

AR10 Hand

10 Degrees of Freedom Humanoid Hand

Assembly Guide

AR10 Humanoid Robotic Hand

Thank you for choosing the AR10 Robotic Hand.

This assembly guide provides you with information relating to the build of the AR10 robotic hand.

Latest Instructions



Check the Active8 Robots website for the latest build instructions and documentation. www.active8robots.com

Case



The foam in the box has been shaped to fit a right hand once fully assembled.

To house a left hand simply flip the two layers of foam over.

Left or Right Hand

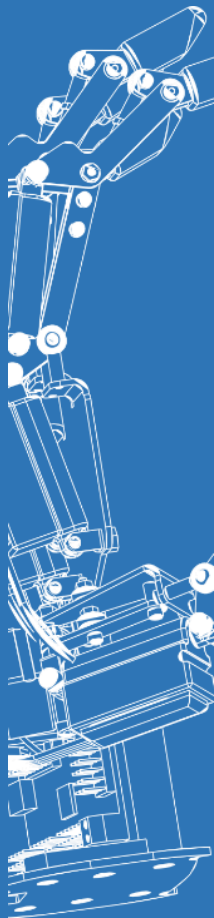


1. Palm plate - H8R & H8L
2. Wrist Support - H7R & H7L
3. Electronics Carrier - ECR & ECL
4. Power Board Carrier – PBR & PBL



EC and PB come ready assembled for a right hand.
To build a left hand the circuit boards need to be fitted to ECL and PBL (see pages 60 & 62)

The first half of the build is identical for both left and right hands.



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Ensure these instructions are noted for correct assembly.

Loctite



Loctite must be used on ALL screw fixings.

A small amount is to be applied on the thread of the screws. Avoid getting any on the bearings.

Tightening



It is important to firmly tighten each fixing, whilst paying careful attention that all plates remain parallel.

Lock nuts require further force. Tightening should continue after initial resistance is felt.

Gap Setting Tool



The Gap Setting Tool (GST):

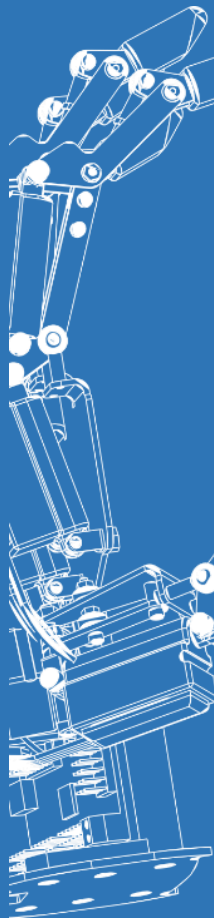
To set 6mm spacing for parallel plates

For use in between bearings (RB) and the metal plate to ensure proper alignment

Spare screws



A number of spare nuts and bolts have been included within the kit. You may therefore complete the assembly with left over nuts and bolts.



Parts List

Parts List

Metal Parts

*Thumb B***H1**

x1

*Thumb A***H2**

x1

*Thumb Tip***H3**

x2

*Finger Link Tip***H4**

x8

*Finger Link***H5**

x8

*Lower Finger Left***H6L**

x4

*Lower Finger Right***H6R**

x4

*Wrist Support***H7R**

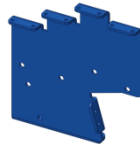
x1

*Wrist Support***H7L**

x1

*Palm Right***H8R**

x1

*Palm Left***H8L**

x1

*Base Plate***H9**

x1

Parts List

Electronics



*Firgelli Actuator
250mm cable*

**19, 17, 15, 13
LA250**

x4



*Firgelli Actuator
200mm cable*

**18, 16, 14, 12, 11, 10
LA200**

x6



*Right Servo
Controller*

ECR

x1

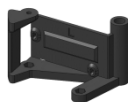


*Power Board
Right*

PBR

x1

Miscellaneous Parts



*Servo Controller
Bracket Left*

ECL

x1



*Power Board
Bracket Left*

PBL

x1



Fingertip

FT

x4



Thumb Tip

TH

x1



Finger Linkage

L1

x4



Rod End Bearing

RB

x12



U Bracket

B1

x6



Flanged Bearing

FB

x32



6mm Spacer

S6

x15



40mm Pillar

P40

x3

Fixings



Cap Screw

M2x4

x12



Cap Screw

M2x6

x20



Cap Screw

M2x8

x10



Cap Screw

M2x12

x8

Fixings



Cap Screw

M2x16

x1



Cap Screw

M3x14

x15



Cap Screw

M3x16

x5



Dome Screw

M3x5D

x6



Dome Screw

M3x6D

x4



Countersink Screw

CSK2

x8



Countersink Screw

CSK3

x5



Nut

N2

x9



Nut

N3

x20



Lock Nut

LN2

x9



Lock Nut

LN3

x16



Washer

W2

x20



Gap Setting Tool

GST

x1



Allen Key 1.5mm

AL1

x1



Allen Key 2mm

AL2

x1



Loctite 262 10ml

L262

x1

Tools



Spanner 4mm

SP4

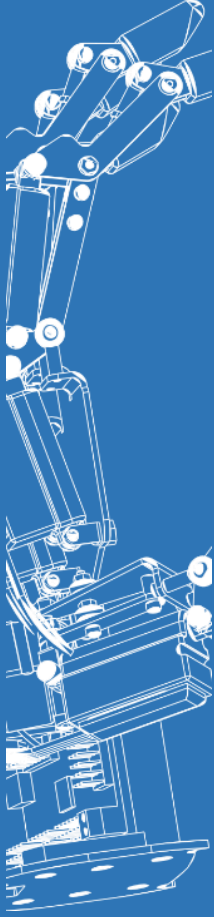
x1



Spanner 5.5mm

SP5

x1

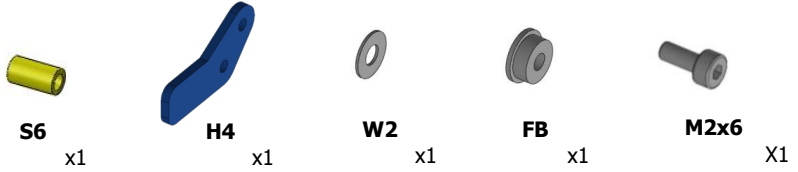


Fingertip Assembly

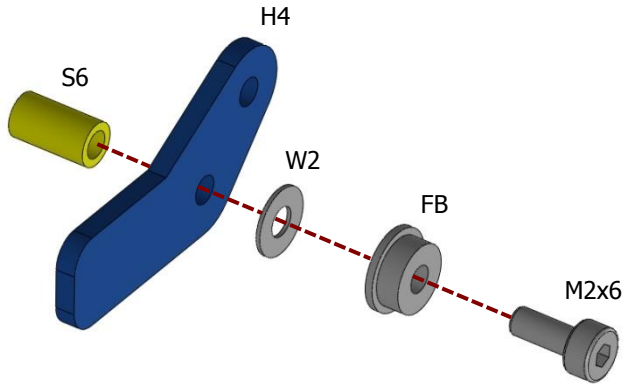
Fingertip Assembly

Ensure you have read the assembly instructions before beginning the build.

Parts Required



Assembly



Notes

Fingertip Assembly

Parts Required

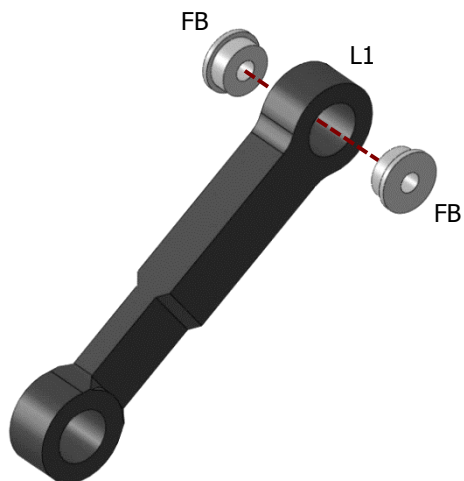
**L1**

x1

**FB**

x2

Assembly

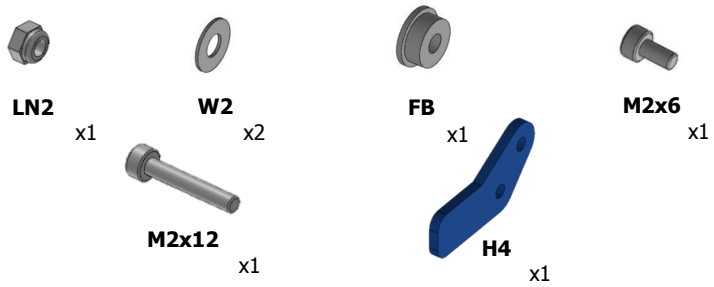


Notes

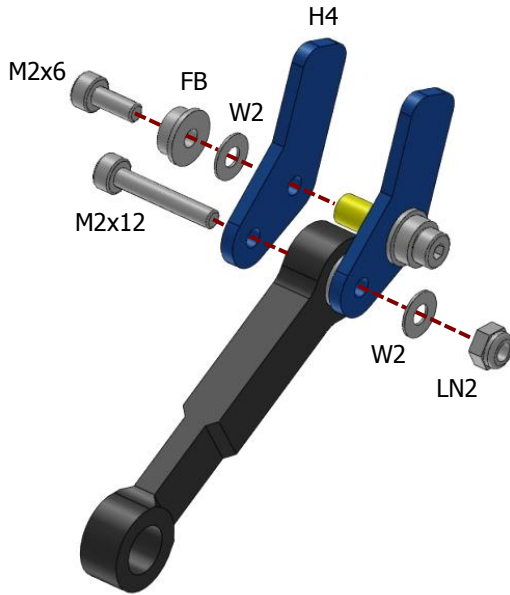
Insert 2 bearings through the eyelet of the thicker side of the linkage.

Fingertip Assembly

Parts Required



Assembly



Notes

Ensure all plates are aligned and parallel. Lock nuts require further force to tighten. Continue tightening M2x12 once initial resistance is felt.

Fingertip Assembly

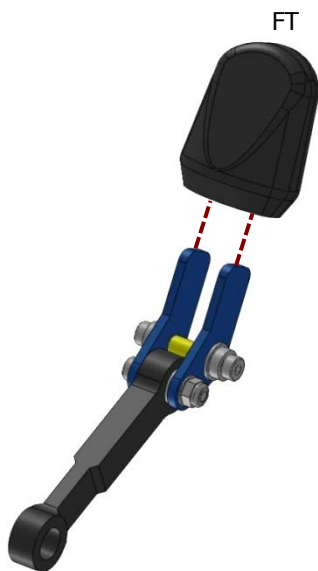
Notes

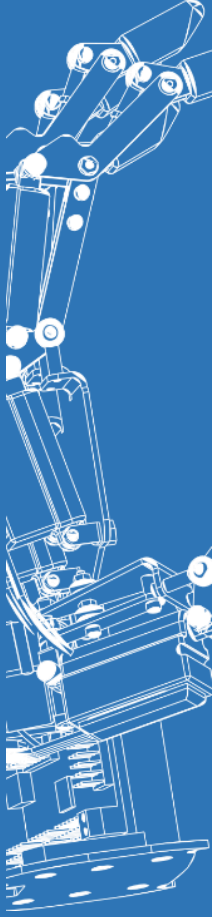
Assembly

Parts Required

**FT**

x1





Lower Finger Assembly

Lower Finger Assembly

Parts Required

**N2**

x2

**W2**

x2

**H6L**

x1

**FB**

x2

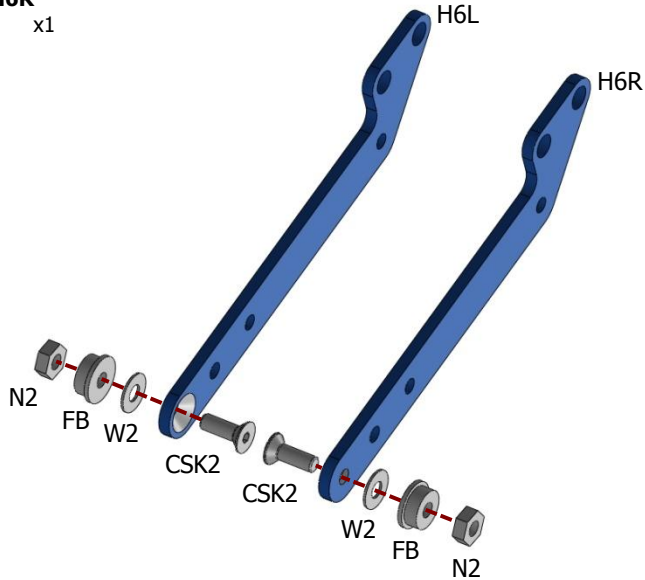
**CSK2**

x2

**H6R**

x1

Assembly



Notes

Ensure the CSK2 screws are fitted from the countersunk side of the H6 finger part. Avoid getting Loctite on the bearings.

Lower Finger Assembly

Parts Required

**S6**

x2

**M2x8**

x1

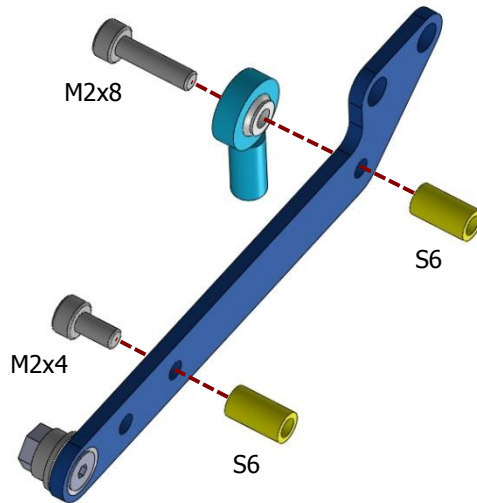
**M2x4**

x1

**RB**

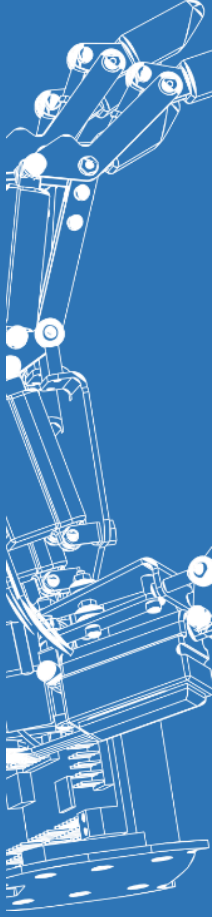
x1

Assembly



Notes

Only assemble the H6L side as shown.



Full Finger Assembly



Full Finger Assembly

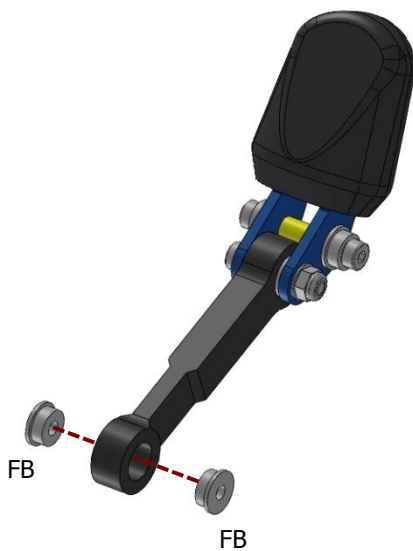
Parts Required



FB

x2

Assembly



Notes

Full Finger Assembly

Parts Required

**RB**

x1

**LN2**

x1

**M2x4**

x1

**M2x8**

x1

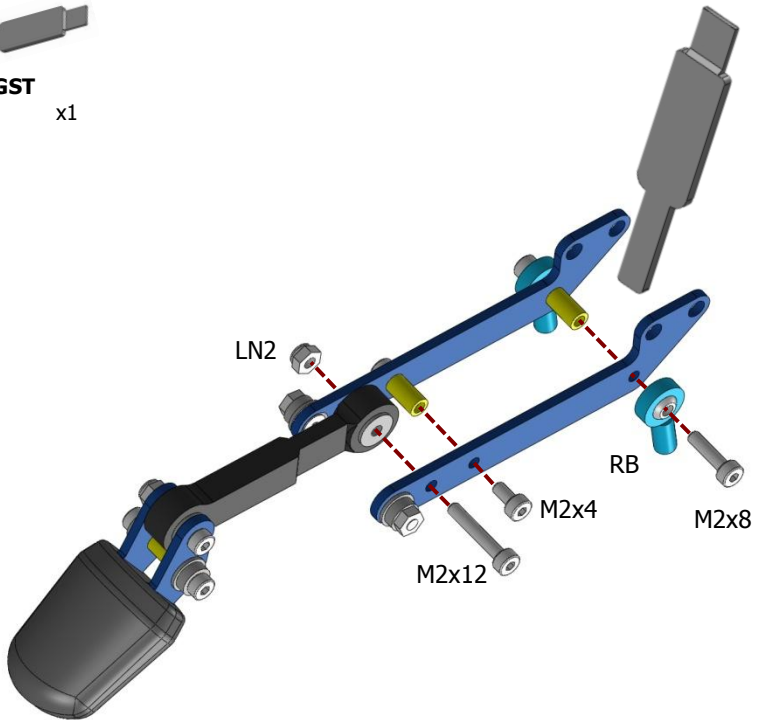
**M2x12**

x1

**GST**

x1

Assembly



Notes

Only tighten LN2 once the other two bolts have been tightened.

Use the Gap Setting Tool (GST) whilst fastening M2x12 to ensure overtightening does not occur and the plates remain parallel.

Both RB and the fingertip assembly should be parallel to the plate and move freely.

Full Finger Assembly

Parts Required

**19, 17, 15, 13**

x1

**M3x14**

x1

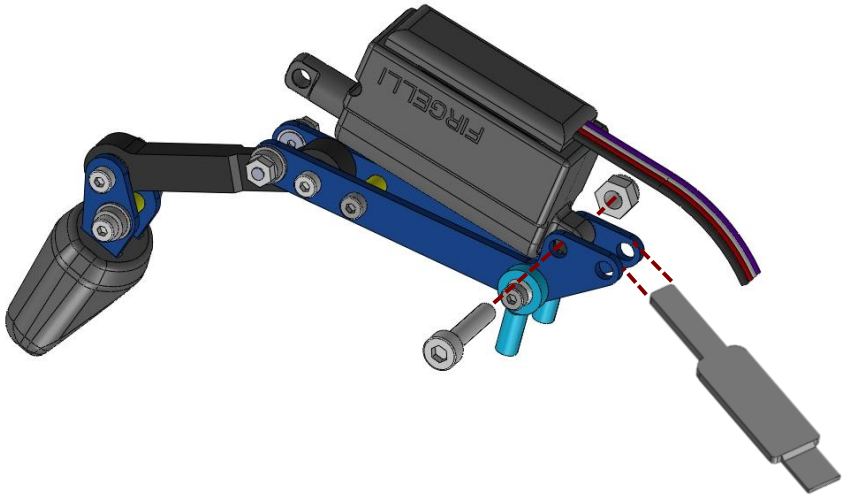
**LN3**

x1

**GST**

x1

Assembly



Notes

Use motors 19, 17, 15, 13.

Use the Gap Setting Tool (GST) to ensure the plates remain parallel.

Full Finger Assembly

Parts Required

**N3**

x1

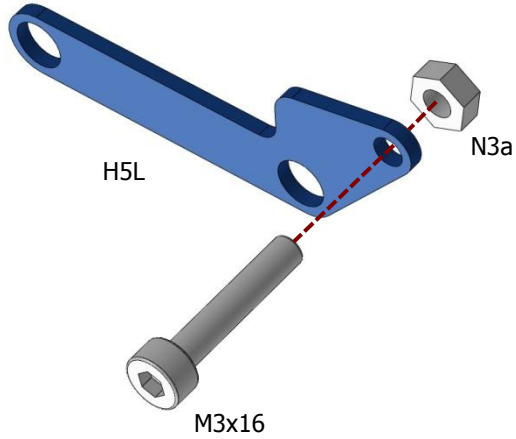
**M3x16**

x1

**H5**

x1

Assembly



Notes

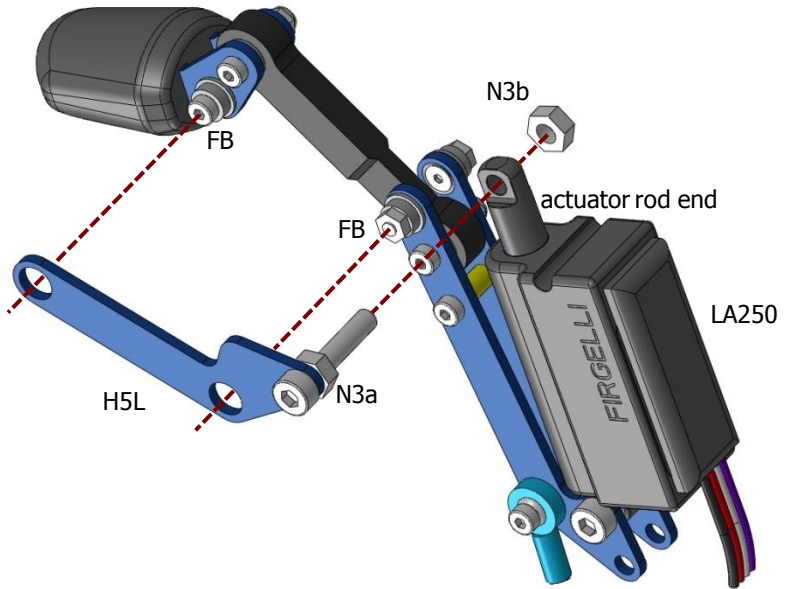
Tighten N3a to hold H5L firmly.

Parts Required

**N3**

x1

Assembly



Notes

Insert M3x16 into the actuator rod end of LA250 (19,17,15,13) whilst placing H5L over both FB as shown.

Hold in place with N3b.

Full Finger Assembly

Parts Required

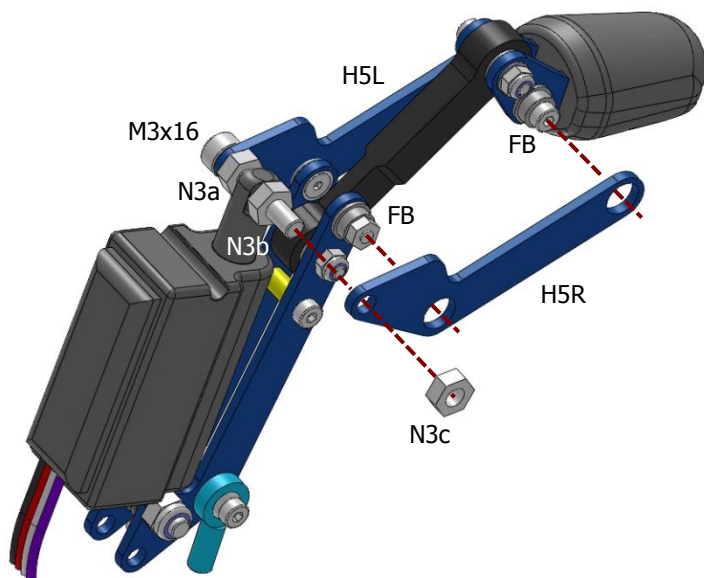
**N3**

x1

**H5**

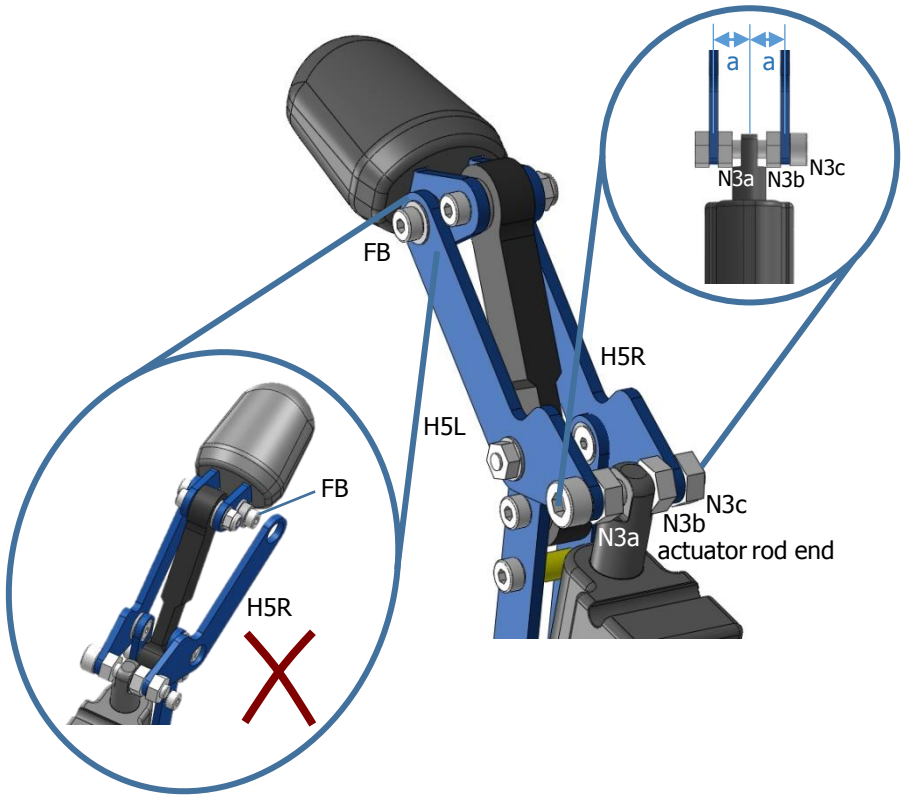
x1

Assembly



Notes

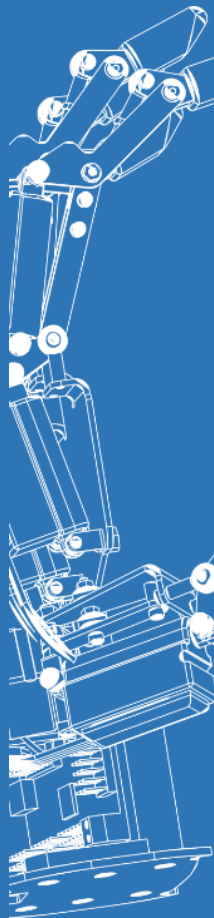
Position H5R over both FB and M3x16. Secure with N3c, whilst holding both H5 in place.



Ensure H5L and H5R sit parallel. Adjust and tighten N3b and N3c so that H5L and H5R are snugly fitted over FB on both sides and stay firmly in place.

This completes one finger.

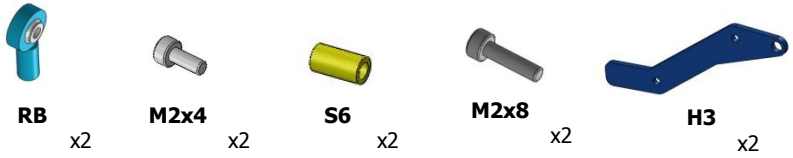
Repeat for the remaining three fingers.



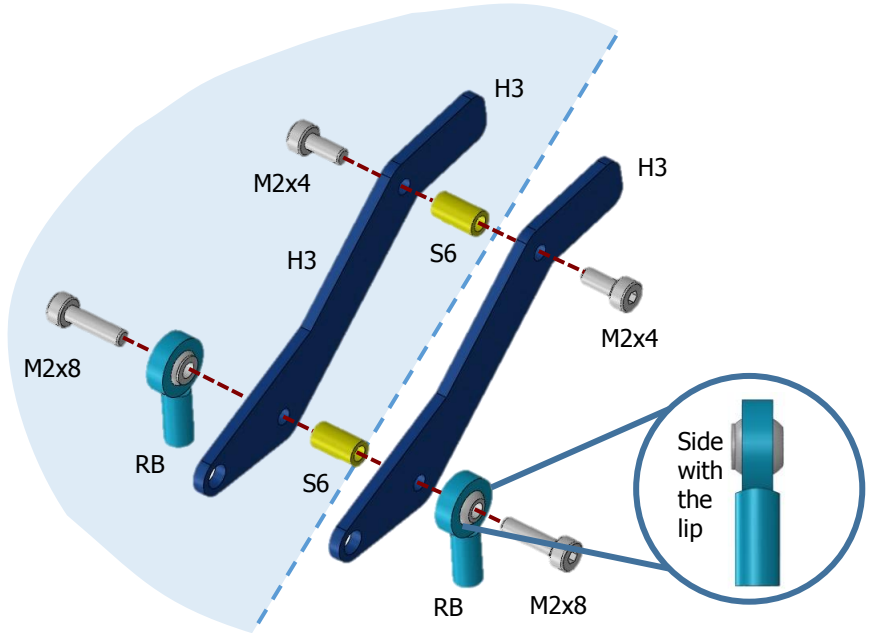
Thumb Assembly

Thumb Assembly

Parts Required



Assembly



Notes

Construct the highlighted side first.

When adding the opposite side, ensure H3 plates are parallel and RB lips are mounted in the same direction as each other.

Ensure RB move freely.

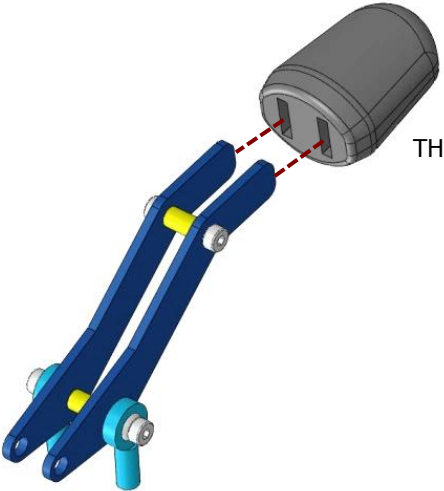
Thumb Assembly

Parts Required



TH
x1

Assembly



Notes

Thumb Assembly

Parts Required

**H2**

x1

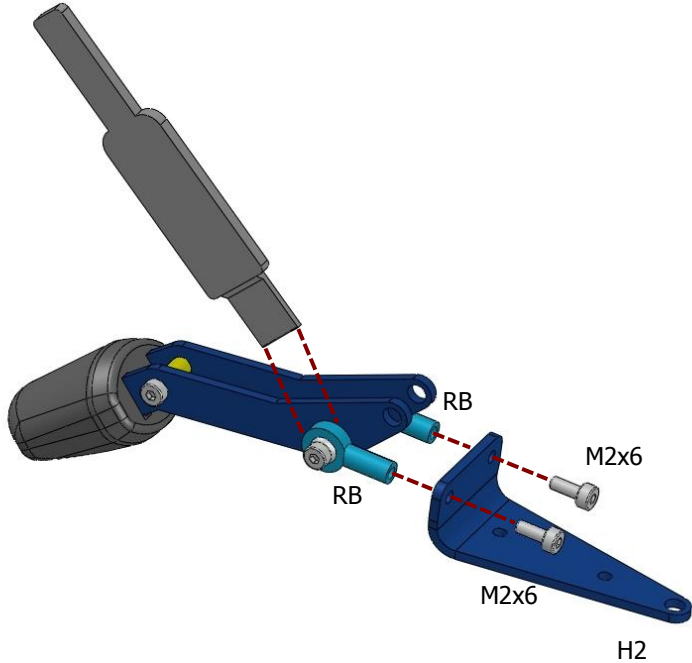
**M2x6**

x2

**GST**

x1

Assembly

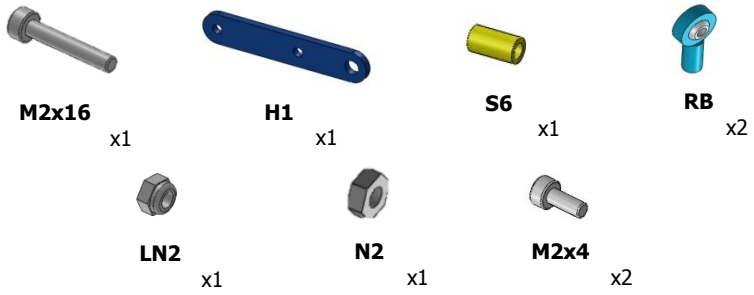


Notes

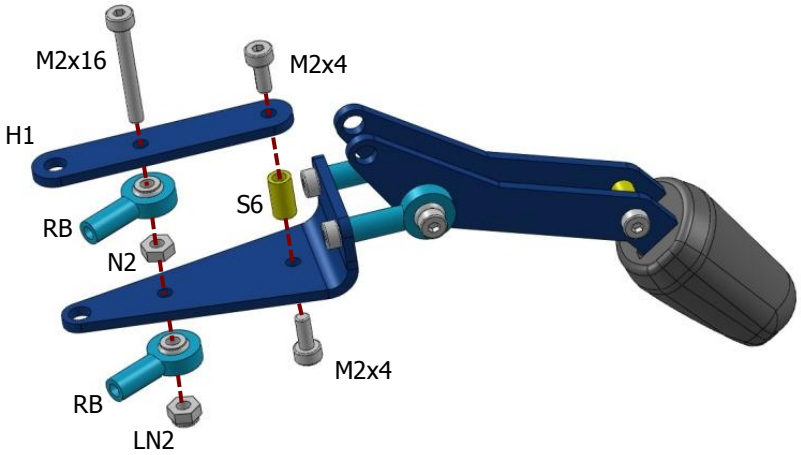
When tightening M2x6 use the Gap Setting Tool (GST) between RB and the plate to prevent twisting RB. Once tightened ensure RB still moves freely.

Thumb Assembly

Parts Required



Assembly

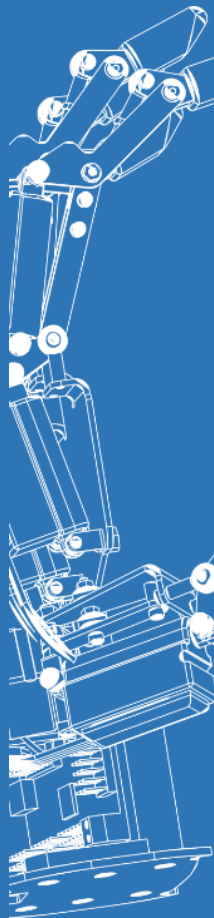


Notes

Once assembled put the thumb to one side to be attached later.

| | | |
|---|--------------------------|----|
| R | Right Hand Assembly..... | 31 |
|---|--------------------------|----|

| | | |
|---|-------------------------|----|
| L | Left Hand Assembly..... | 48 |
|---|-------------------------|----|



Right Hand Assembly

Palm Assembly - Right



Parts Required

**H8R**

x1

**N3**

x5

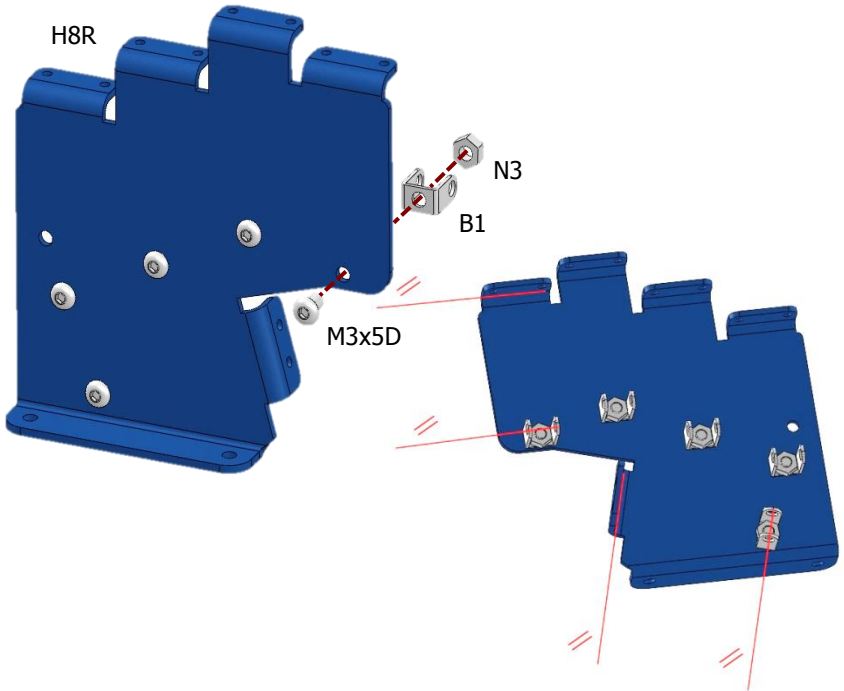
**M3x5D**

x5

**B1**

x5

Assembly



Notes

Attach B1 to H8 ensuring they are parallel to the flanges as shown above. Ensure they are fully tightened.

Parts Required

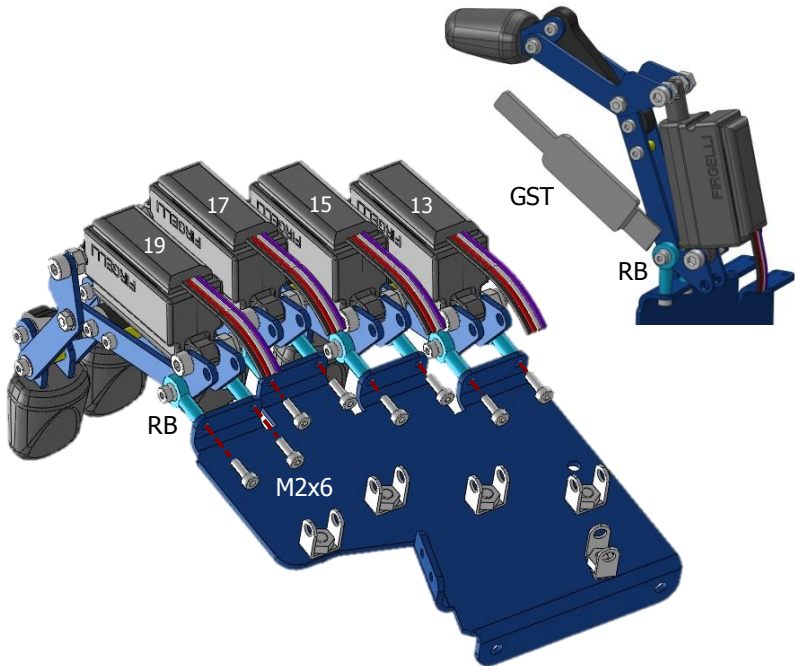
**M2x6**

x8

**GST**

x1

Assembly



Notes

Take careful note of the number on the motors. Ensure the order matches the diagram above.

Use the Gap Setting Tool (GST) between the rod end bearing (RB) and the finger plate. This ensures the RBs remain parallel thus enabling the fingers to hinge freely.

Parts Required



18, 16, 14, 12
LA200

x4



M3x14

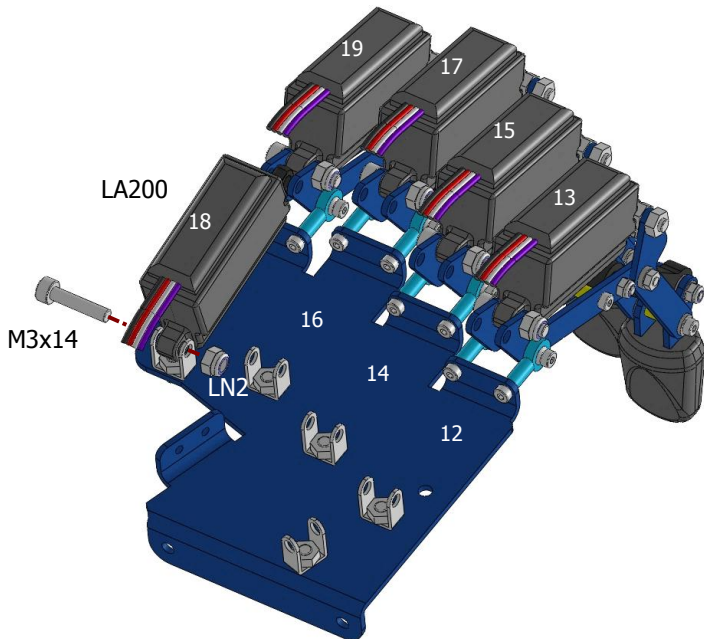
x4



LN3

x4

Assembly



Notes

Take careful note of the number on the LA200 actuators. Ensure they match the diagram above.

Tighten fully making sure the actuator can still pivot freely.

Repeat this for all 4 motors.

Parts Required

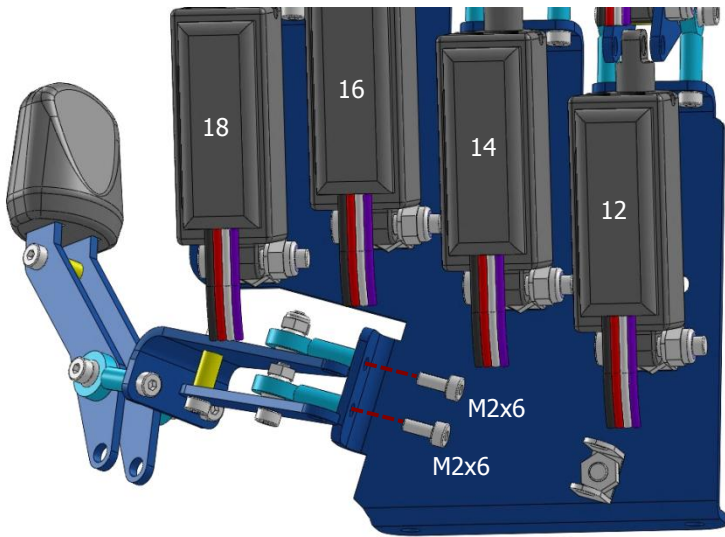
**M2x6**

x2

**GST**

x1

Assembly



Notes

Use the Gap Setting Tool (GST) to ensure RB do not twist and can move freely.

Palm Assembly - Right



Parts Required



10
LA200

x1



M3x14

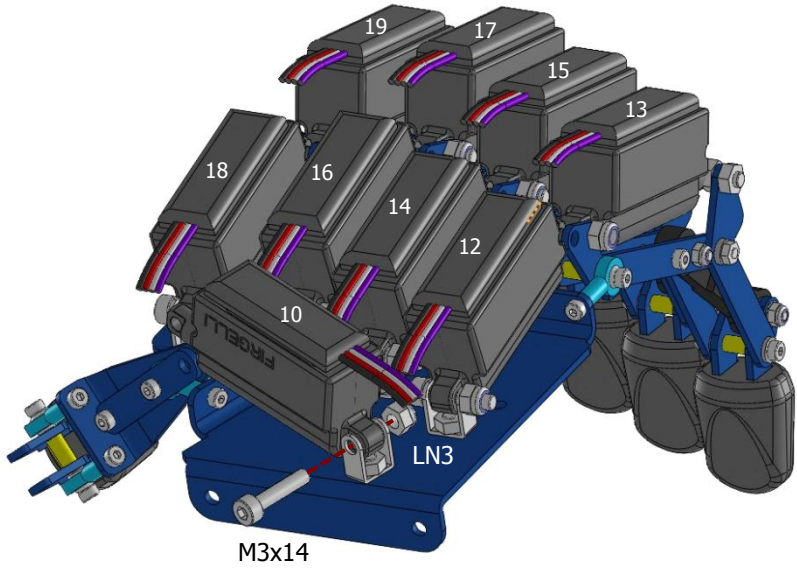
x1



LN3

x1

Assembly



Notes

Check the actuator used is labelled as no. 10.

Tighten fully making sure the actuator can still pivot freely.

Parts Required

**11
LA200**

x1

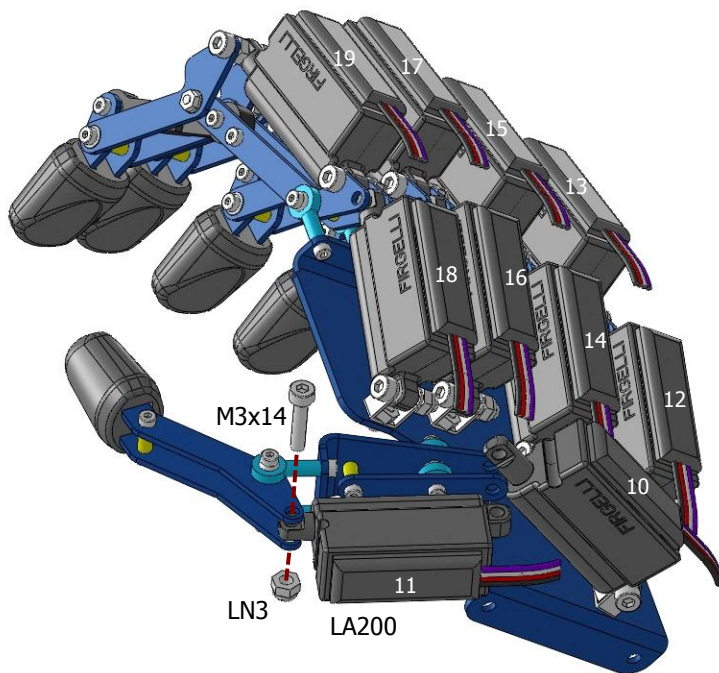
**M3x14**

x1

**LN3**

x1

Assembly



Notes

Check the actuator used is labelled as no. 11.

Palm Assembly - Right



Parts Required



H7R

x1



P40

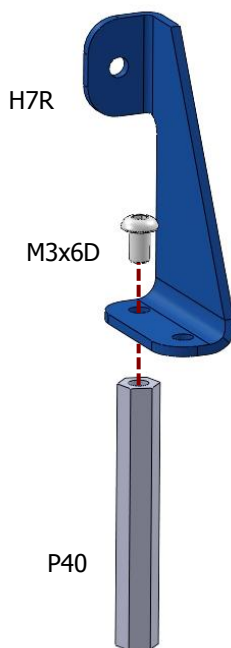
x1



M3x6D

x1

Assembly



Notes

Parts Required

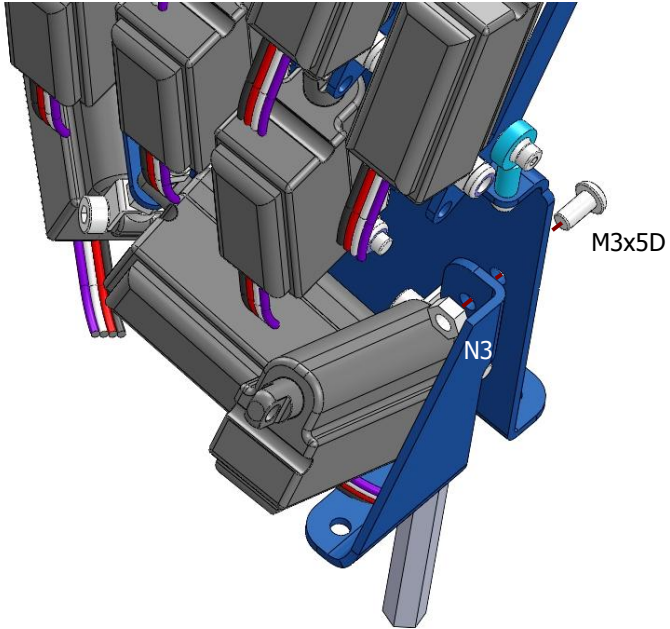
**N3**

x1

**M3x5D**

x1

Assembly

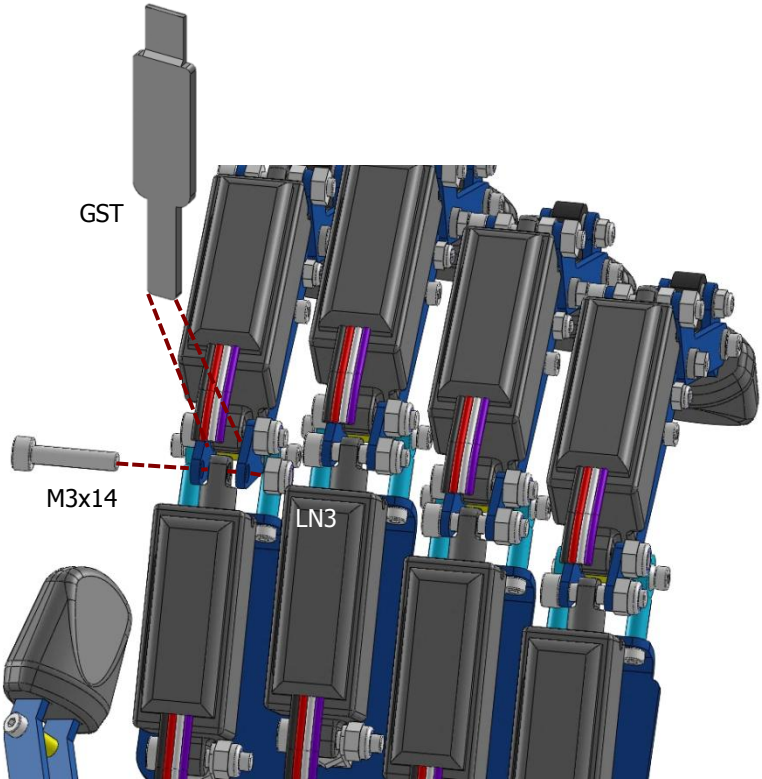


Notes

Parts Required



Assembly



Notes

Use the Gap Setting Tool (GST) whilst fastening to ensure overtightening does not occur and the plates remain parallel.

Repeat this for all 4 fingers.

Palm Assembly - Right



Parts Required

**M3x16**

x1

**B1**

x1

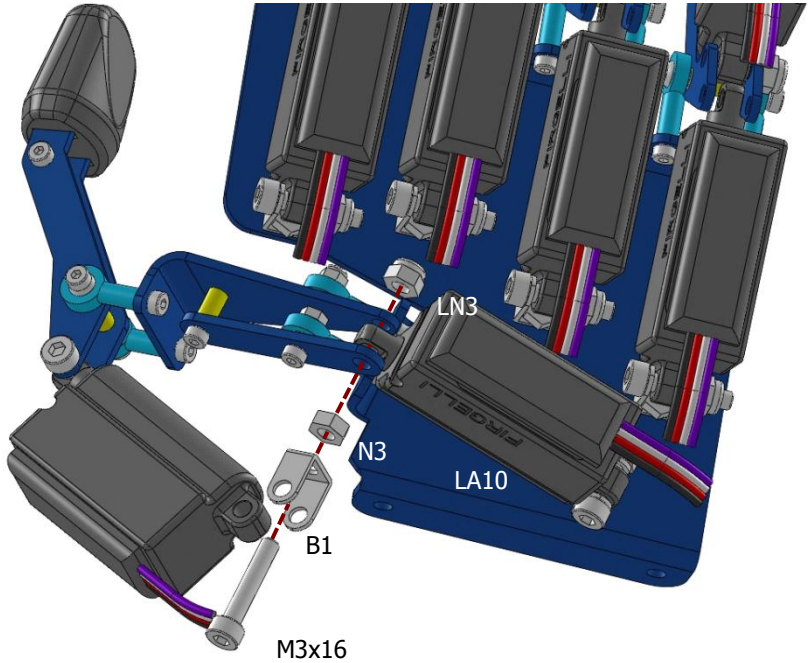
**N3**

x1

**LN3**

x1

Assembly



Notes

Route the actuator cables tidily under LA10 before securing the top of LA10.

Parts Required

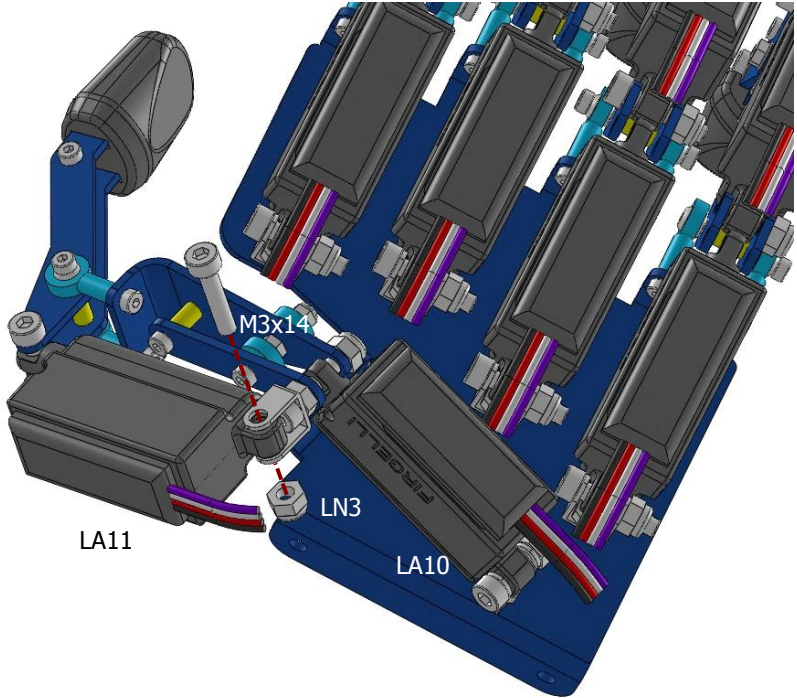
**M3x14**

x1

**LN3**

x1

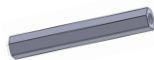
Assembly



Notes

Ensure the cables below LA10 actuator run smoothly before fixing LA11 at the base.

Parts Required

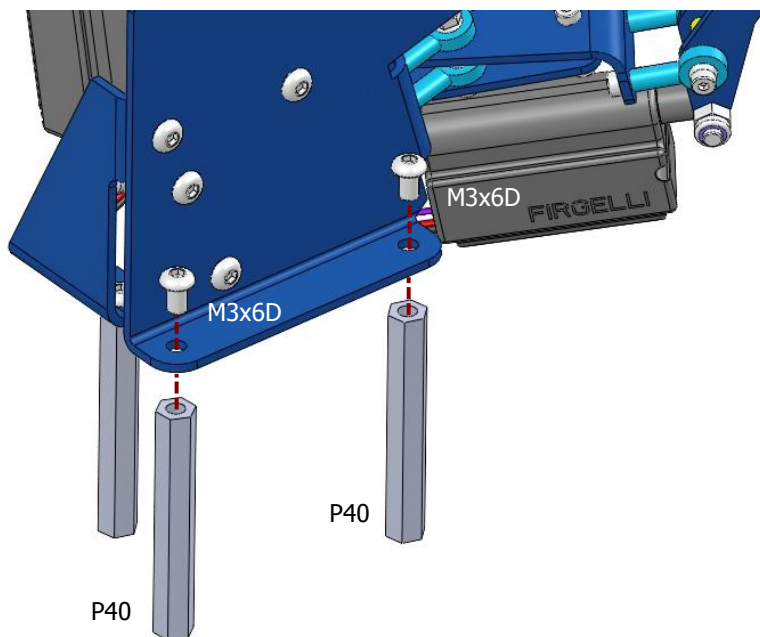
**P40**

x2

**M3x6D**

x2

Assembly



Notes

Parts Required



EC

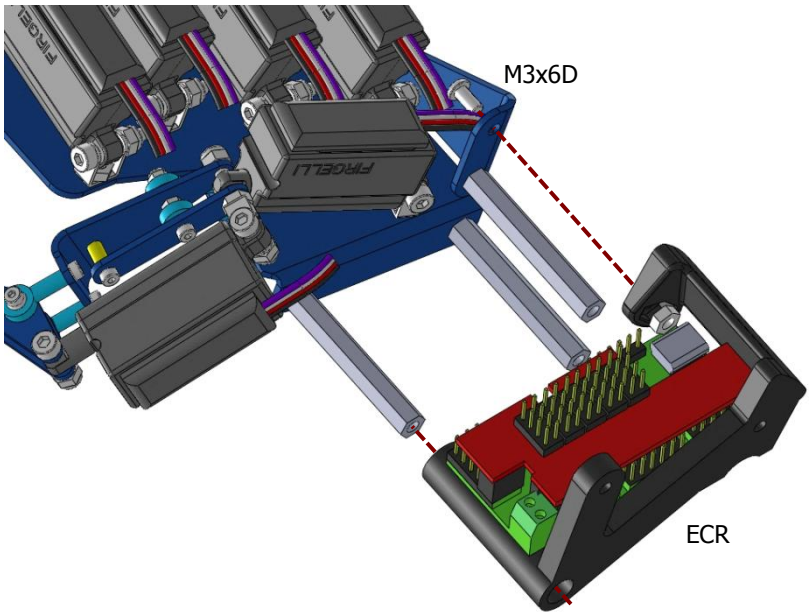
x1



M3x6D

x1

Assembly



Notes

Carrier houses nut for M3.

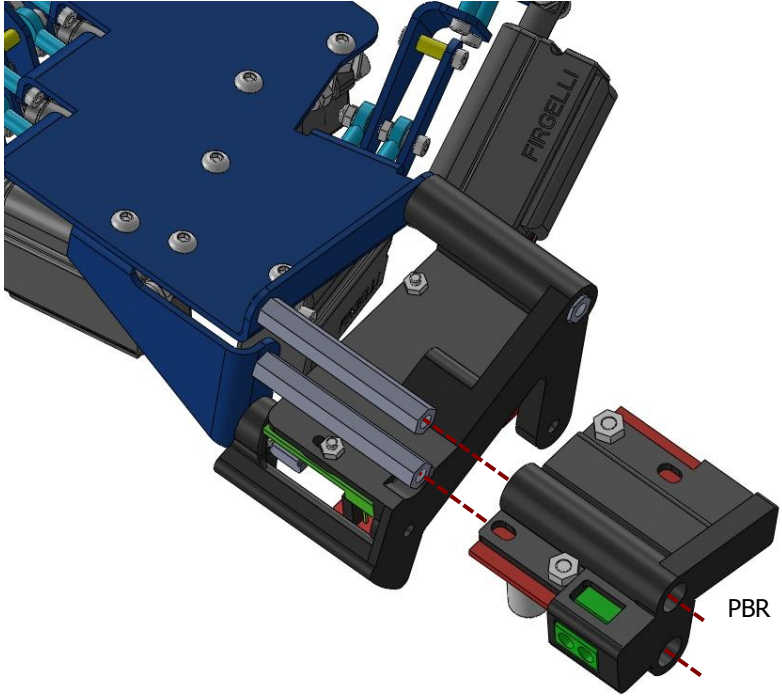
Notes

Assembly

Parts Required



PBR
x1



PBR

Parts Required



H9

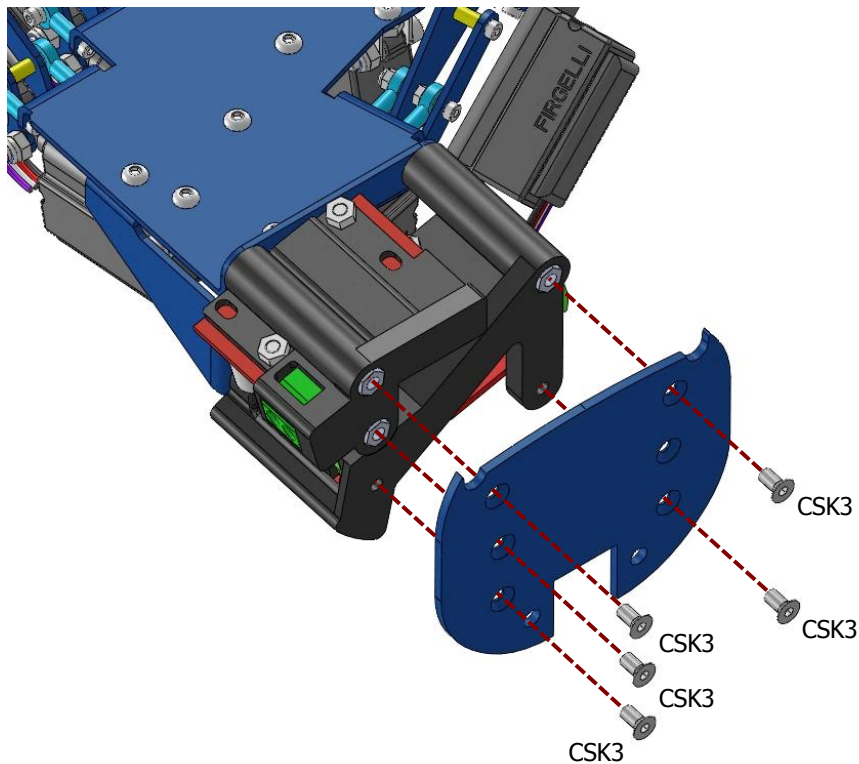
x1



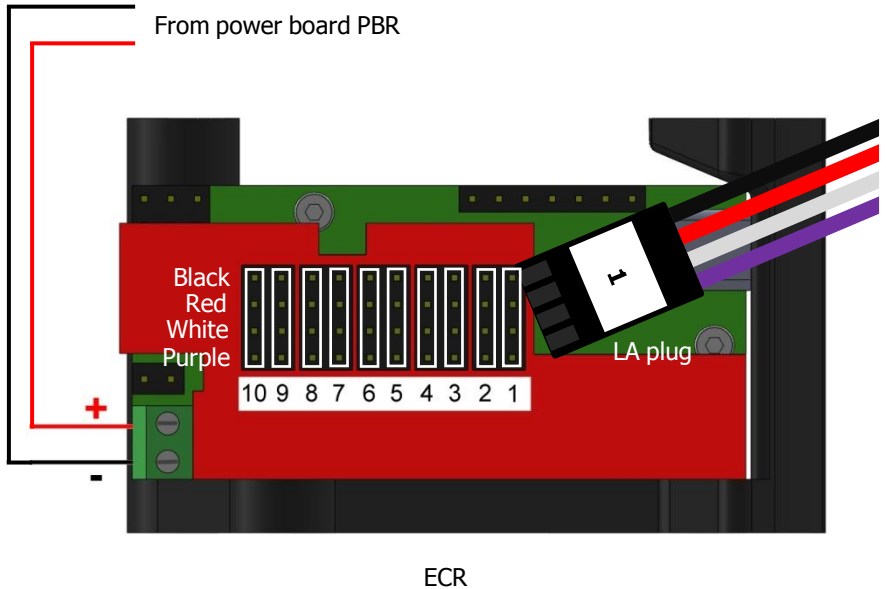
CSK3

x5

Assembly

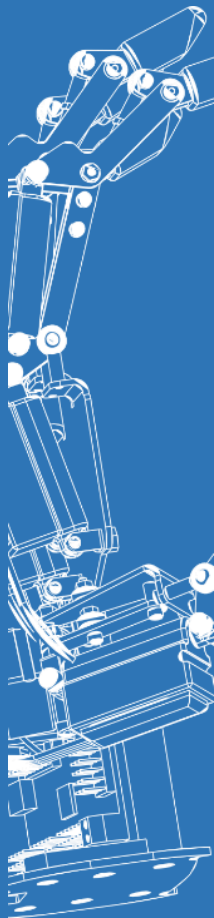


Notes



Connect LA plugs to ECR pins, taking care the numbers on the plugs match the numbers on the board. Ensure the purple wire is plugged in nearest the board numbers.

Connect the wire from the power board (PB) to the terminal on EC ensuring correct polarity.



Left Hand Assembly

Palm Assembly - Left



Parts Required

**H8L**

x1

**N3**

x5

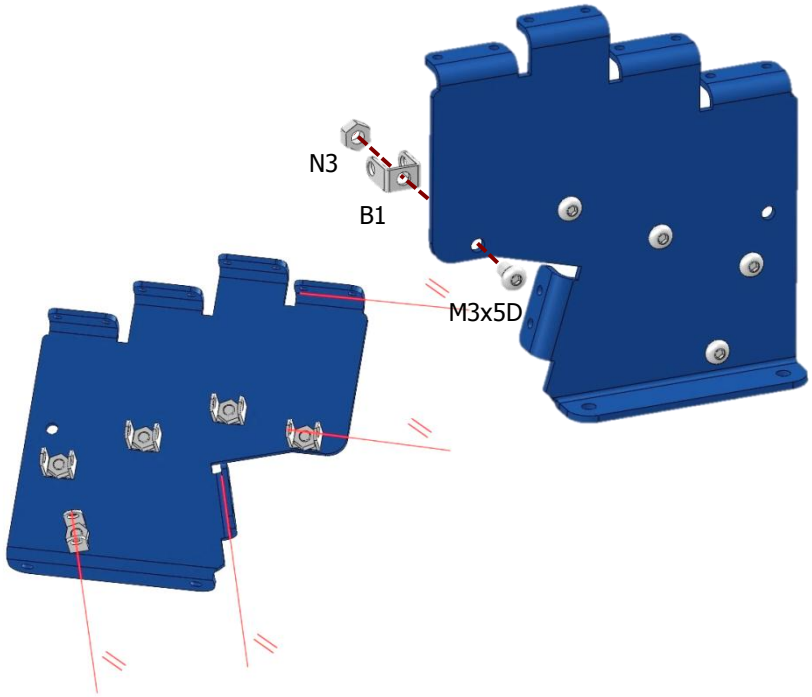
**M3x5D**

x5

**B1**

x5

Assembly



Notes

Attach B1 to H8L ensuring they are parallel to the flanges as shown above. Ensure they are fully tightened.

Parts Required

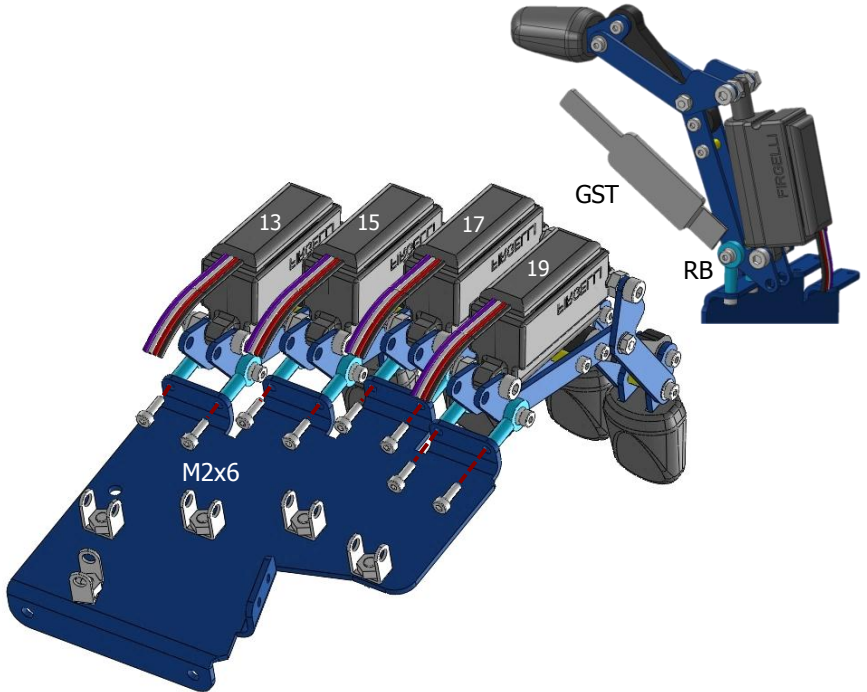
**M2x6**

x8

**GST**

x1

Assembly



Notes

Take careful note of the number on the motors. Ensure they match the diagram above.

Use the Gap Setting Tool (GST) between the rod end bearing (RB) and the finger plate. This ensures the fingers remain parallel and, enabling them to hinge smoothly.

Palm Assembly -Left



Parts Required



18, 16, 14, 12
LA200

x4



M3x14

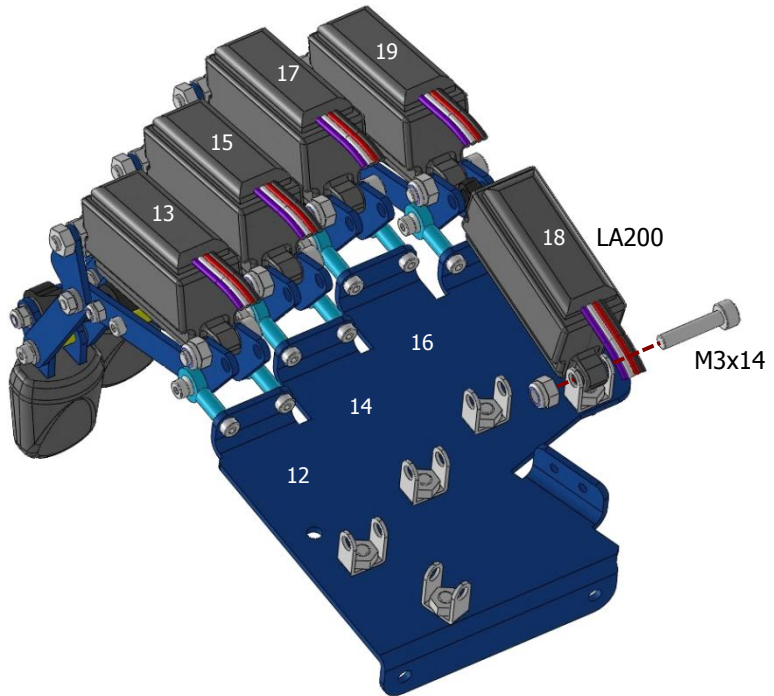
x4



LN3

x4

Assembly



Notes

Take careful note of the number on the LA200 actuators. Ensure they match the diagram above.

Tighten fully making sure the actuator can still pivot freely.

Repeat this for all 4 motors.

Parts Required

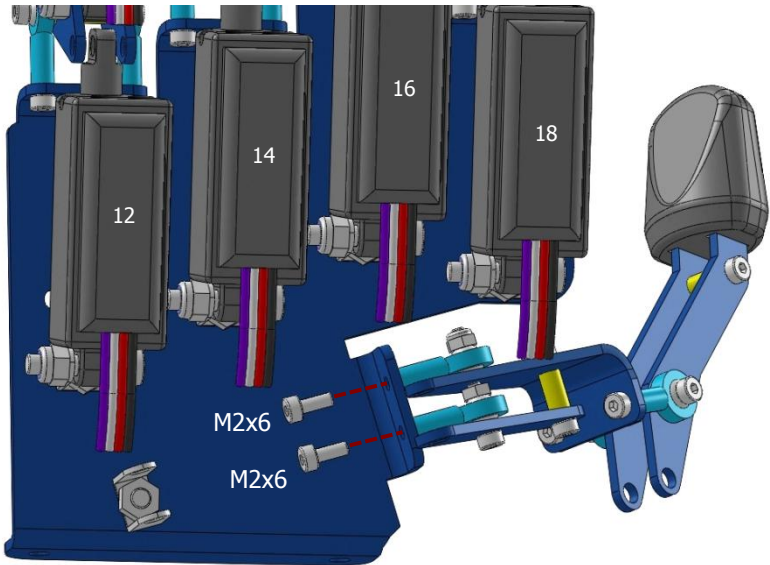
**M2x6**

x2

**GST**

x1

Assembly



Notes

Use the Gap Setting Tool (GST) to ensure RB do not twist and can move freely.

Palm Assembly - Left



Parts Required



10
LA200

x1



M3x14

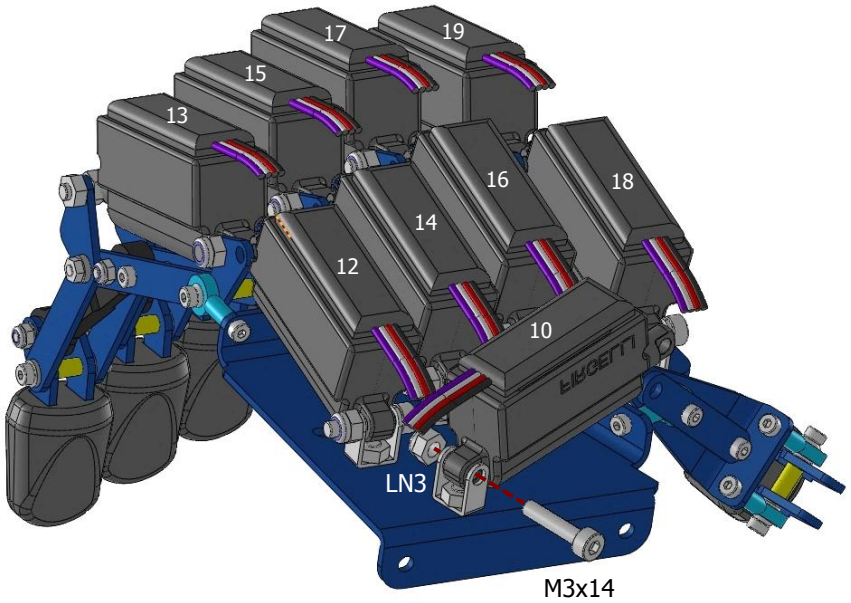
x1



LN3

x1

Assembly



Notes

Check the actuator used is labelled as no. 10.

Tighten fully making sure the actuator can still pivot freely.

Palm Assembly - Left



Parts Required

**11
LA200**

x1

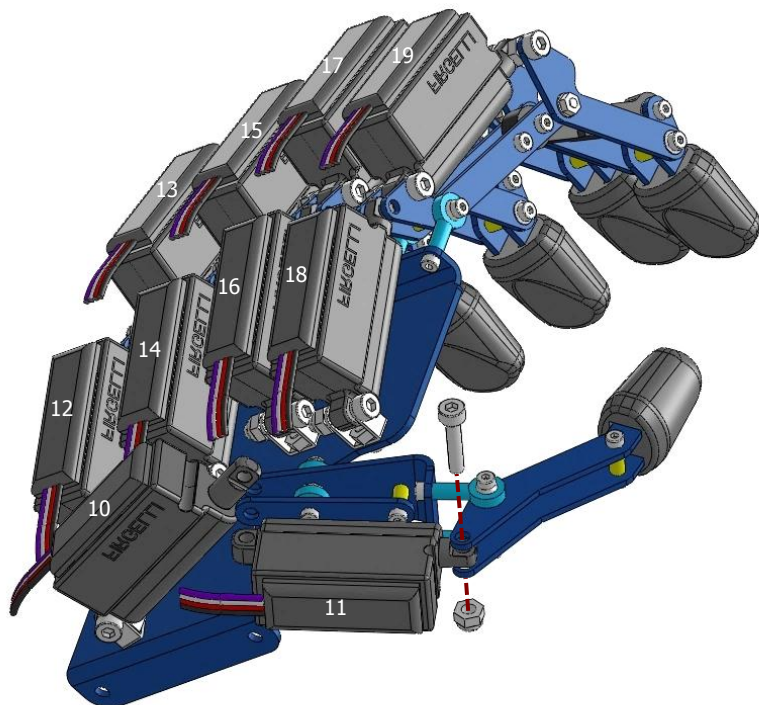
**M3x14**

x1

**LN3**

x1

Assembly



Notes

Check the actuator used is labelled as no. 11

Palm Assembly - Left



Parts Required

**H7L**

x1

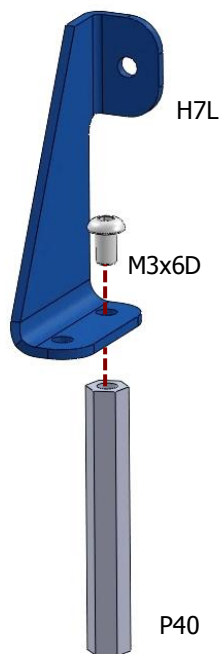
**P40**

x1

**M3x6D**

x1

Assembly



Notes

Parts Required

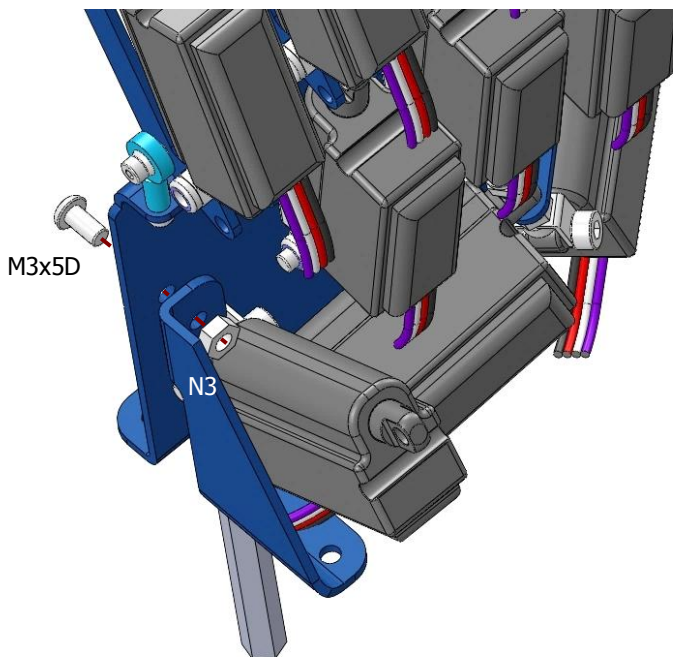
**N3**

x1

**M3x5D**

x1

Assembly



Notes

Palm Assembly - Left



Parts Required

**M3x14**

x4

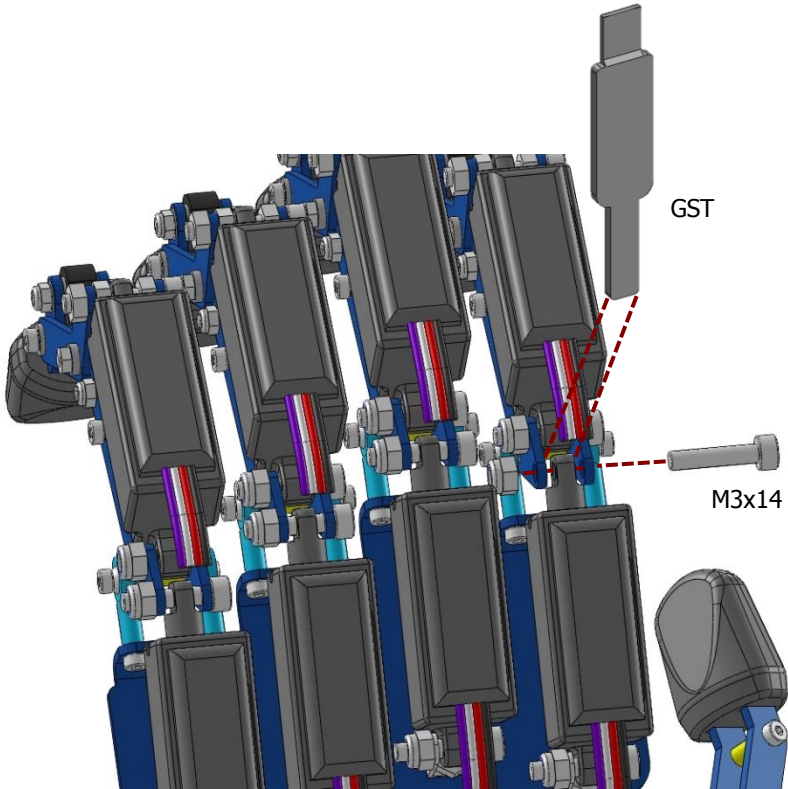
**LN3**

x4

**GST**

x1

Assembly



Notes

Use the Gap Setting Tool (GST) whilst fastening to ensure overtightening does not occur and the plates remain parallel.

Repeat this for all 4 fingers.

Palm Assembly - Left



Parts Required

**M3x16**

x1

**B1**

x1

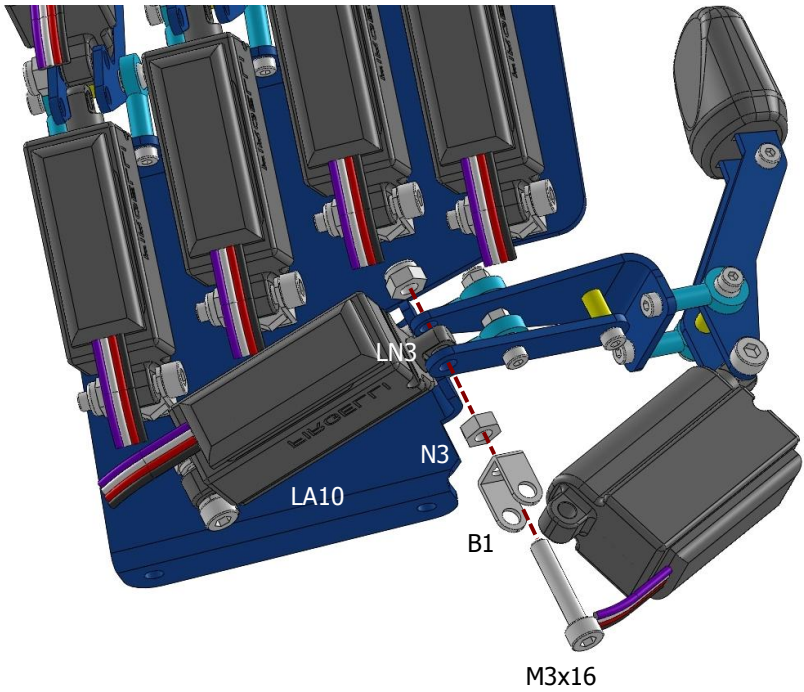
**N3**

x1

**LN3**

x1

Assembly



Notes

Route the actuator cables tidily under LA10 before securing the top of LA10.



Parts Required

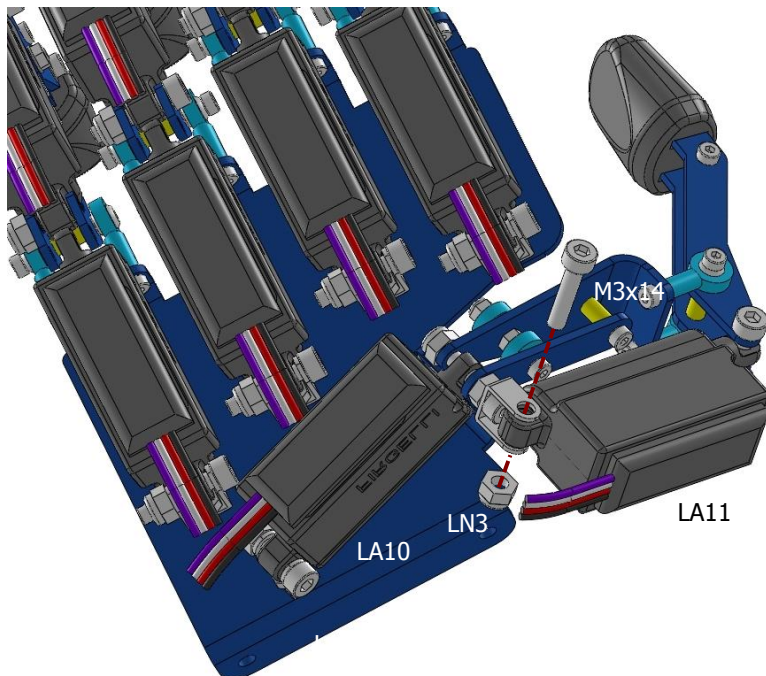
**M3x14**

x1

**LN3**

x1

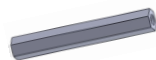
Assembly



Notes

Ensure the cables below LA10 actuator run smoothly before fixing LA11 at the base.

Parts Required



P40

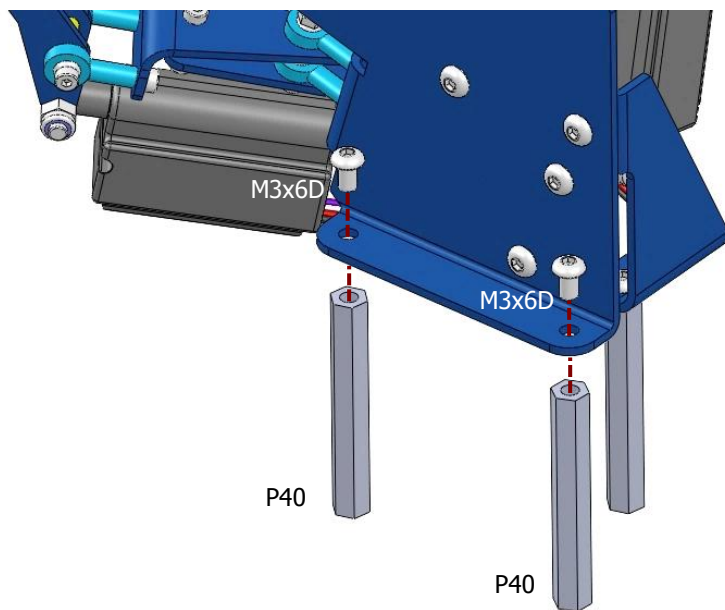
x2



M3x6D

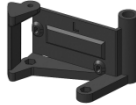
x2

Assembly



Notes

Parts Required

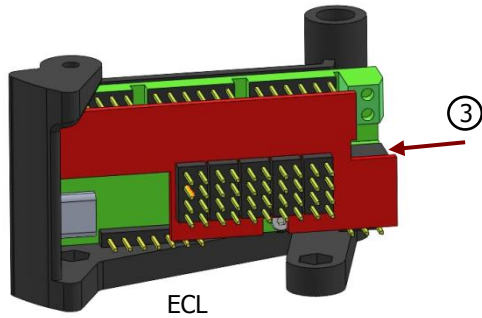
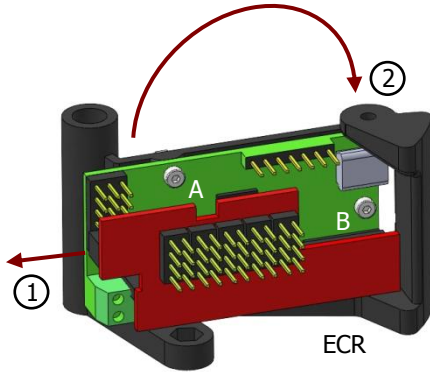
**ECR**
x1**ECL**
x1

Assembly

R



L



Notes

Remove the circuit board from ECR by unscrewing A and B.
 Turn it around by 180 degrees.
 Insert it into ECL.
 Replace bolts A and B.

Parts Required

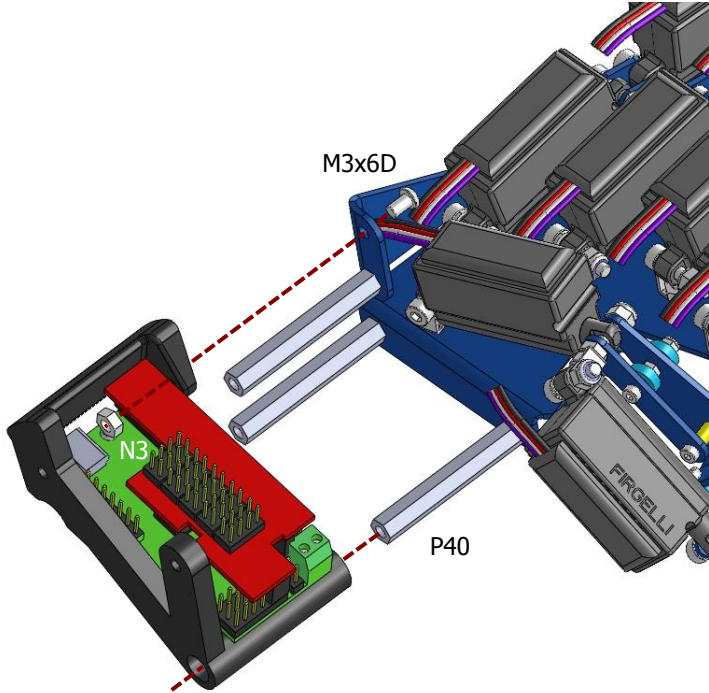
**ECL**

x1

**M3x6D**

x1

Assembly



Notes

Slide ECL over P40.
N3 should already be in ECL.
Attach ECL using M3x6D.

Parts Required

**PBR**

x1

**PBL**

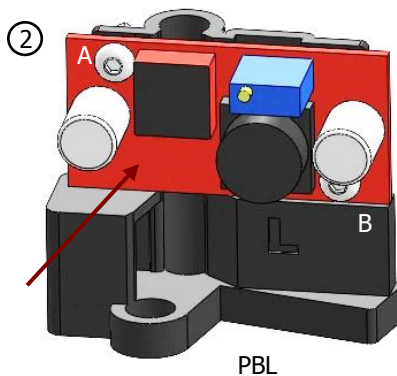
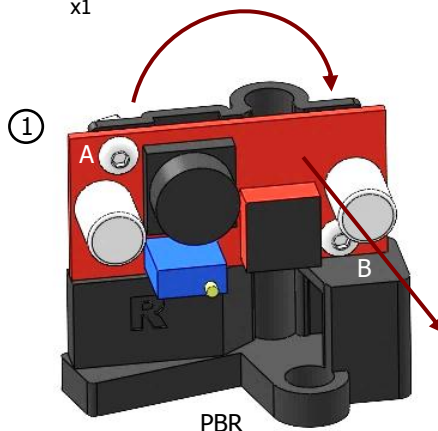
x1

Assembly

R



L



Notes

Unscrew A and B to remove PBR.
Place the power board onto PBL.
Rotate the board 180 degrees.
Replace bolts A and B.

Notes

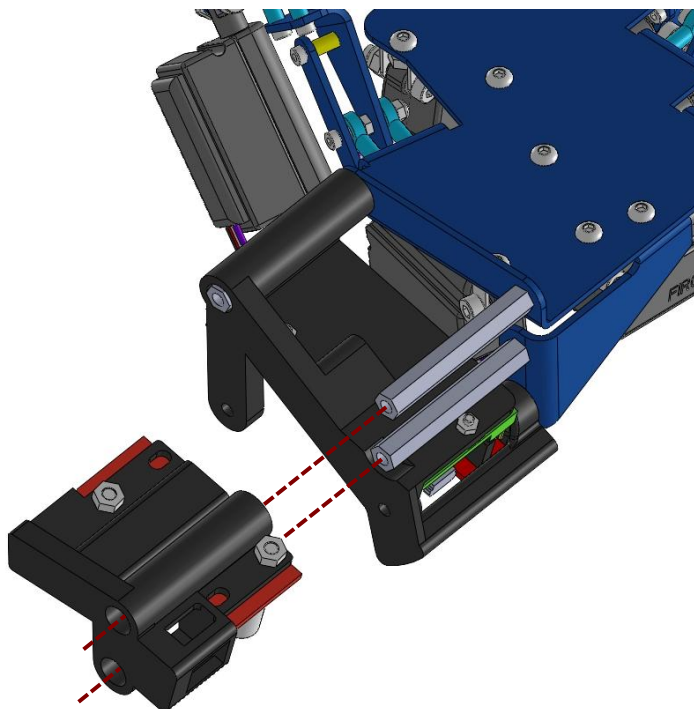
Assembly

Parts Required



PBL

x1



Parts Required



H9

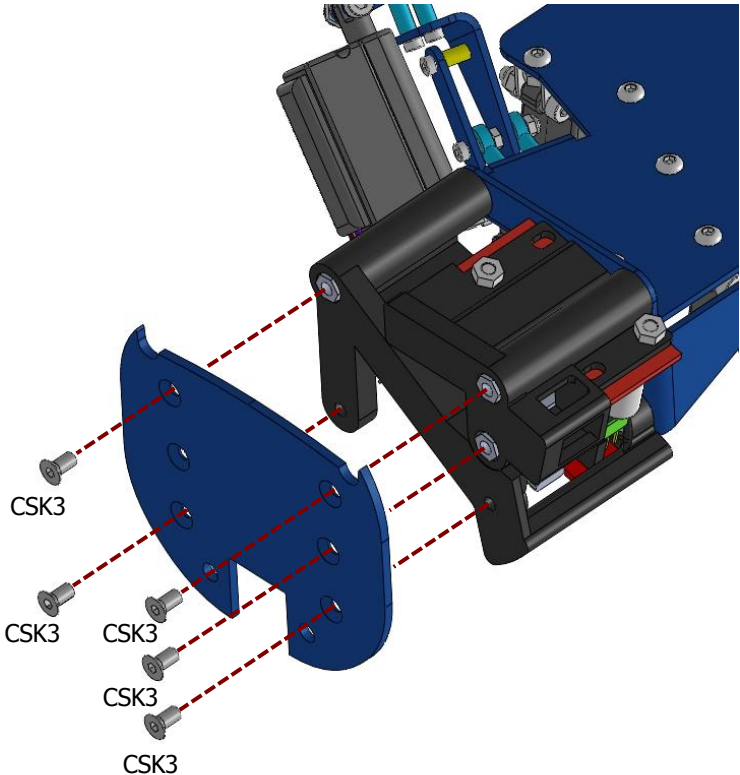
x1



CSK3

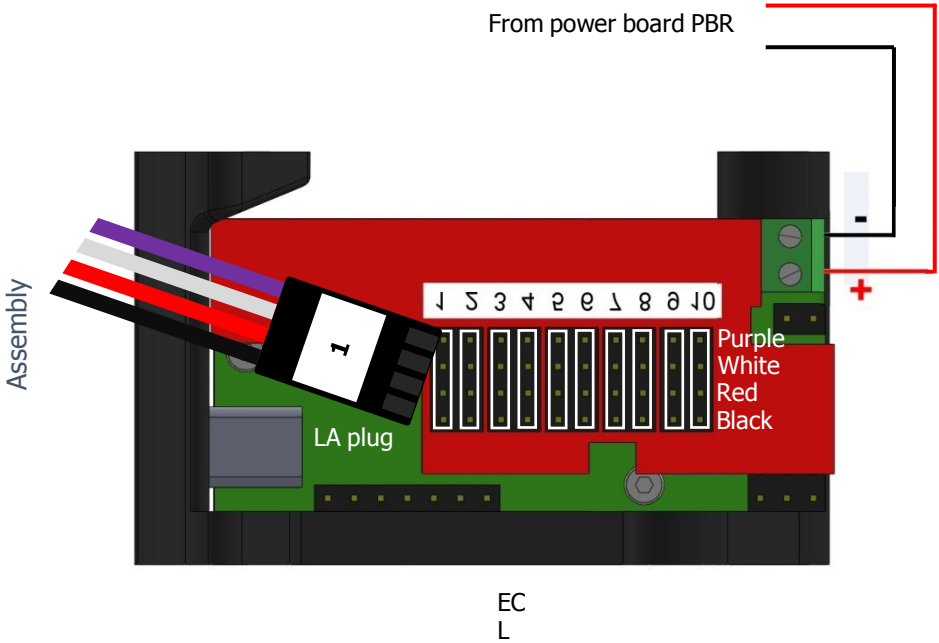
x5

Assembly



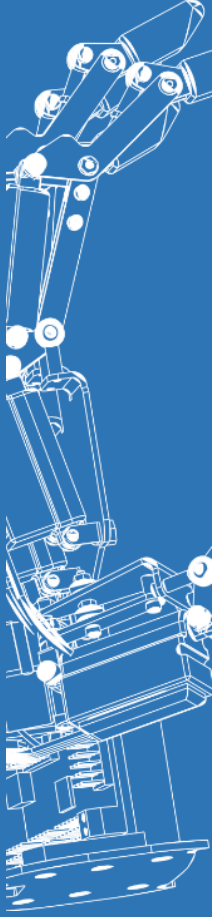
Notes

Parts Required



Notes

1. Connect LA plugs to ECL pins, taking care the numbers on the plugs match the numbers on the board. Ensure the purple wire is plugged in nearest the board numbers.
2. Connect the wire from the power board (PB) to the terminal on EC ensuring correct polarity.



oncluding Notes



Your hand should now be fully assembled. Check all assemblies are firmly secured with minimal movement.

Getting Started Guide



Now refer to the ***Getting Started Guide***

The contents of the guide include:

- The correct way to power the hand
- Details of the electronics components
- The use of the Pololu Maestro Control Centre
- Programming the hand in Python

Storing the Hand



In order to house the hand in the case, the thumb will need to be moved to the correct position. This can be done by connecting the hand to a workstation and using *Pololu Maestro Control Center* software (refer to the *Getting Started Guide*).

The *Case Position* file (located on the USB stick) can then be loaded into the *Pololu Maestro Control Center* to ensure the hand will fit in its case.

Notes

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