis motor to the inside of the rear panel of the printer housing. It is held in place on a three-part bracket by four truss head screws.

The bracket used to hold the motor in position is made of three 'U'-shaped pieces of acrylic that are put together before tightening the mounting screws through the back of the housing and into the screw holes in the motor. The holes in the housing are oblong, so you can move the motor up and down to adjust the tension in the timing belt, which is hooked over the pulley attached to the motor.
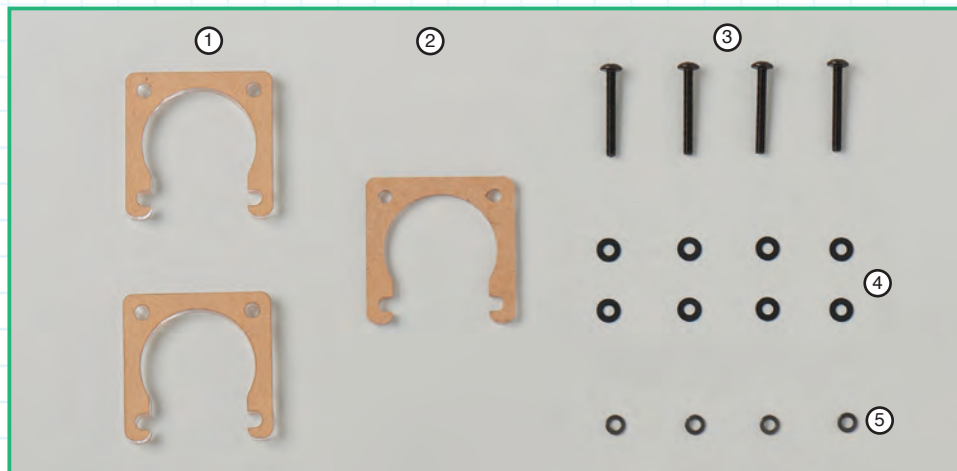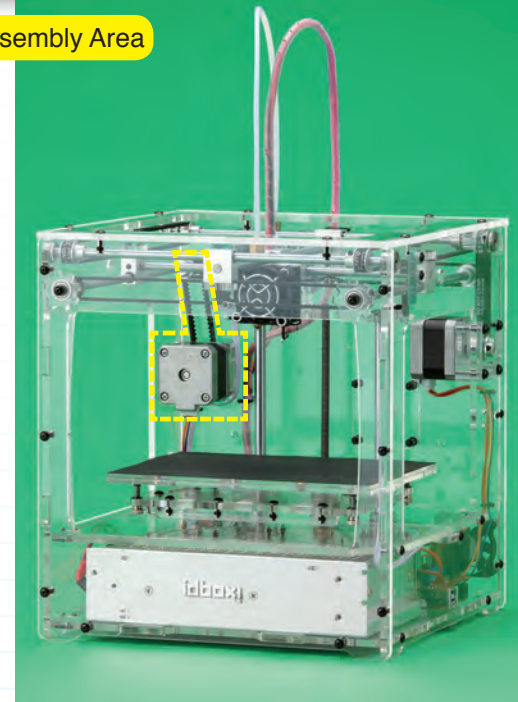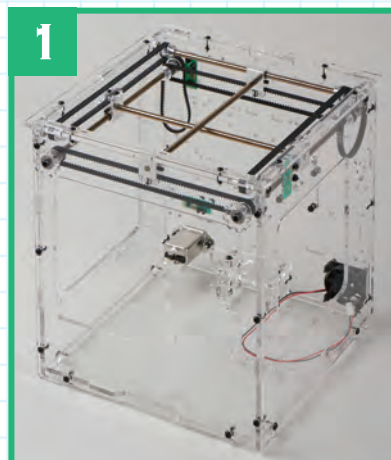

Stage 33 Components

1: Brackets (5mm thick) × 2
2: Bracket (4mm thick) × 1
3: M3 truss head screws (24mm) x 4
4: M3 flat washers x 8
5: M3 spring washers x 4

Note: You will use four of the flat washers, but the other four are provided if you need to fill a larger gap between the screw heads and the housing.

Tools you will need

Phillips screwdriver size 1

Parts to have ready

1

For this assembly, you will need the housing for the printer and the X-axis motor that you last worked on in Stage 32.
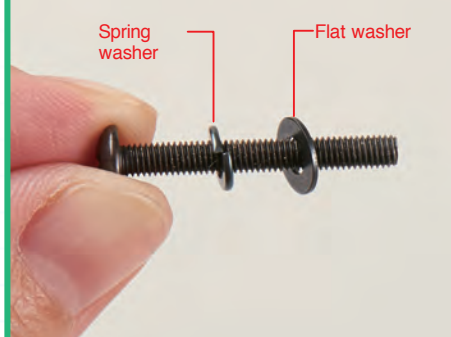
2

Peel the protective covering from both sides of the three brackets supplied with this stage.

Assembly Guide

Attach the bracket to the housing

3
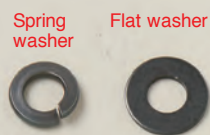
Spring washer — Flat washer

Put a spring washer and a flat washer onto one of the 24mm M3 truss head screws. Repeat this for the other three screws.

HINT The spring washer is a slight spiral, and has a break when viewed from above.
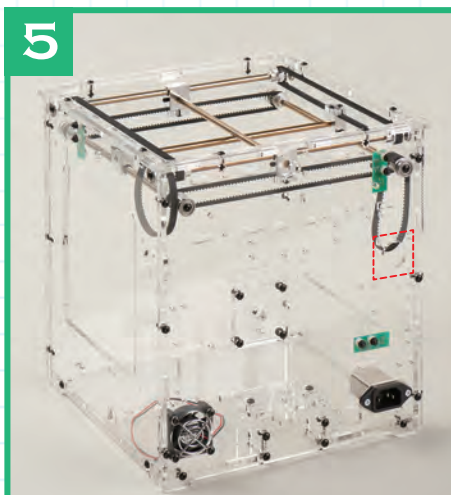
Spring washer — Flat washer

4

4mm
5mm — — 5mm

Put the pieces together as shown, with the 5mm brackets on the outside and the 4mm bracket on the inside. The three brackets make a 'U' shape.

5

'U' shape

Turn the housing so the rear panel is facing you. The large hole on the right has four oblong screw holes (ringed in red). Position the 'U' shape as shown, and the screw holes in the brackets will align with the screw holes in the housing.
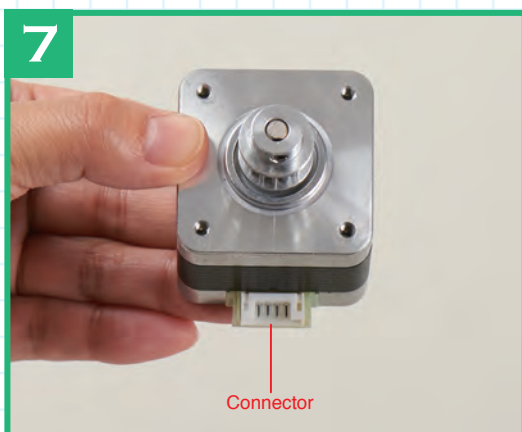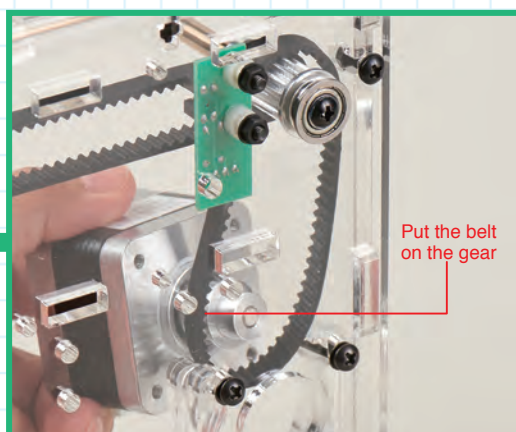
6

Insert the four 24mm M3 truss head screws (with their washers) into the oblong holes (ringed in red) in the housing.
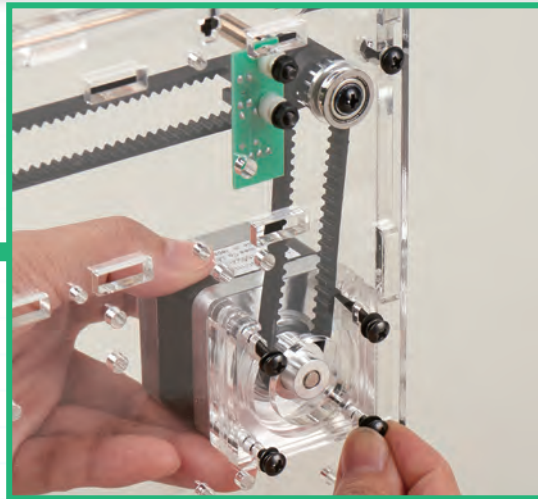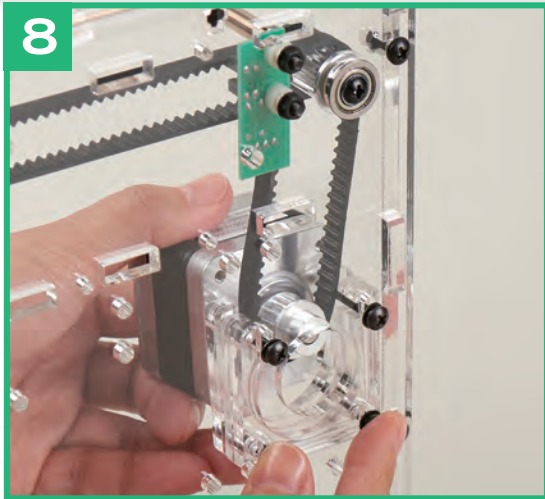
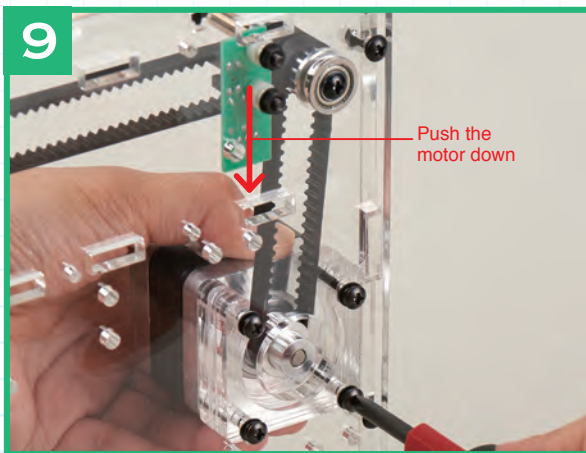## Attach the motor

7

Connector

Put the belt on the gear

Hold the motor so the connector is at the bottom and hook the small timing belt over its pulley, as you offer up the motor from the inside of the casing.

8

Hold the bracket assembly and the truss head screws in position. Tighten them with your fingers so that they are done up enough to hold the motor in position.

9

Push the motor down

Push down on the top of the motor firmly but gently with your thumb while you tighten the screws with a screwdriver. You do this to move the screws down in their oblong screw holes and take up any slack in the timing belt.
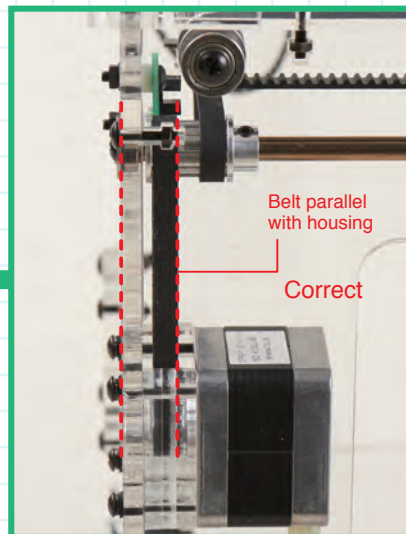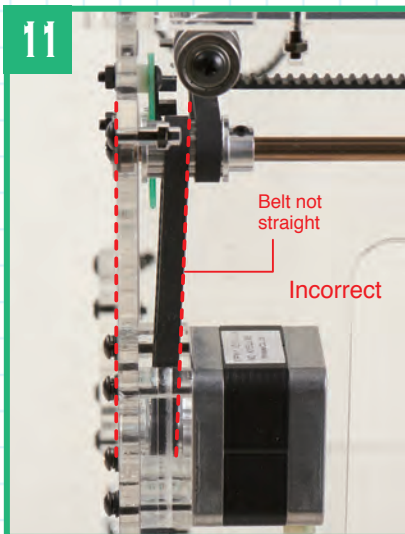
HINT If there is a gap between the heads of the screws and the housing, add one of the four extra flat washers to each of the screws.

10
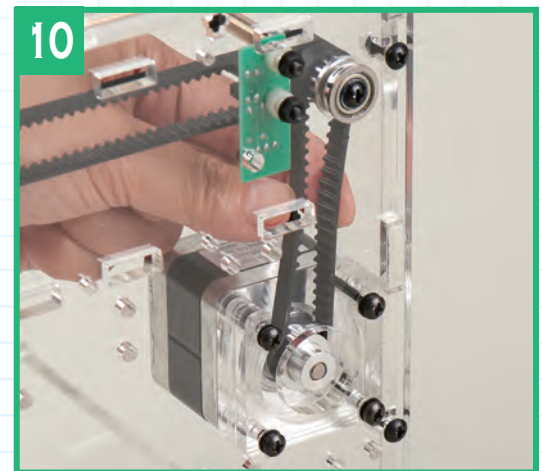
When the motor is attached, check the tension again in the small timing belt. It should be about the same as in the large timing belts.

Stage finished

11

Belt not straight

Incorrect

Belt parallel with housing

Correct

Look at the motor from the left of the housing to check the belt alignment. If it is not parallel with the housing's rear panel, slide the belt along the large pulley at the top until it is. Check the belt's tension after aligning, and adjust as required.
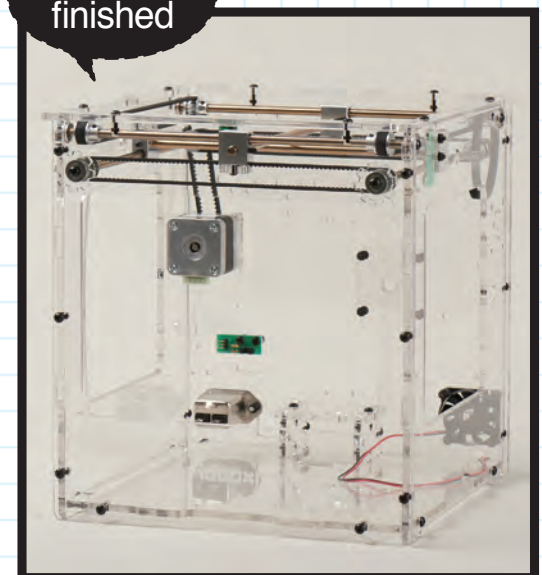
The X-axis motor is now attached to the housing. Next time, you begin work on the Y-axis motor.

Stage 34: Attach the timing pulley to the Y-axis motor shaft

In this stage, you will work on the Y-axis motor, the one that controls the front and back movements of the printer head. The assembly involves adding a pulley to the shaft of the motor and it is virtually identical to the one you attached in Stage 32, when you added a pulley to the X-axis motor.

As in Stage 32, the assembly of the timing pulley onto the Y-axis motor shaft is relatively straightforward. Just remember to align the flat surface of the motor shaft with the screw hole for the set screw that holds the pulley onto the shaft. And make sure the pulley is on the right way round and that the end of the motor shaft is level with the end of the pulley; if it's not in the correct position the motor can run roughly.
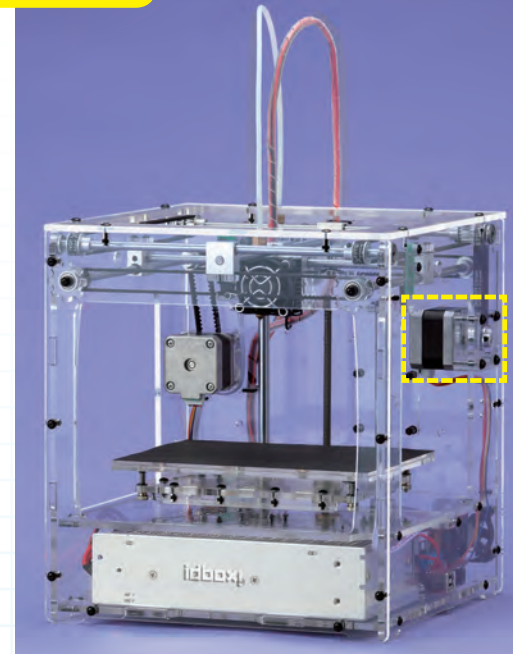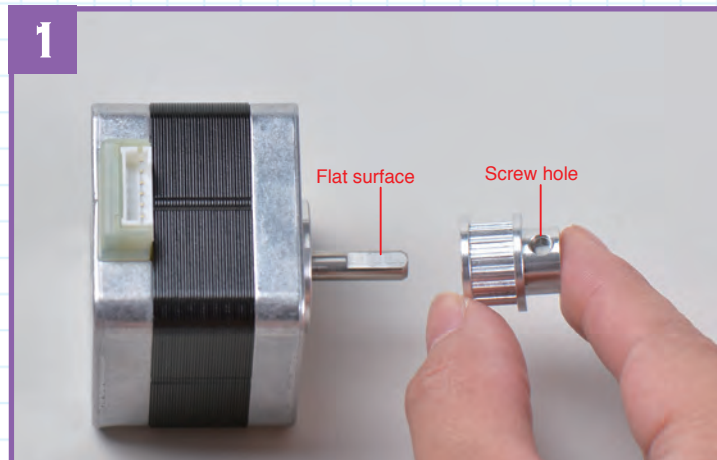

Stage 34 Components

1: Y-axis motor
2: M4 set screw 3mm x 1
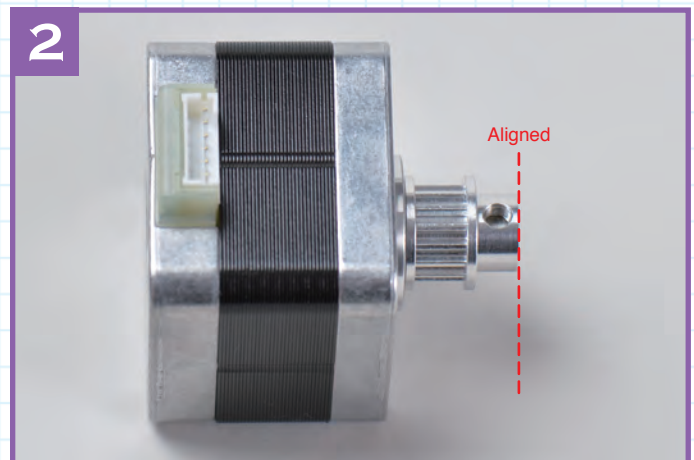**3:** S3M timing pulley (15-5-7) x 1

Tools you will need

Allen key (2mm) provided with Stage 11

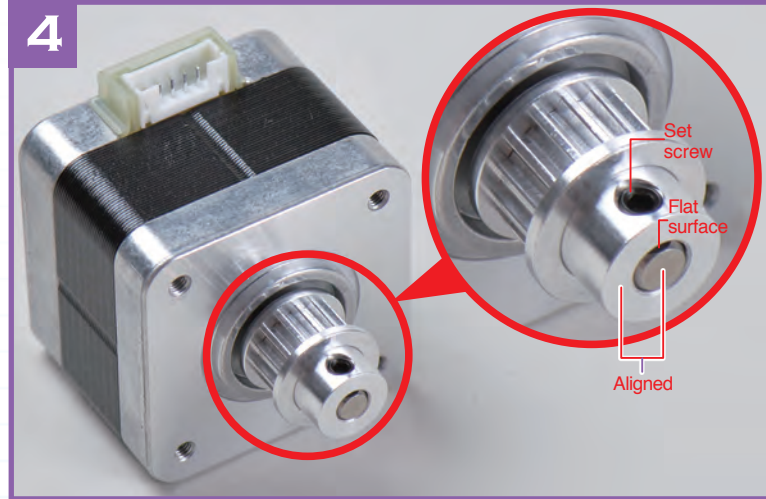## Add the timing pulley to the motor shaft

1

Flat surface   Screw hole

Insert the motor shaft into the pulley so that the flat section of the shaft and the screw hole in the pulley are on the same side.

2

Aligned

Align the end of the shaft with the end of the pulley.

3

Put the set screw on the Allen key and insert it into the screw hole, and tighten it by turning clockwise.

4

Set screw

Flat surface

Aligned

Check again that the end of the shaft is aligned with the end of the timing pulley, and that the set screw is tightened up against the flat section of the motor shaft.

Checking the function of the X-axis motor

The X-axis motor was attached to the frame and the timing pulley in Stage 33; you can now check out how it's functioning. With the right of the printer housing facing you, slowly move the left and right sliders back and forth together using one hand on each. This will rotate the motor. When in operation, the sliders are moved by the motor but the sliders will also move the motor and you can check that the pulleys and belts are doing their job. The slider rods have not yet been lubricated, so do not move the sliders too vigorously.
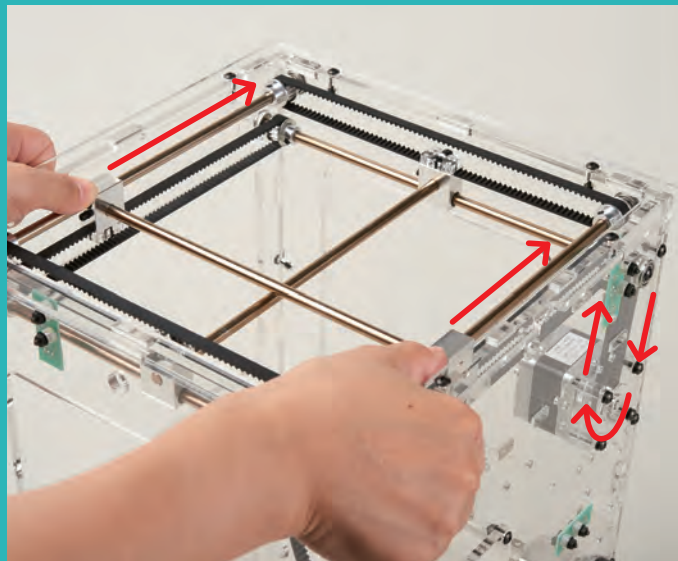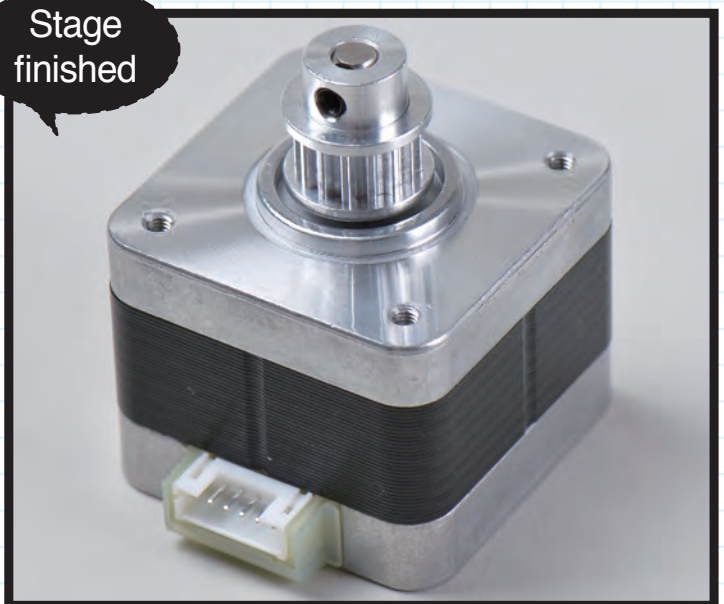

Electronically controlled stepper motor

CLOSE-UP

The type of motor used in the idbox! is a stepper motor. Under electronic control, these motors can move by exact amounts one way or the other. Such a motor can give very precise control and their use in the idbox! enables the printer to create models highly accurately.

Stage finished

The pulley is now attached to the shaft of the Y-axis motor. Next time, the motor is added to the right side of the housing.

Stage 35 Assembly Area

Stage 35: Attach the Y-axis motor to the right of the printer housing

In this stage, you attach the Y-axis motor to the inside of the right panel of the printer housing. It is held in place on a three-part bracket by four truss head screws.

The assembly in this stage is very much like that for Stage 33, where you attached the X-axis motor. Remember that the bracket used to hold the motor in position is made of three 'U'-shaped sections of acrylic that you put together before screwing the mounting screws through the back of the housing and into the screw holes in the motor. The holes in the housing are oblong, so you can move the motor up and down to adjust the tension in the timing belt, which you hook over the pulley that you attached to the Y-axis motor in Stage 34.
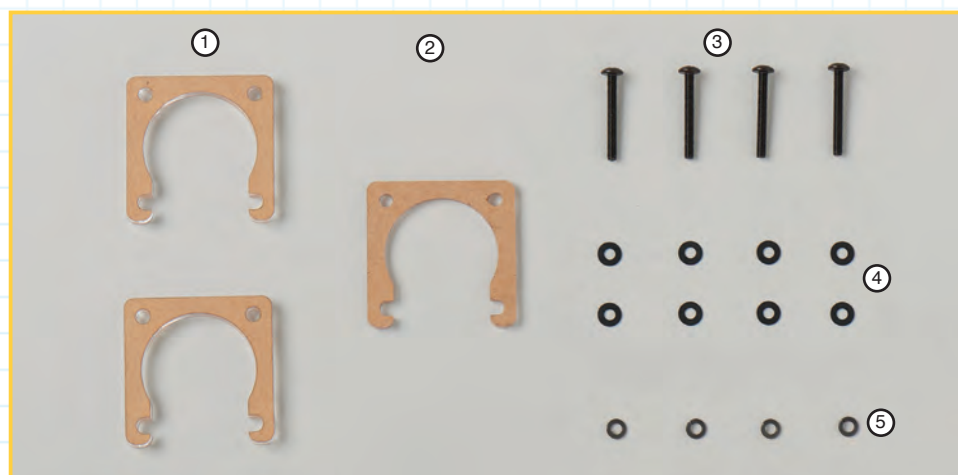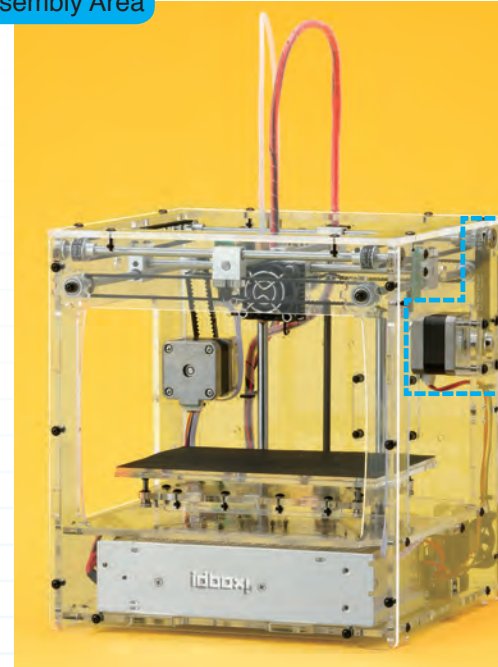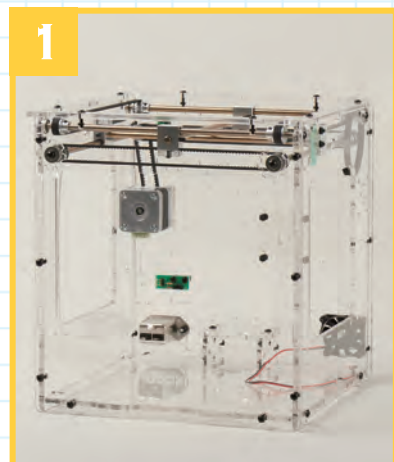

Stage 35 Components

1: Brackets (5mm thick) × 2
2: Bracket (4mm thick) × 1
3: M3 truss head screws (24mm) x 4
4: M3 flat washers x 8
5: M3 spring washers x 4

Note: You will use four of the flat washers as a matter of course; the other four are provided if there is a gap between the screw heads and the housing.
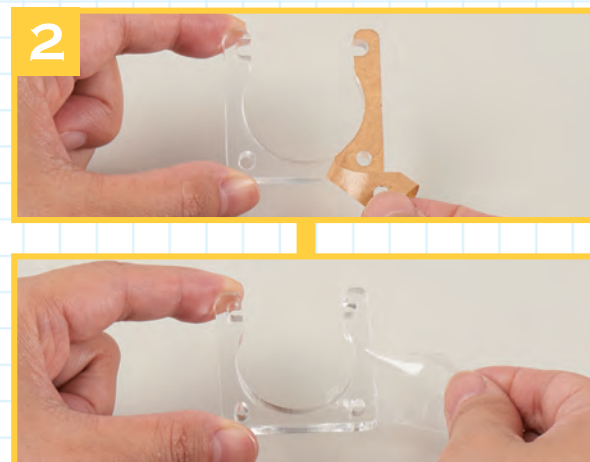
Tools you will need

Phillips screwdriver size 1
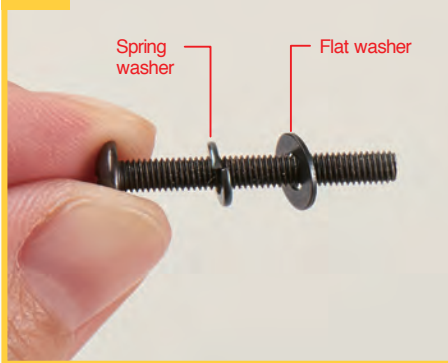
Parts to have ready

1

Get ready the housing for the printer and the Y-axis motor that you last worked on in Stage 34.

2

Peel the protective layers off both sides of the three brackets supplied with this stage.

Loosely attach the bracket to the housing
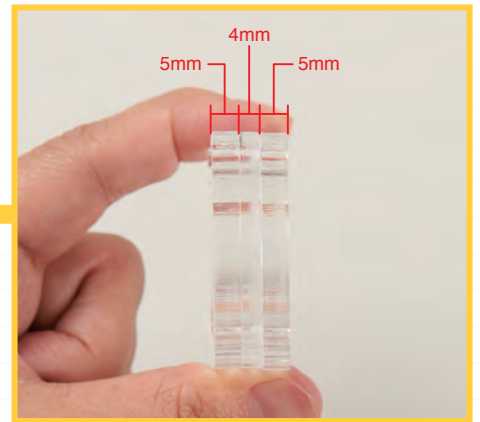
3

Spring washer — — Flat washer

Put a spring washer and then a flat washer onto one of the 24mm M3 truss head screws. Repeat this for the other three screws supplied with this stage.
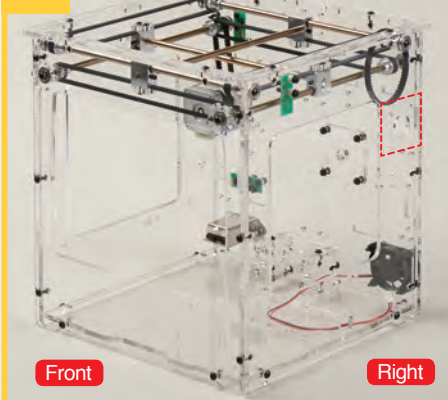
4

4mm
5mm — — 5mm

Put together the three brackets, as shown, to make a 'U' shape, with the two 5mm brackets on the outside and the 4mm bracket on the inside.

5

Front   Right

Brackets make 'U' shape

Turn the printer so that its right and front panels are facing you. The large hole on the right (outlined in red above left) has four oblong screw holes (ringed in red above right), around it. From the inside of the housing, offer up the stack of brackets with the 'U' shape the correct way up so the screw holes align with the ones on the housing.
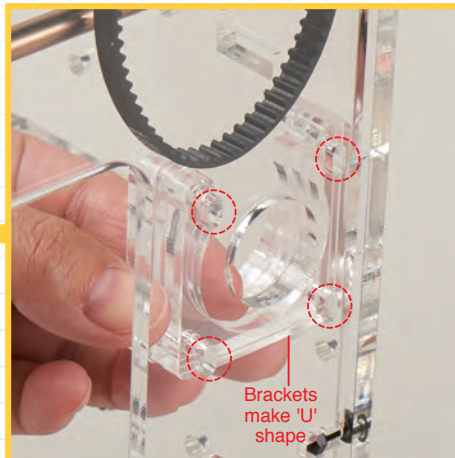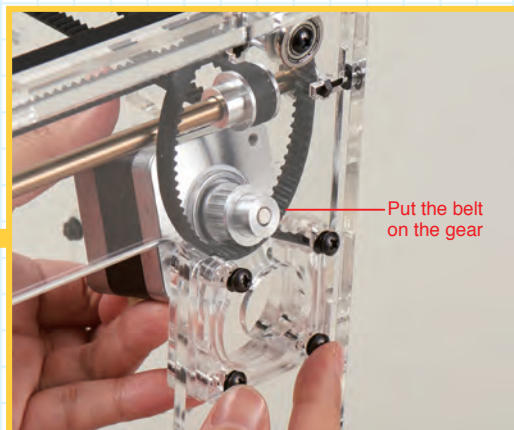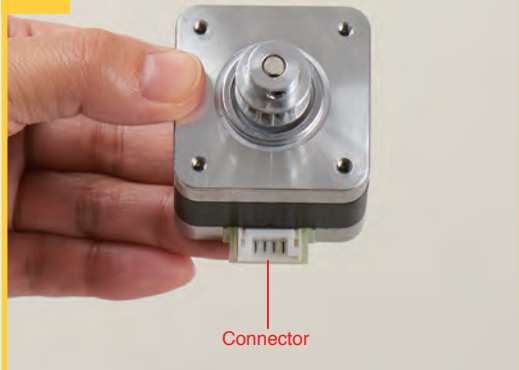
6
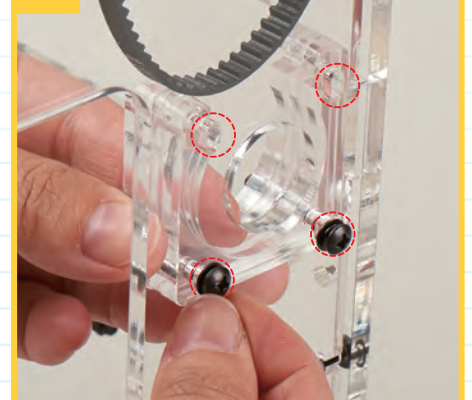
Insert the four 24mm M3 truss head screws (with their washers) into the oblong holes (ringed in red) in the housing.

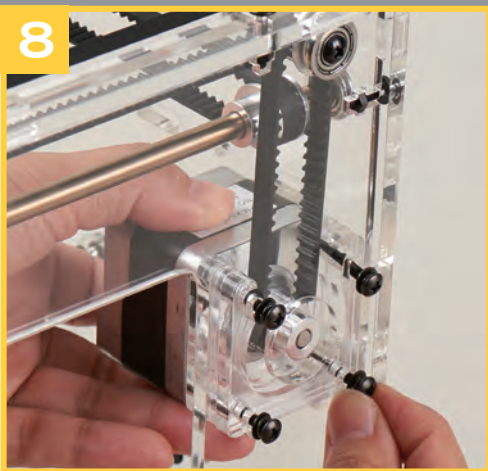## Attach the motor

7

Connector

Put the belt on the gear

Hold the motor so the connector is at the bottom and hook the small timing belt over its pulley as you offer up the motor from the inside of the casing. Hold onto the brackets and truss head screws to stop them falling off while you do this.
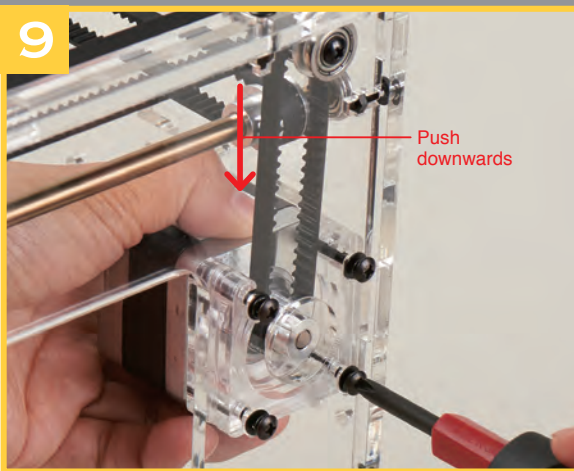
8

Screw the truss head screws into the screw holes in the motor using your fingers, so they are tight enough to hold the motor in place.

9

Push downwards

Push down on the top of the motor firmly but gently with your thumb while you tighten the screws with a screwdriver. By pushing the motor down, you move the screws down in their oblong screw holes and take up any slack in the timing belt.

HINT

If there's a gap between the heads of the screws and the housing, add one of the four extra flat washers to each of the screws.

POINT

Check the tightness of the screws holding the motor in position periodically when using the idbox! as they can become loose because of vibration from the motor.

Adjust the position of the belt and pulley

10

Belt touching pulley

Incorrect

Pulley centred to belt

Correct
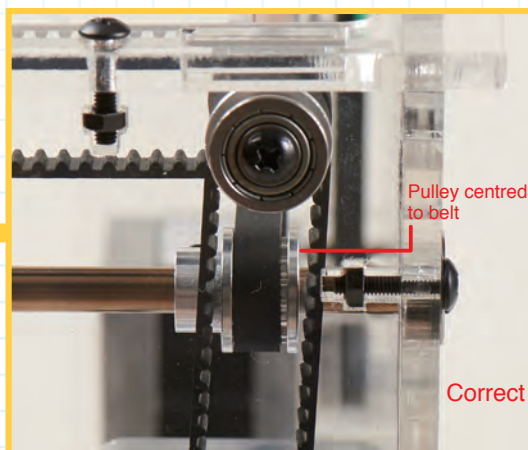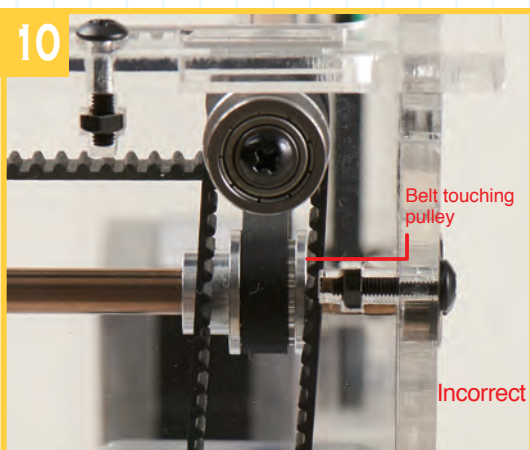
Check to see whether the small pulley is touching the timing belt coming from the Y-axis motor. If it is, loosen the pulley's set screw and move the pulley until it clears the belt, and then retighten the set screw.

POINT

If the position of the pulley needs adjusting, loosen its set screw with an Allen key.

11

Belt not straight

Incorrect

Belt parallel with housing

Correct
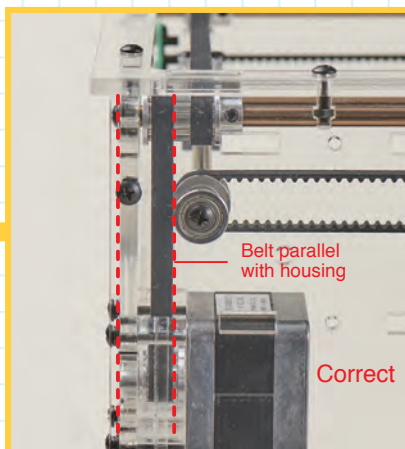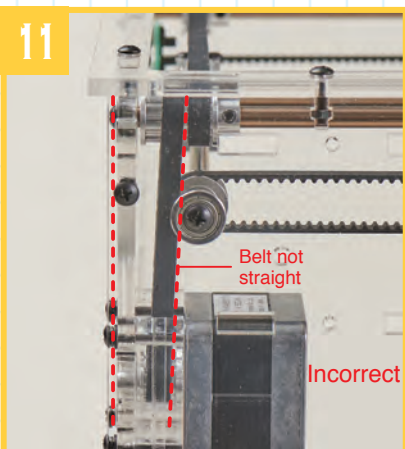
Look at the motor from the rear of the housing to check the belt alignment. If it's not parallel with the housing's right panel, slide the belt along the large pulley at the top until it is. Check the belt's tension after aligning, and adjust as required. It should be about the same as that of the large timing belts.

Stage finished
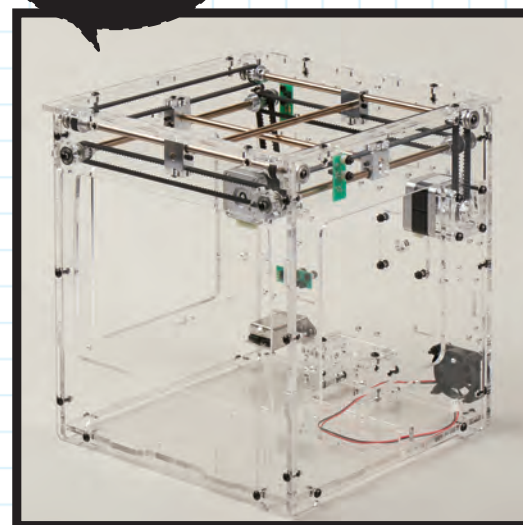
The Y-axis motor is now attached to the housing.

BUILD YOUR OWN

idbox!
3D PRINTER