

HACKberry

HANDBOOK

User manual to assemble and customize HACKberry



table of contents

1. HACK berry and is

0 1 HACK berry the aim world 0 2 specification P 0 0 6

..... P 0 0 8

Zero for 3 license form 0 4 security..... P 0 1 0

and responsibility P 0 1 3

2. Let's assembly

0 1 upload of 0 4 basic soldering 0 5 program before any P 0 1 6

HACK do you assemble a berry 0 assemble 2 parts of P 0 twenty two

how to obtain 0 3

..... P 0 2 6

..... P 0 5 2

0 6 assembly of assembly 0 9 Mitsuyubi of assembly 0 8 P 0 5 8

index finger of assembly 0 7 thumb of the battery case

socket P 0 8 0 P 0 8 8

1 0 Assembly 1 4 initial position setting of the assembly 1 3 sensor voltage P 0 9 2

adjustment and the initial position setting of the servo motor 1 1 palm of the

assembly 1 2 Wrist P 1 2 2

..... P 1 3 0 P 1 3 4

3. Let's move

0 1 Nomenclature	P 1 4 6
0 2 Battery mounting	0 3 Calibration	0 P 1 4 7 P 1 4 8
4 Hand mounting	0 5 operates in Shiwi P 1 5 0 P 1 5 1
ashaku屈	0 6 muscle photoelectric sen	
sor wrist		
	 P 1 5 1

4. More to enjoy it a HACK berry

0 1 Introduction	P 1 5 4
0 2 HACK berryhandboard M	k 2 Specification	0 operations HACK P 1 5 5 P 1
berry by 3 muscle photoelectric sensor	0 4 acetone surface	5 8
treatment	0 5 Nylon staining P 1 6 2 P 1 6 8

5. Problem Solving? If you think

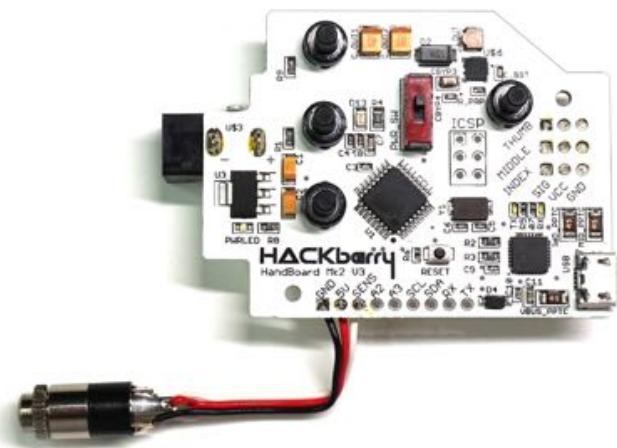
..... P 1 7 4

1. HACKber ry The

01 HACKber ry of the aim world	P006
02 Specifications · · · · ·	P008
03 license form	P010
04 security and with respect to responsibility	P013

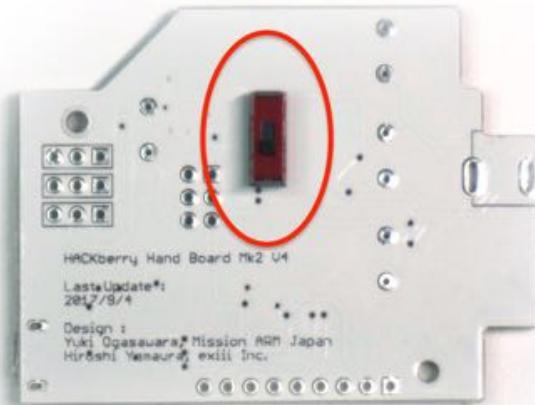
[7] Solder the other end of the flat cable to the substrate. **SENS** is white cable, **red** is 5V, **black** GND

It supports. This soldering of HACKberry hand board Mk2 is completed.

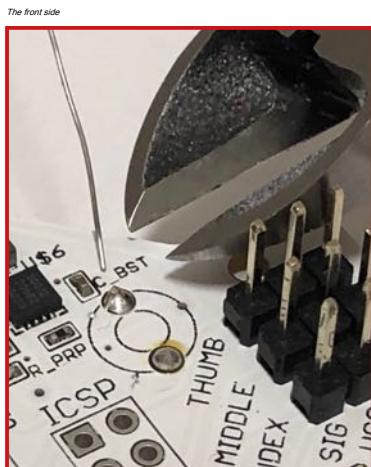
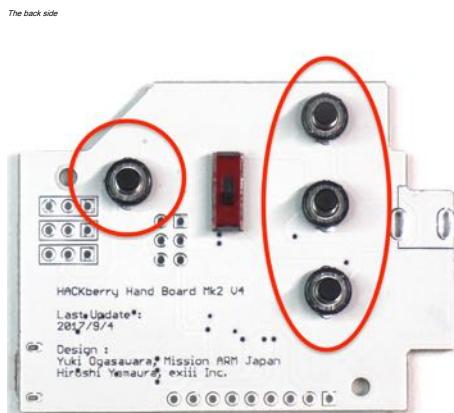


Soldering of the case to be used in the left hand

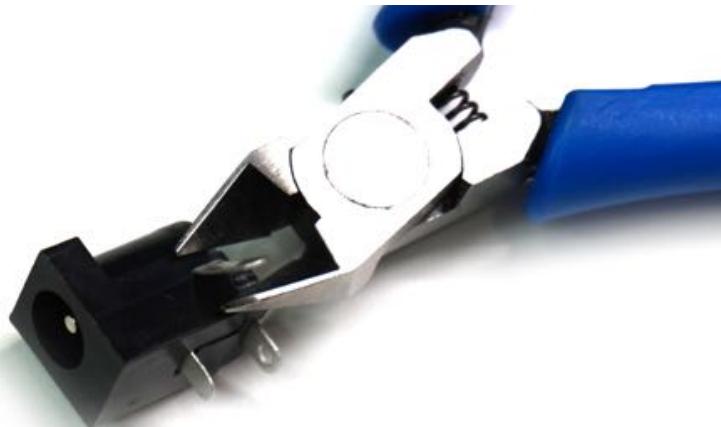
[1] The slide switch on the board **The back side** Solder to. The substrate **Surface HACKberry of the logo is not printed** is the back surface. Moreover, there is no polarity (direction) to the slide switch.



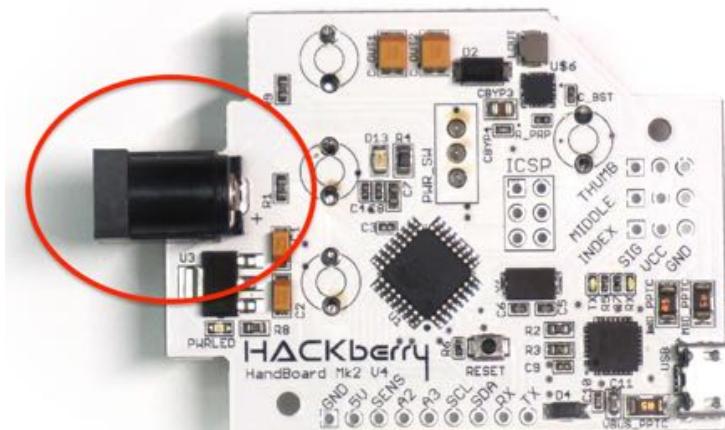
[2] and then soldered the tact switch on the front side of the substrate. Excess lead wires protruding on the back side will be cut at the root. As a guide to cut within 2mm from the surface of the substrate.



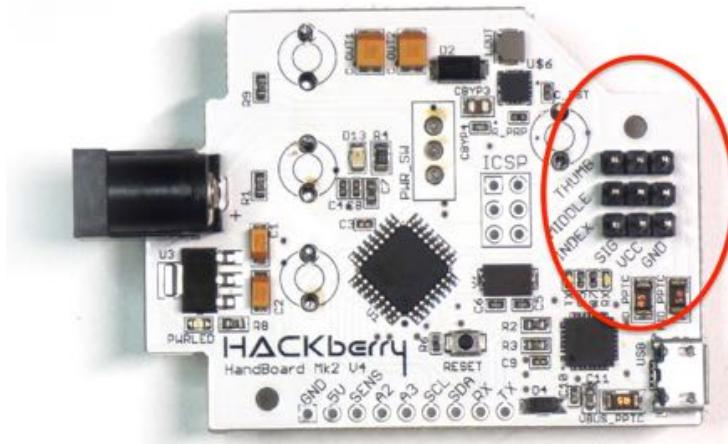
[3] and then perform the soldering of the front surface. Cut the metal terminal that has come out from the side of the DC jack in the nippers.



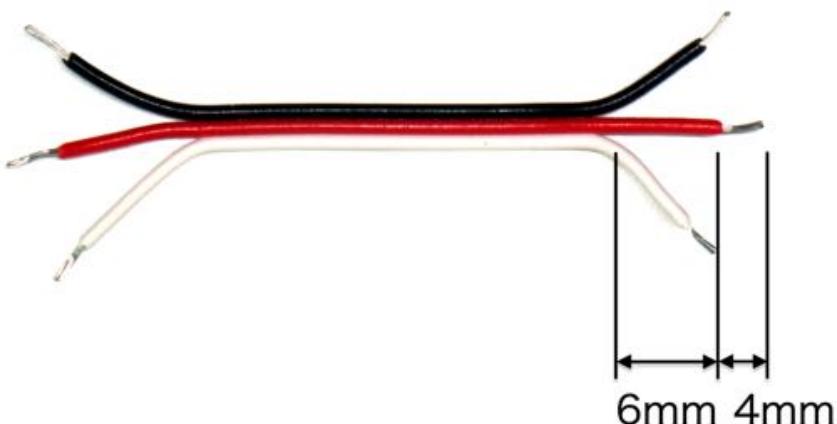
[4] and then soldered as shown in the illustration DC jack.



[5] pin header is soldered by interpolating the shorter to the substrate . **Easy slope diagonally** Please be careful so.



[6] devote each about 10mm both ends of the flat cable. Strip using, for example, further each 4mm about wire strike Ripper film. Core wire is collectively twisted by hand.

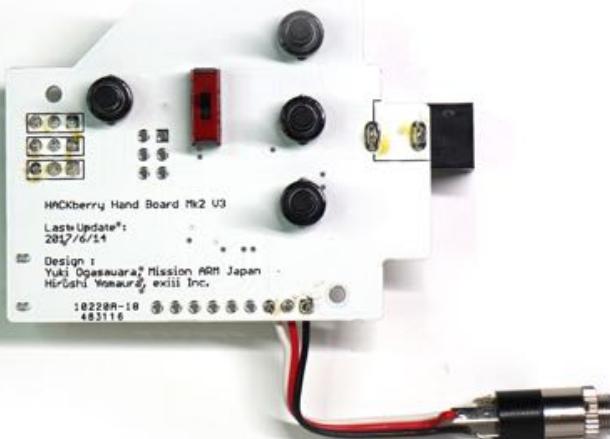


[7] and then soldering the flat cable to the stereo jack of the terminal. At this time, **White in the upper right corner of the terminal, red to end child of under, and the black cable to the upper left corner of the terminal** Solder so as not to mistake.



[8] Solder the other end of the flat cable to the substrate. **SENS is white cable, red is 5V, black GND**

It supports. This HACKberry hand board Mk2 soldering of the substrate is completed.



As sembli ng

05 Upload of the program

Program how to change in the case of the left and right and the kind of the substrate

This section describes how to upload the program using Windows.

[1] Arduino's official website <https://www.arduino.cc/en/Main/Software#>

Access to download the latest version of the Arduino IDE software.

* What is this writing at that time you may design and version of the home page is different.



Download the Arduino IDE

ARDUINO 1.8.4
The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.
This software can be used with any Arduino board. Refer to the [Getting Started](#) page for installation instructions.

Windows Installer
Windows ZIP file for non admin install
Windows app Get

Mac OS X 10.7 Lion or newer
Linux 32 bits
Linux 64 bits
Linux ARM

[Release Notes](#)
[Source Code](#)
[Checksums \(sha512\)](#)

ARDUINO SOFTWARE HOURLY BUILDS

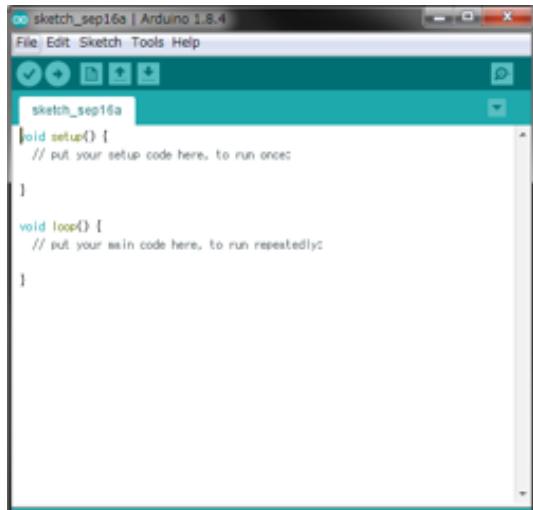
LAST UPDATE
29 August 2017 1:12:58 GMT

Download a preview of the incoming release with the most updated features and bugfixes.
Windows
Mac OS X (Mac OSX Lion or later)
Linux 32 bit, Linux 64 bit, Linux ARM

ARDUINO 1.0.6 / 1.5.x / 1.6.x PREVIOUS RELEASES

Download the previous version of the current release, the classic Arduino 1.0.x, or the Arduino 1.5.x Beta version.
All the Arduino 00xx versions are also available for download. The Arduino IDE can be used on Windows, Linux (both 32 and 64 bits), and Mac OS X.

[2] run the installation file of Arduino, to install the Arduino to a personal computer according to the instructions. Installation will start the Arduino IDE Once you have completed correctly.

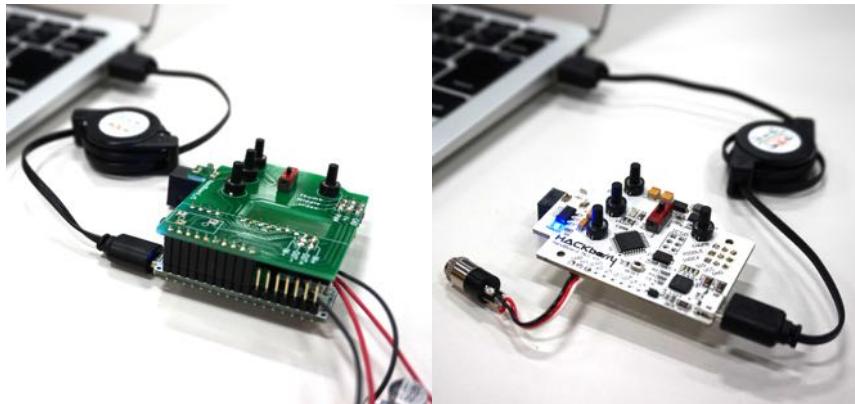


The screenshot shows the Arduino IDE interface. The title bar reads "sketch_sep16a | Arduino 1.8.4". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu is a toolbar with icons for new, open, save, and upload. The main workspace contains the following code:

```
sketch_sep16a
void setup() {
  // put your setup code here, to run once
}

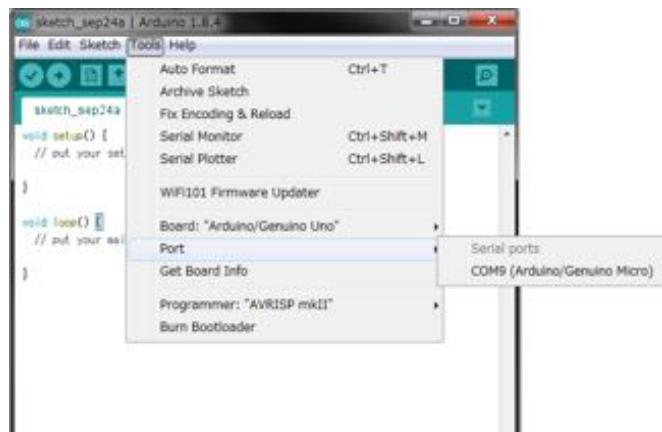
void loop() {
  // put your main code here, to run repeatedly
}
```

[3] The Arduino Micro and the PC is Mk1 case of a substrate, in the case of Mk2 board to connect the Mk2 board and the PC with a micro USB cable.



[4] the driver installation will start automatically. The port column in the tool tab of Arduino IDE When the installation is complete, select it because the new COM port is displayed.

* If you do not see disconnect the micro-USB cable from the once Arduino Micro or MK2 board, and connect again.

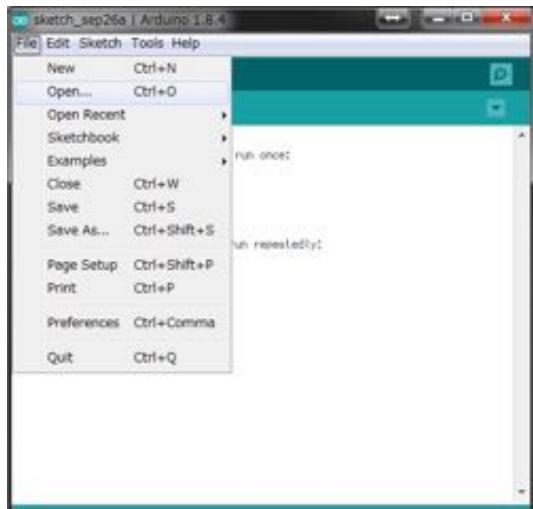


[5] of HACKberry repository of GitHub HACKberry / HACKberry_program / Hackberryv3.0. Access to ino, on hand if there is a HACKberry hand board Mk1 "Hackberry v3.0" To, if there is a HACKberry hand board Mk2" Hackberry vMk2v1.0 Open the ", right-click the "RAW" button, select "Save Link destination".

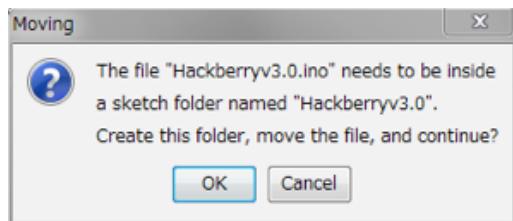
* version of the program may have changed with this writing at that time.

A screenshot of a GitHub repository page. The URL is "mission-arm / HACKberry". The repository name is "HACKberry / HACKberry_program / Hackberryv3.0.ino". The file content is a C++ code snippet for a servo driver. A red box highlights the "Raw" button in the toolbar above the code editor.

[6] will open the Arduino IDE from the "File → Open" and select the file you downloaded earlier.

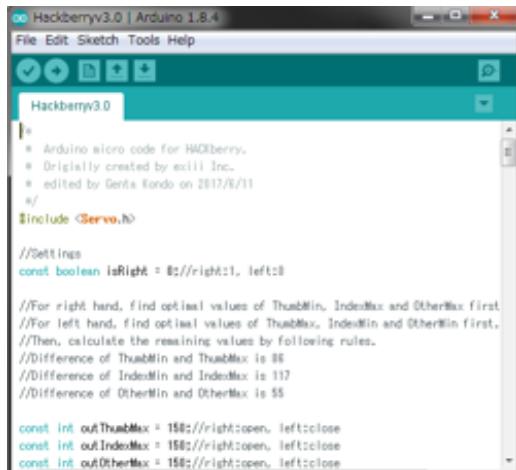


[7] There is a case of middle comes out the following message, but by clicking on the OK, proceed.



[8] and then select the microcomputer board to appropriate from the "Tools → microcomputer board". Finally, press the Ru top left of the screen near "→" button to upload the program.

* microcomputer board, the case if you are using the Mk1 substrate using Arduino Micro, Mk2 board to select the Arduino Nano.



The screenshot shows the Hackberryv3.0 interface within the Arduino IDE. The title bar reads "Hackberryv3.0 | Arduino 1.8.4". The menu bar includes File, Edit, Sketch, Tools, and Help. Below the menu is a toolbar with icons for Open, Save, Print, and others. The main workspace contains the following C++ code:

```
#include <Servo.h>

//Settings
const boolean isRight = 0;//right:1, left:0

//For right hand, find optimal values of ThumbMin, IndexMax and OtherMax first.
//For left hand, find optimal values of ThumbMax, IndexMin and OtherMin first.
//Then, calculate the remaining values by following rules.
//Difference of ThumbMin and ThumbMax is 86
//Difference of IndexMin and IndexMax is 117
//Difference of OtherMin and OtherMax is 55

const int outThumbMax = 150;//right:open, left:close
const int outIndexMax = 150;//right:open, left:close
const int outOtherMax = 150;//right:open, left:close
```


As semb li ng

06 Assembly of the battery case socket

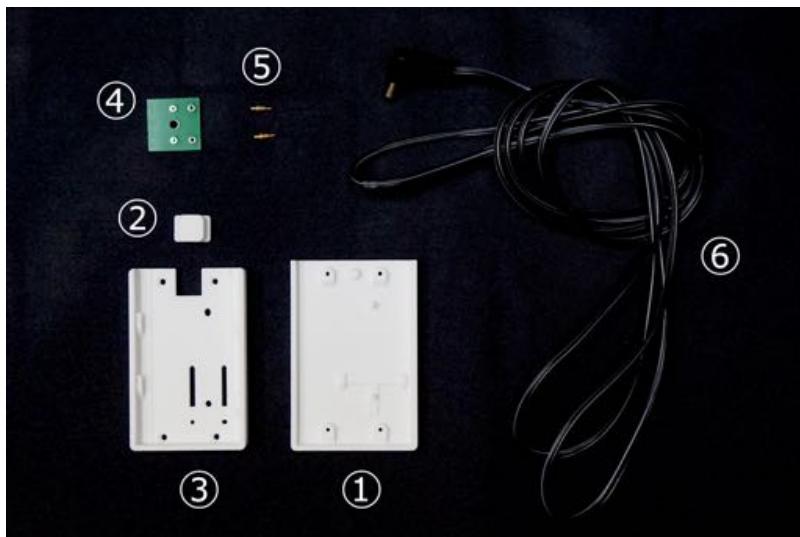
Assembly of the battery case

We will introduce the method of assembling the battery case to be used in HACKberry that does not include a dummy socket in this section. If you please start from 62 pages in the case of assembling a HACKberry with a dummy socket.



- Used parts-

- | | | |
|-------------------|------------------|------------|
| 1. CB-01 | 2. CB-02 | 3. CB-03 |
| 4. Bat tery board | 5. Battery probe | 6. DC plug |

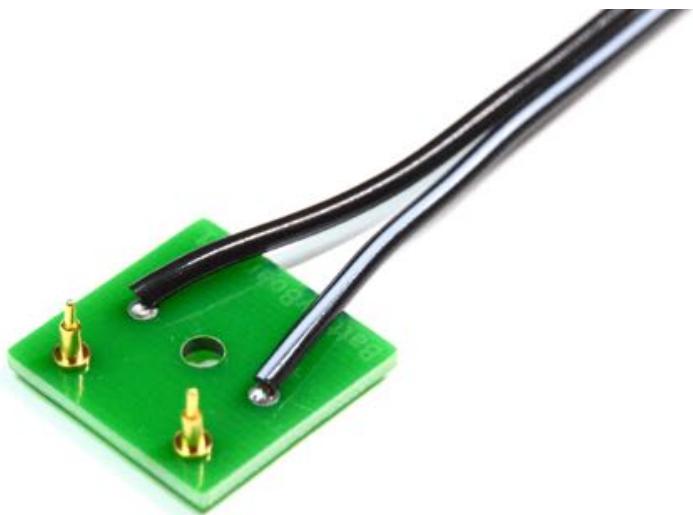
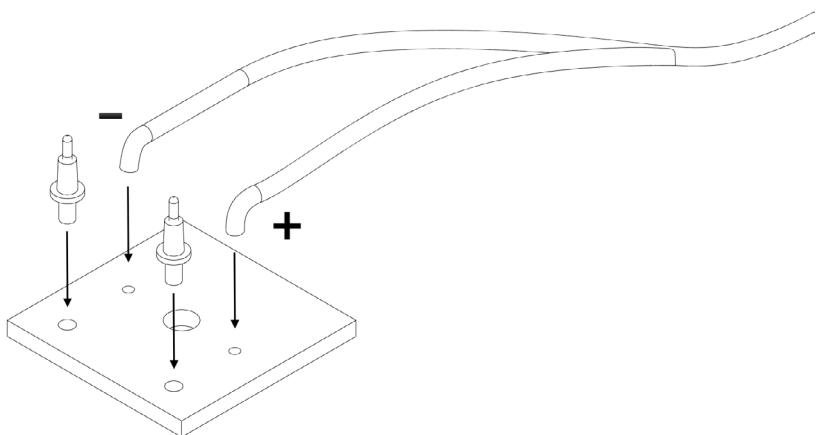


- Use a general-purpose parts -

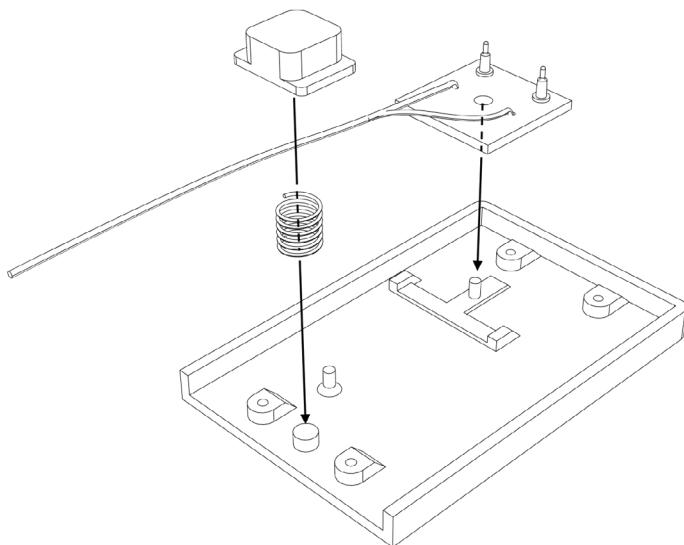


x1

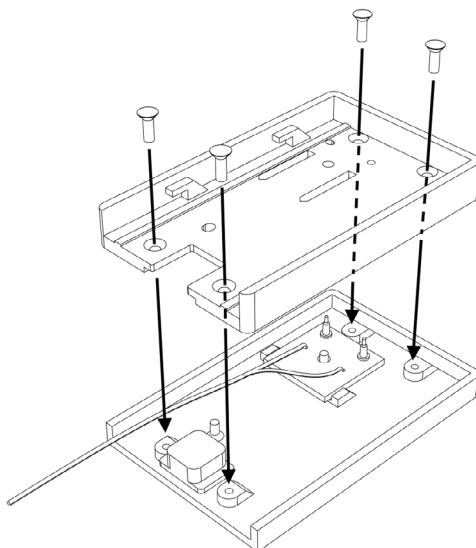
[1] and then soldered as shown in the figure below in the battery probe and the DC plug Ba ttery boa rd. In this case, please so as to be soldered towards the cable there is a white line have to +.



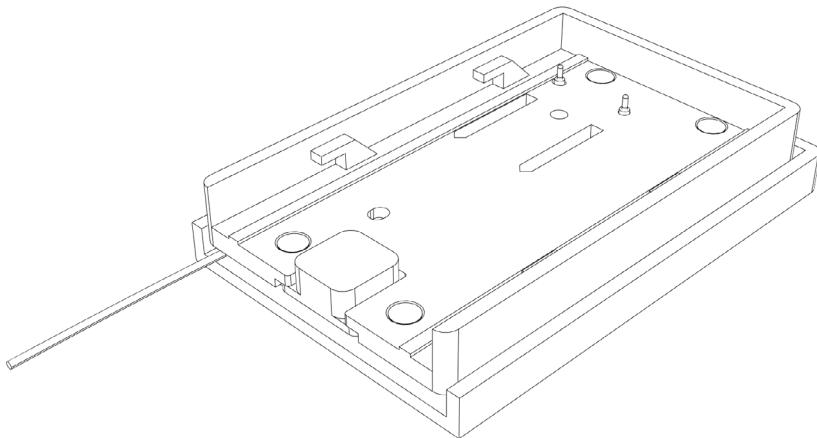
[2] Place the coil spring and the CB-02 as shown in the figure below to CB-01.



[3] to secure as shown in the figure below in the CB-03 the four screws (M2L6).



[4] This completes the assembly of the battery case is.

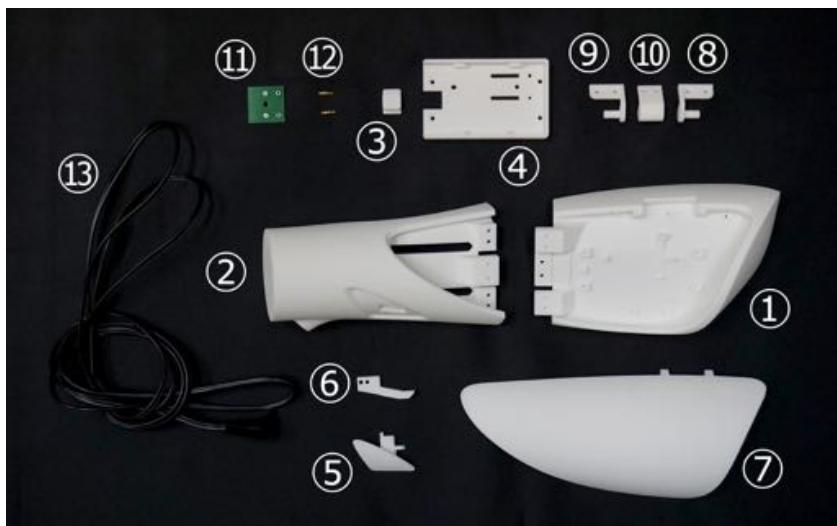


Assembly of the dummy socket



- Used parts -

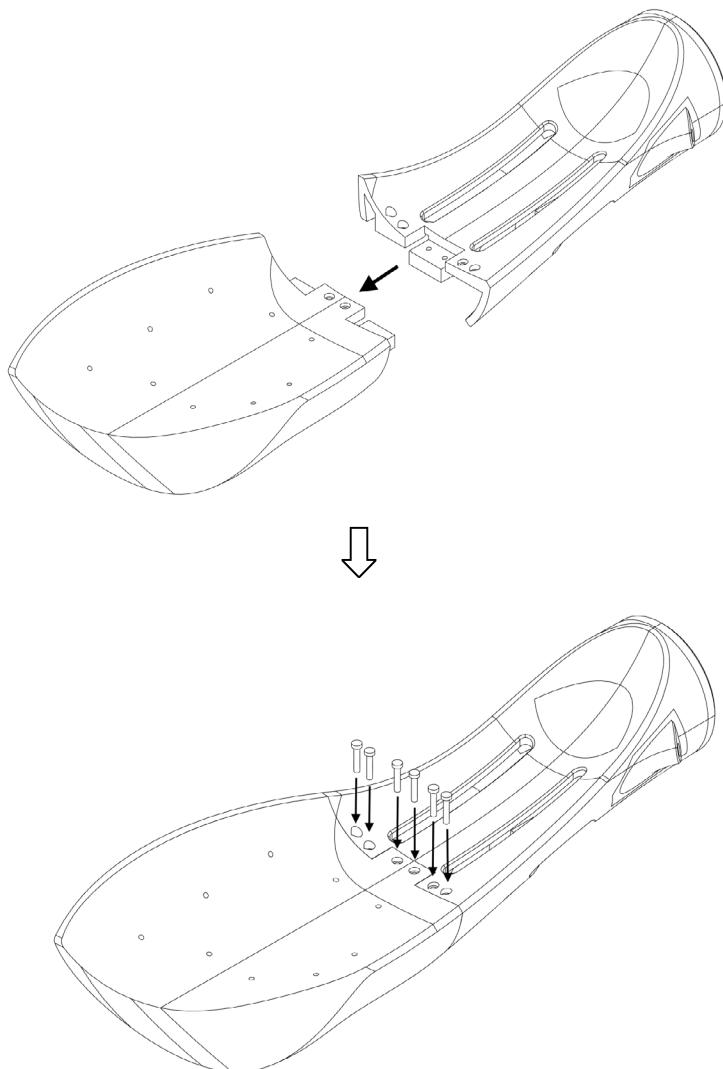
- | | | |
|-------------|--------------------|-------------------|
| 1. R-SO-01 | 2. R-SO-02 | 3. R-SO-03 |
| 4. R-SO-04 | 5. R-SO-05 | 6. R-SO-06 |
| 7. R-SO-07 | 8. R-SO-08 | 9. R-SO-09 |
| 10. R-SO-10 | 11. Bat tery board | 12. Battery probe |
| 13 .DC plug | | |



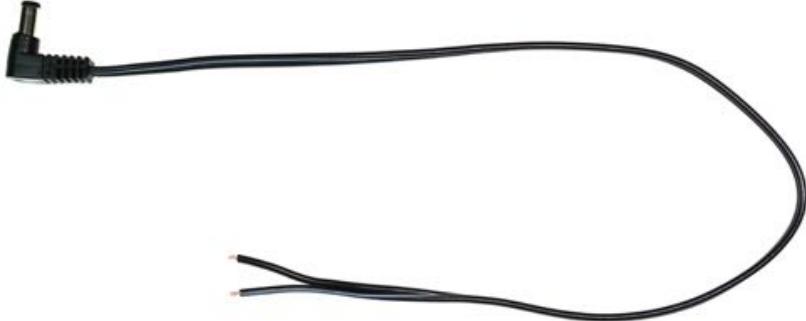
- Use a general-purpose parts -



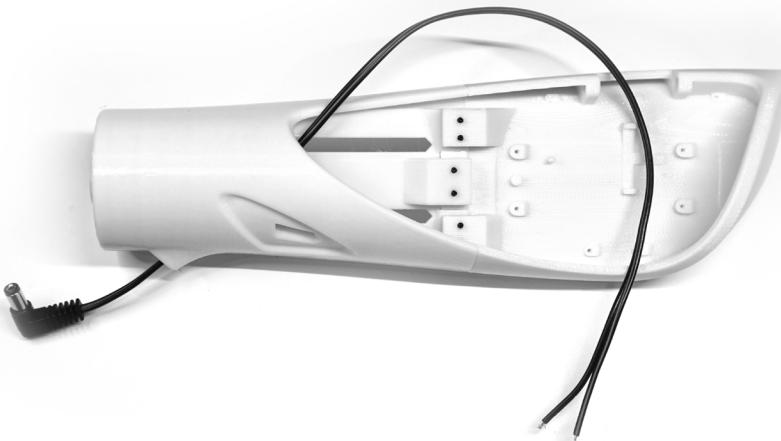
[1] to secure as shown in the figure below the R-SO-01 and R-SO-02 with six screws (M2L10).



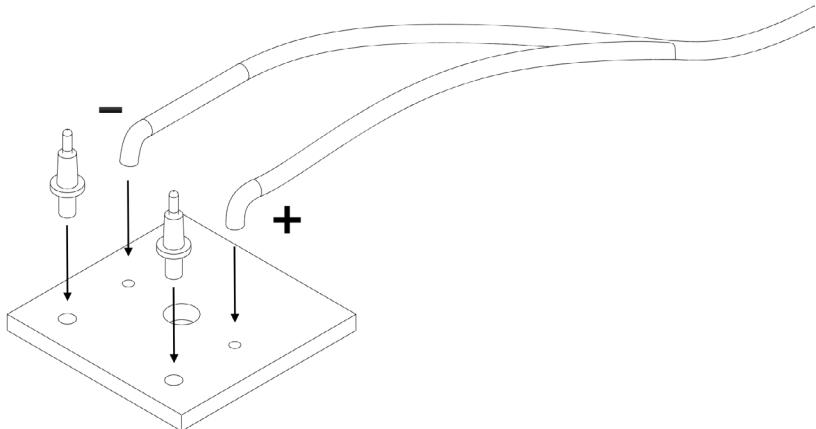
[2] DC plug cut to 33 cm, to Matomema twisting inside of the core wire after peeled 4mm coating of the cut ends. If you do not have a wire stripper at hand it will strip the coating so as to not turn off the core of the interior in the nippers.



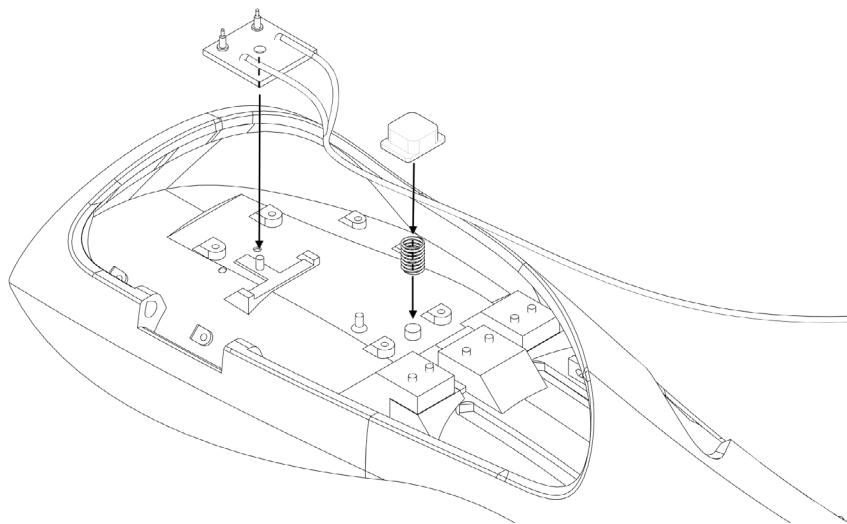
[3] through the line as shown in the figure below the holes in the R-SO-02.



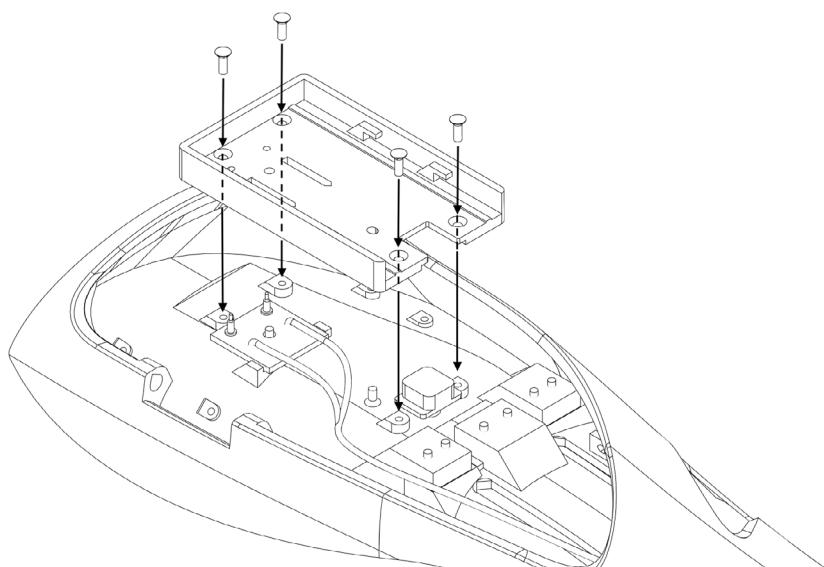
[4] Solder like an image in a battery probe and the DC plug Ba ttery boa rd. In this case, please so as to be soldered towards the cable there is a white line have to +.



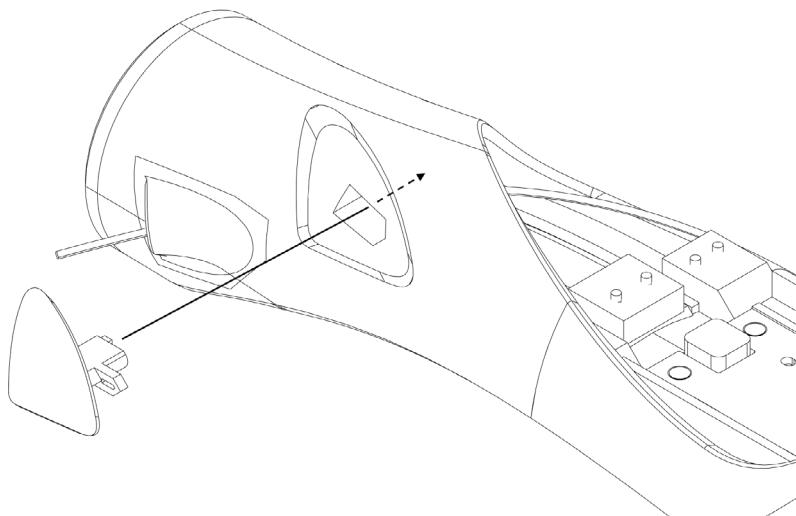
[5] Place the coil spring and the R-SO-03 as shown in the figure below.



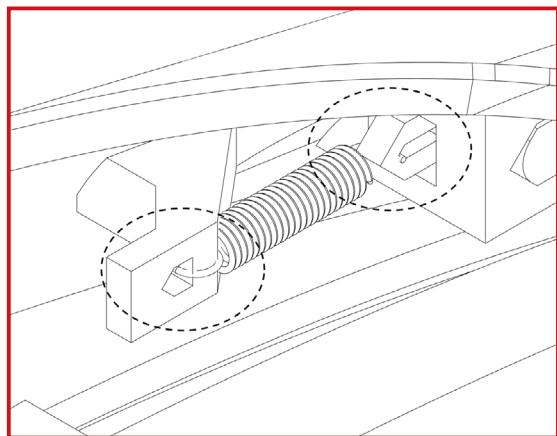
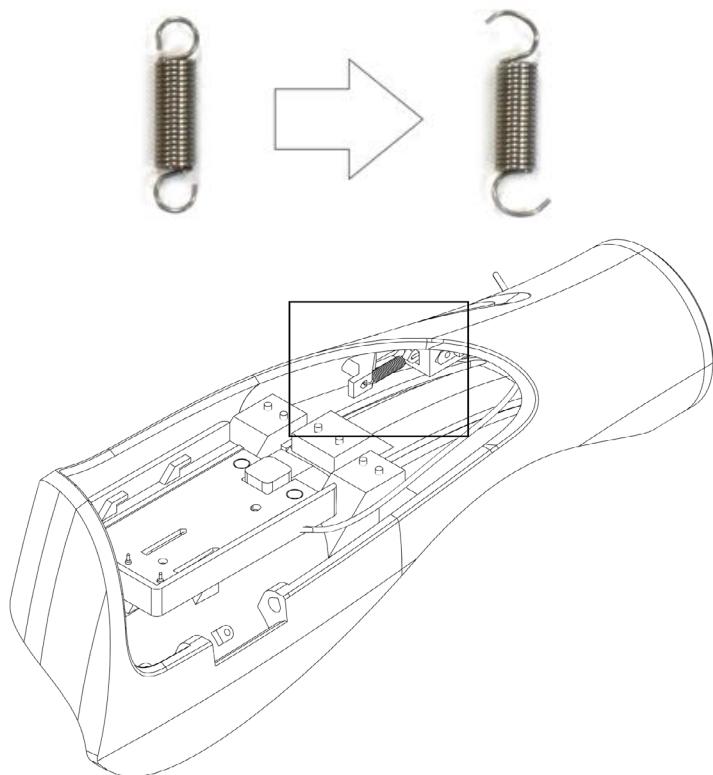
[6] to secure the R-SO-04 with four screws (M2L6) as shown in the figure below.



[7] to R-SO-02 as shown in the figure will fit the R-SO-05.

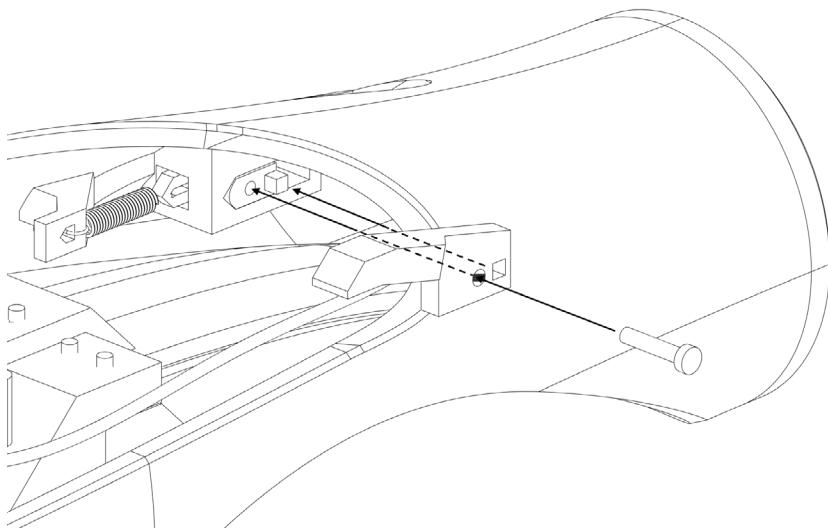


[8] Attach the both ends of the tension spring spread as shown in the figure below.

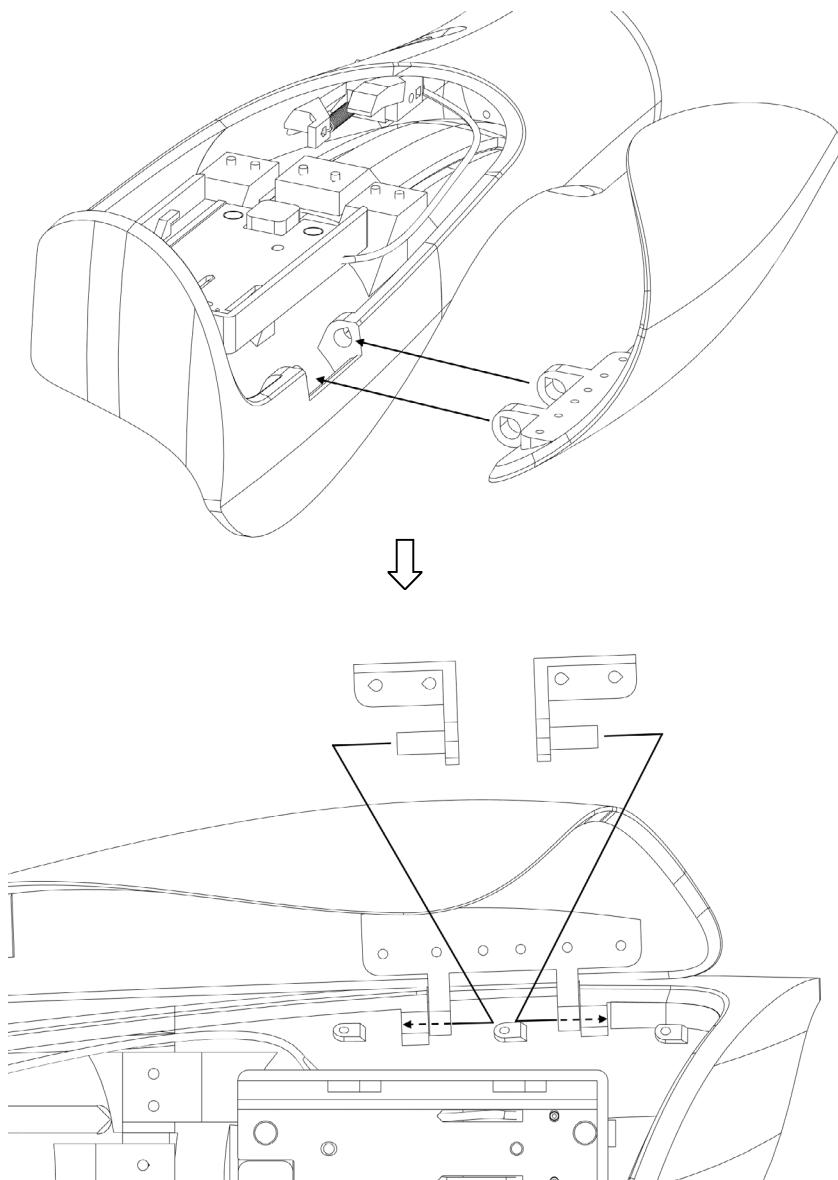


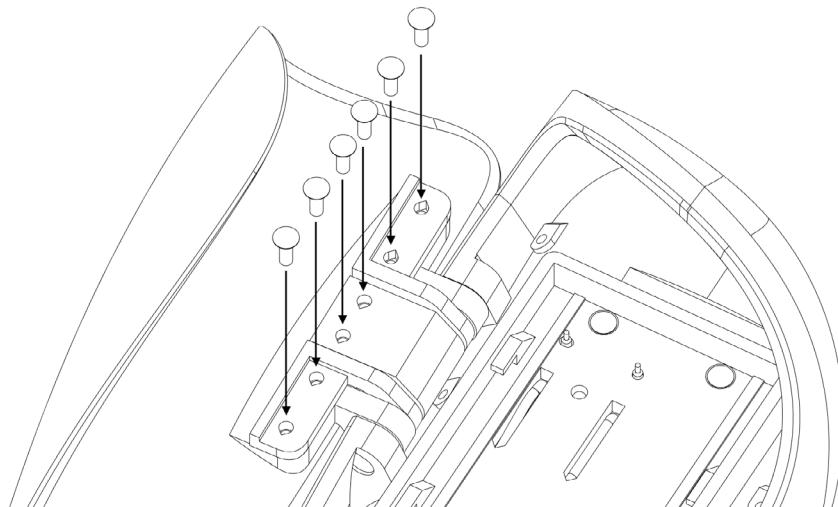
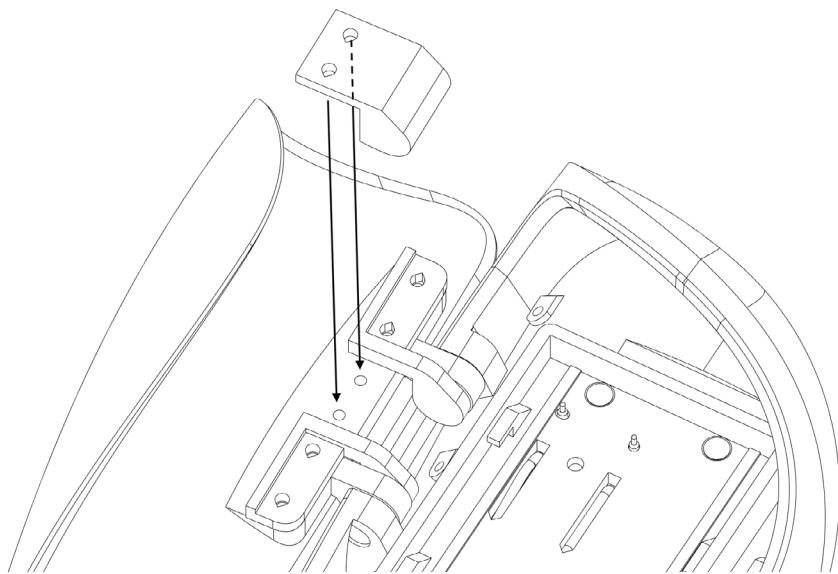
Enlarged view

[9] using a screw (M2L10) to secure as shown in the illustration R-SO-06.

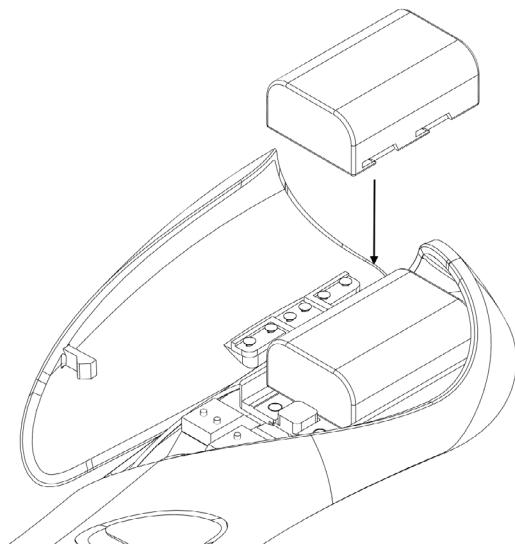


[1 0] and secure it with the R-SO-01 and R-SO-07 to R-SO-08 and R-SO-09 through six screws (M2L6).

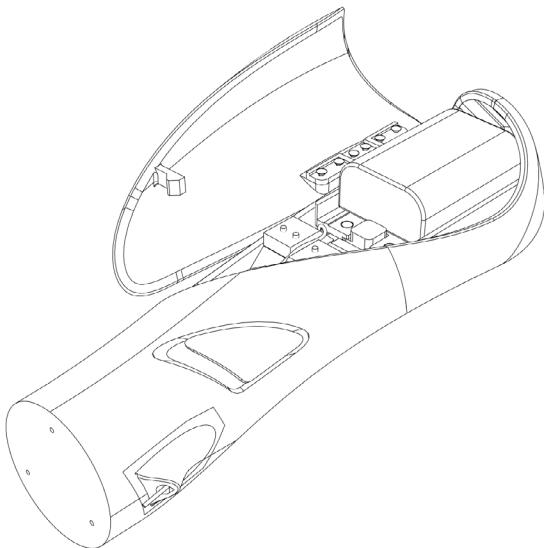




[1] Replace the battery.



[1 2] This assembly of the socket is completed.



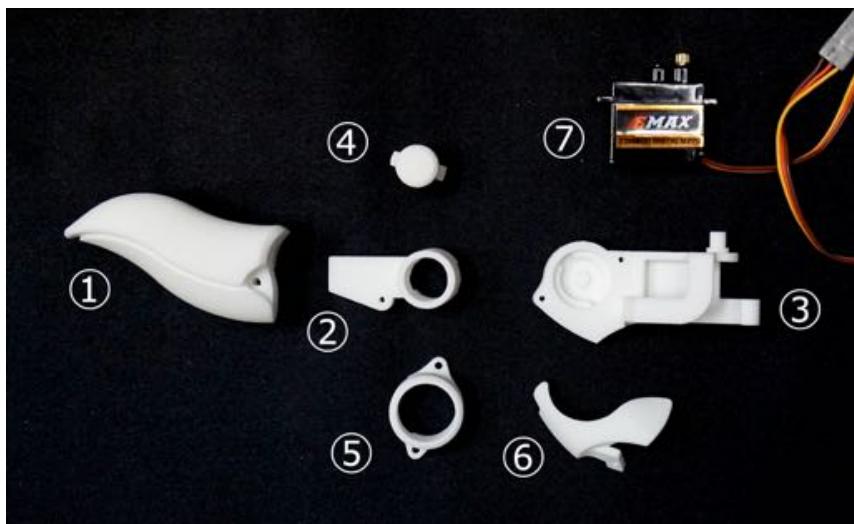
Assembling

07 Assembly of the thumb



- Used parts -

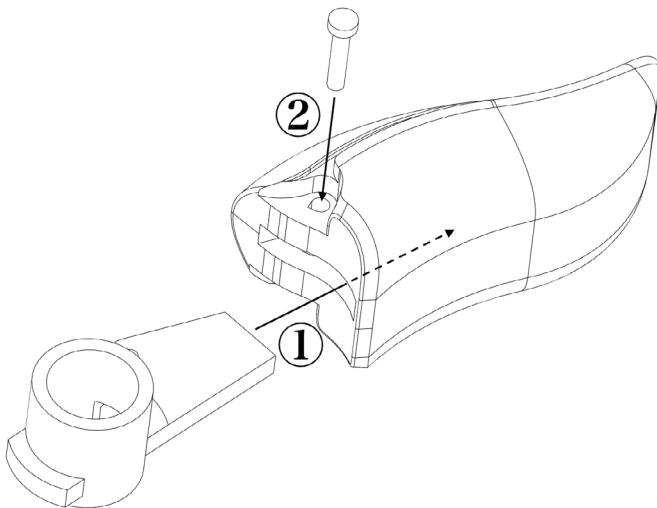
- | | | |
|----------------------|----------|----------|
| 1. RT-01 | 2. RT-02 | 3. RT-03 |
| 4. RT-04 | 5. RT-05 | 6. RT-06 |
| 7. Servo motor Small | | |



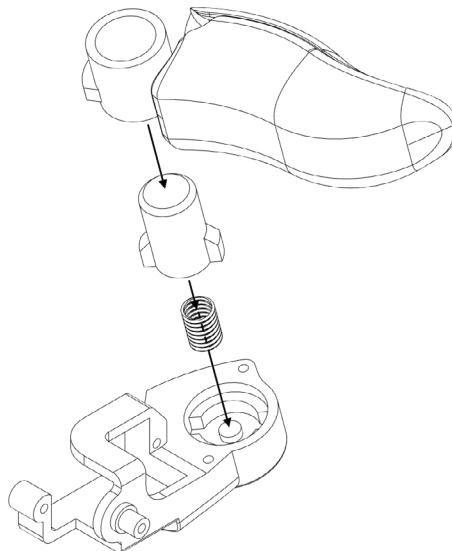
- Use a general-purpose parts -



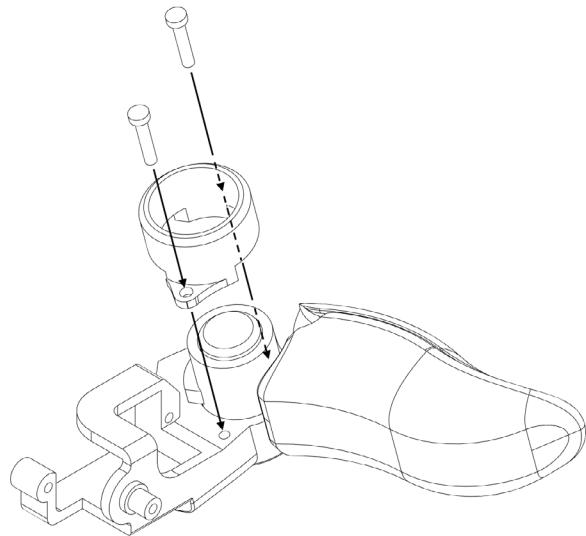
[1] screwed (M2L10) through RT-02 to RT-01.



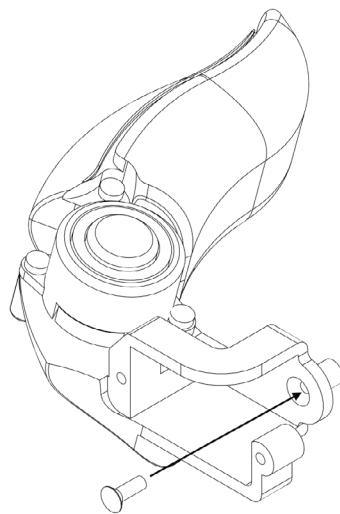
[2] Place the coil spring to the RT-03 as shown in the figure below, the combined RT-04 into the groove, and place so as to cover the coil spring. Thread the RT-02.



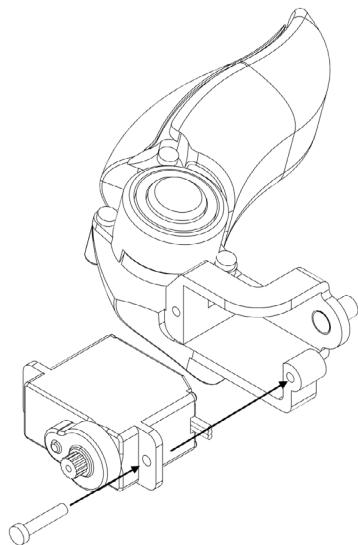
[3] covered with the RT-05, and secure it with two screws (M2L10).



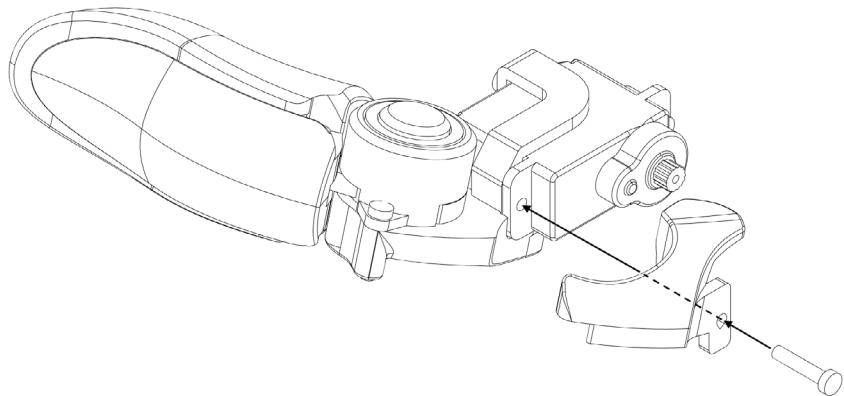
[4] Install the screws (M2L6) to RT-03 as shown in the figure below.



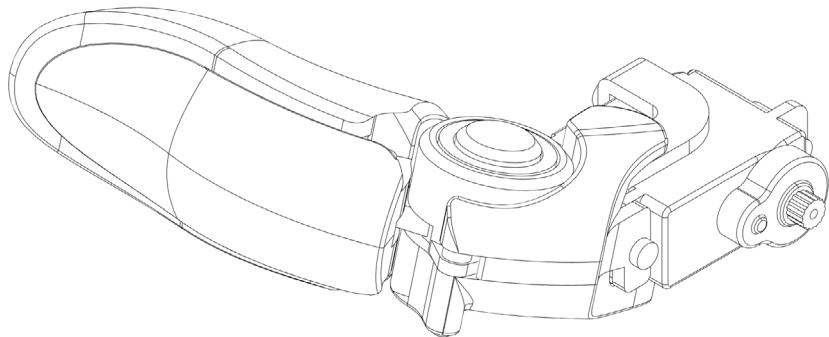
[5] to secure the servo motor small with screws (M2L10).



[6] and then to secure the RT-06 with screws (M2L10).



[7] This is the end assembly of the thumb.



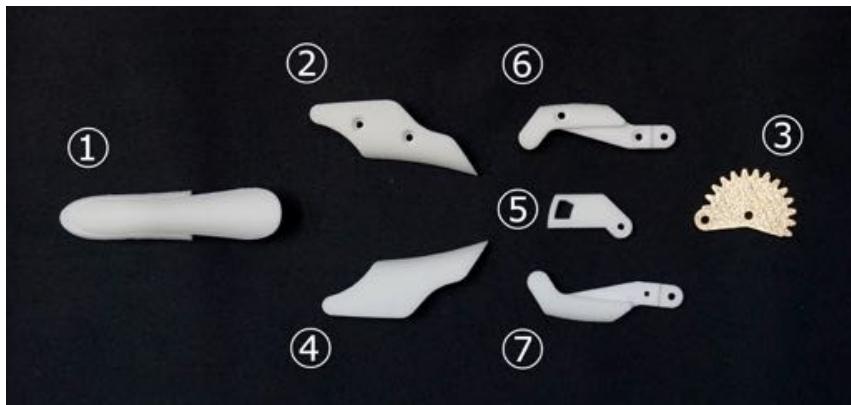
Assembling

08 Assembly of the index finger



- Used parts -

- | | | |
|-----------|-----------|-----------|
| 1. R-I-01 | 2. R-I-02 | 3. R-I-03 |
| 4. R-I-04 | 5. R-I-05 | 6. R-I-06 |
| 7. R-I-07 | | |

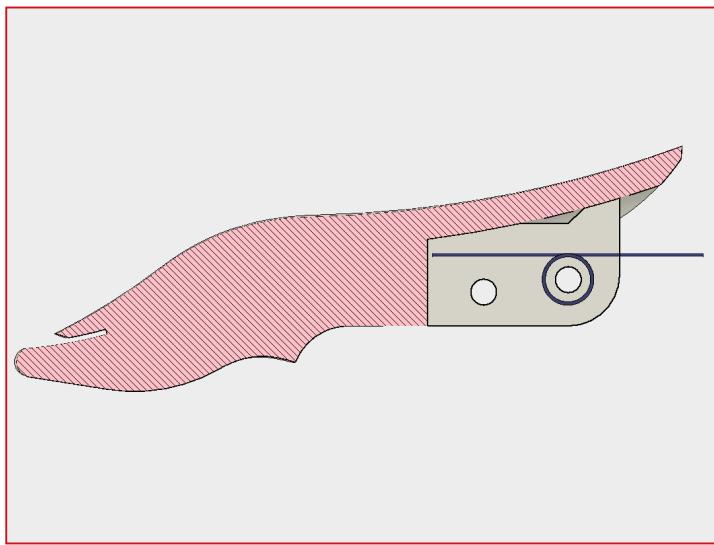
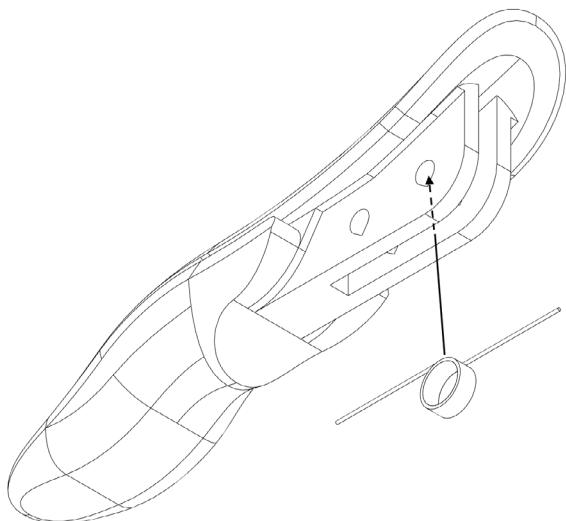


* R-I-03 of the photo was 3D printed using a metal material in order to increase the strength. Strength and durability you will poor, but it is also possible to receive your other parts similarly made of resin material.

- Use a general-purpose parts -

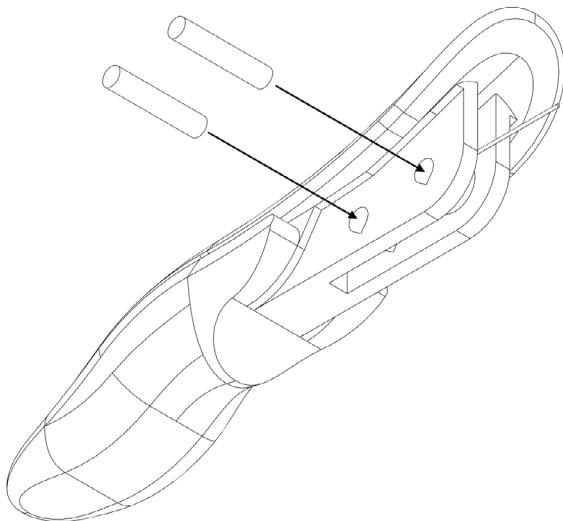


[1] Plug into the torsion spring in the figure below as R- I-01.



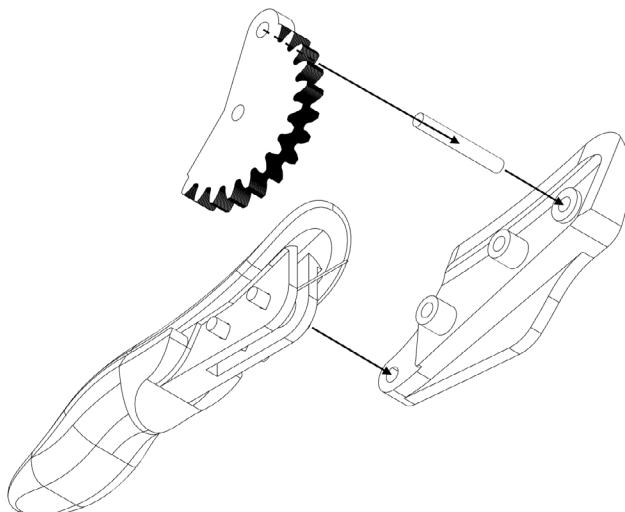
A cross-sectional view

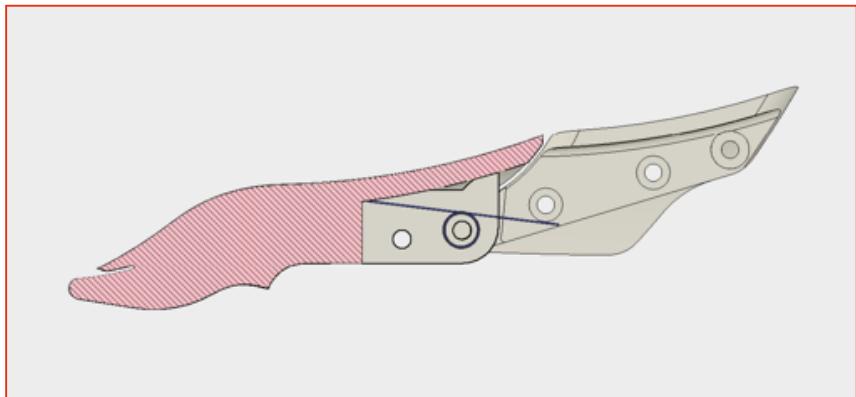
[2] there to two of the shaft (10mm), insert it as shown in the figure below. **At this time, the right side of the figure of the shaft should be careful to pass a circle of the torsion spring.**



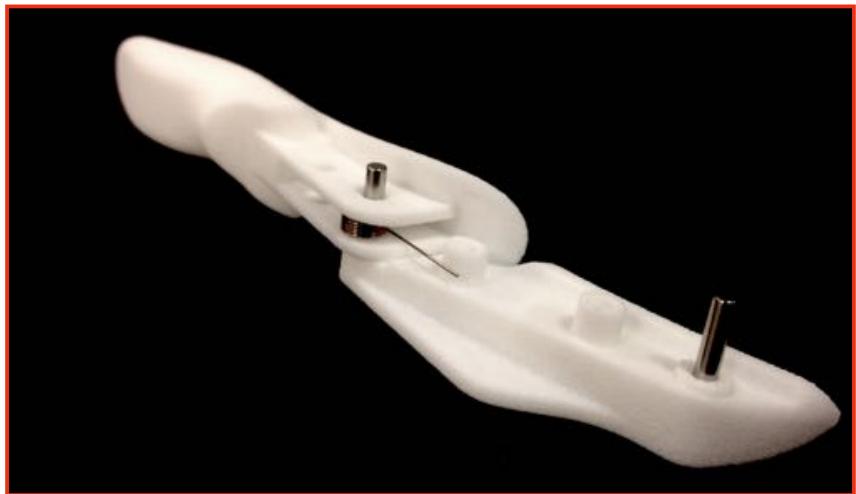
[3] Attach the R- I -02 and R- I -03. R- I -03 is mounted through the shaft (10mm) as shown in the illustration.

※ Please note the position of the torsion spring at this time.



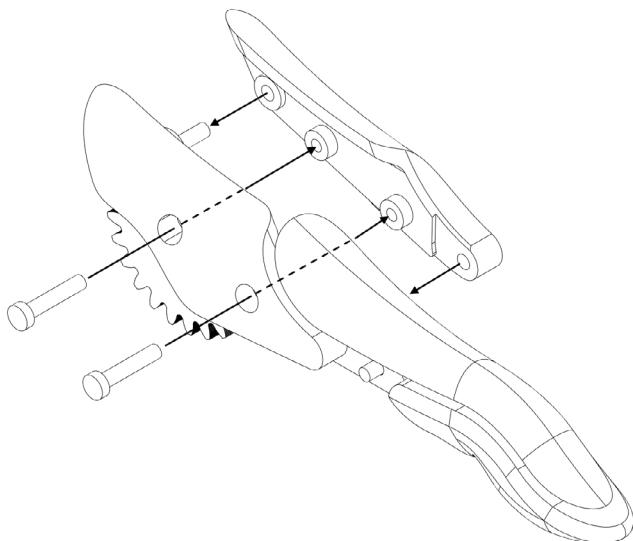


Torsion spring position cross-sectional view

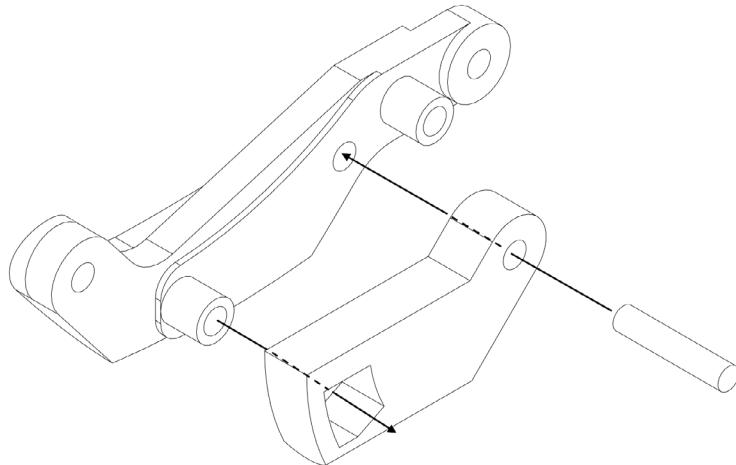


Torsion spring position photo

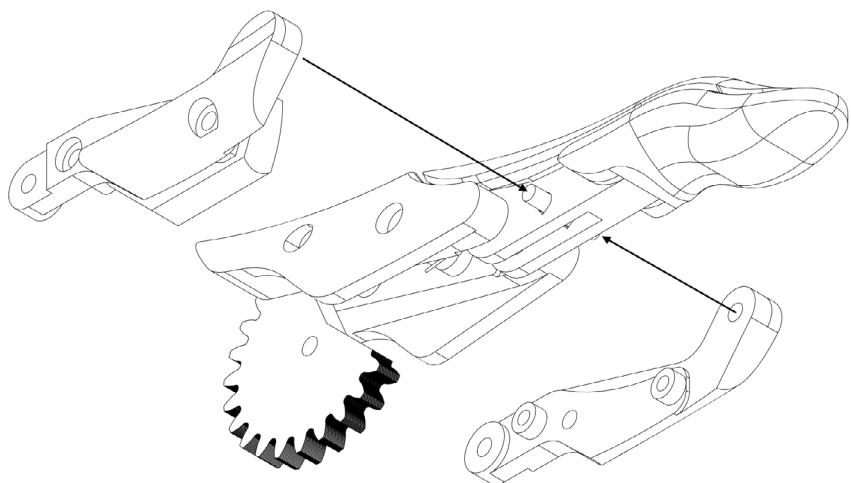
[4] R- covered with the I -04, and secure two places with screws (M2L10).



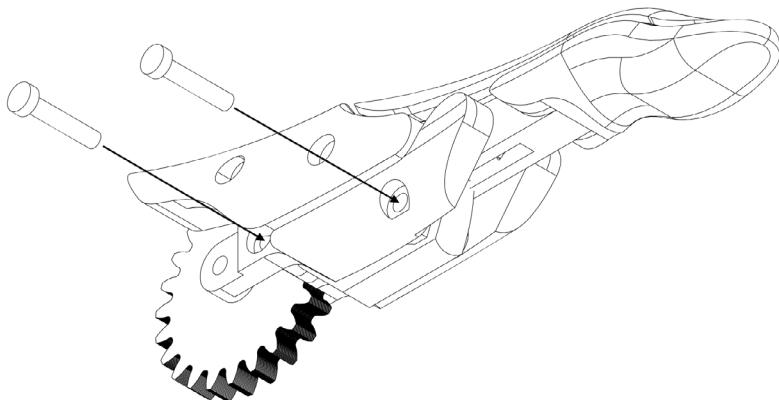
[5] Attach it to the R- I -06 after passing through the shaft (10mm) to R- I -05.



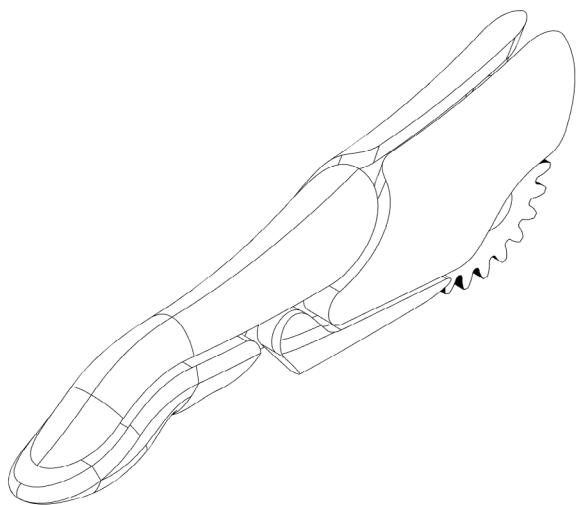
[6] R- I - use the parts that were assembled in 07 and [5], sandwiched from both sides of the parts that were assembled in [4], to Kumiawasema.



[7] combined parts in [6] with a screw (M2L10) as shown in Figure to secure two places.



[8] This index finger is now complete.



As semb li ng

09 Assembly of Mitsuyubi

※ assemble middle finger, ring finger, the little finger. We use the same parts.



- Used parts -

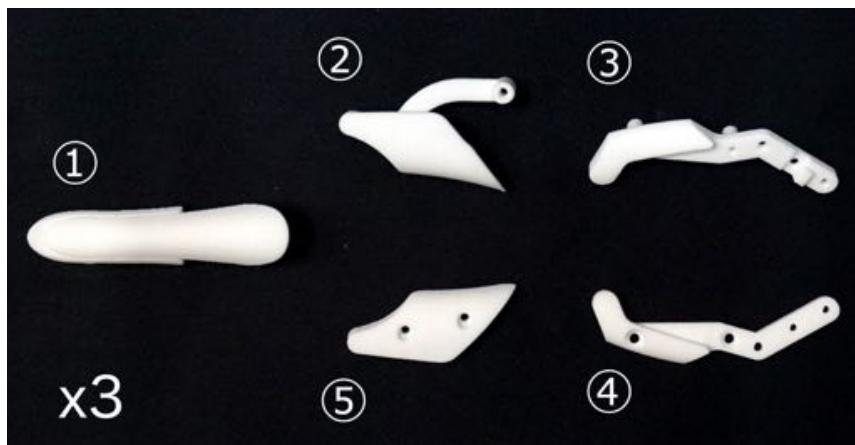
1. RO-01

2. RO-02

3. RO-03

4. RO-04

5. RO-05



- Use a general-purpose parts -

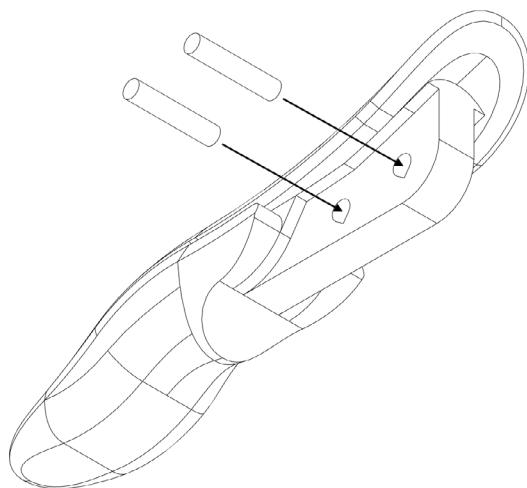


x12

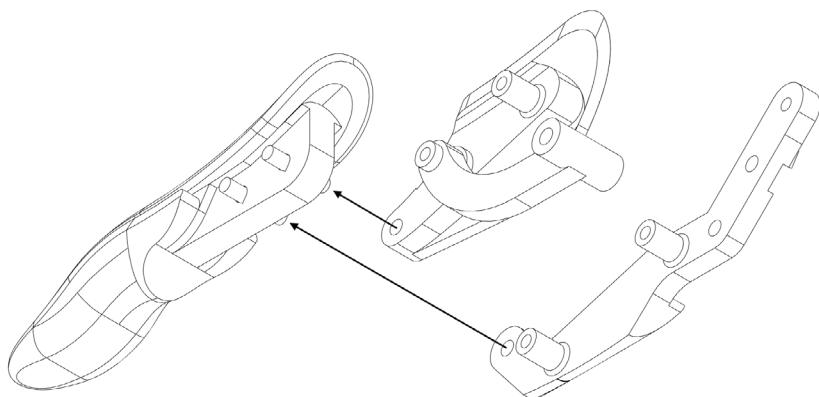


x6

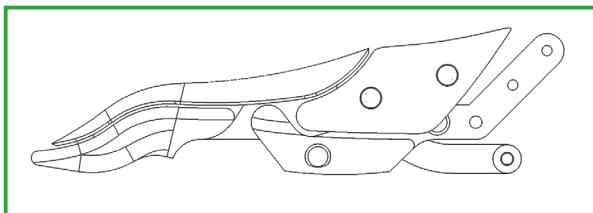
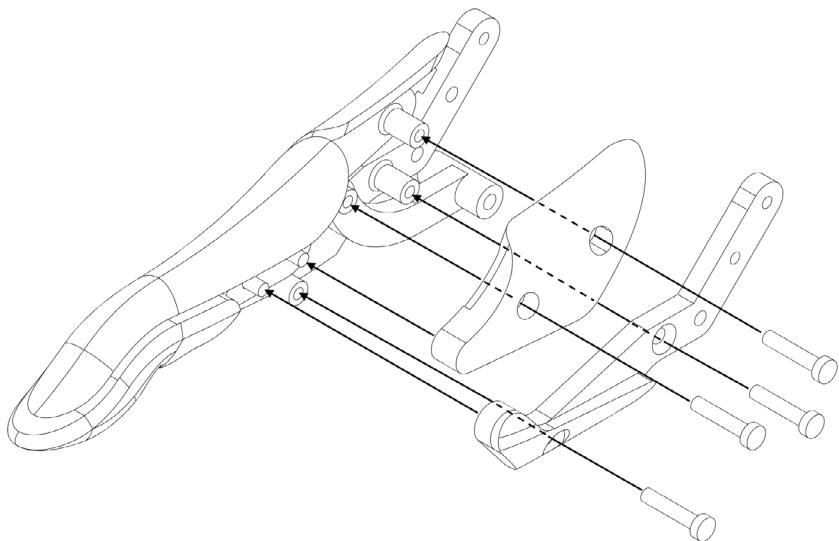
[1] Insert the two shafts the (10mm) to the RO-01.



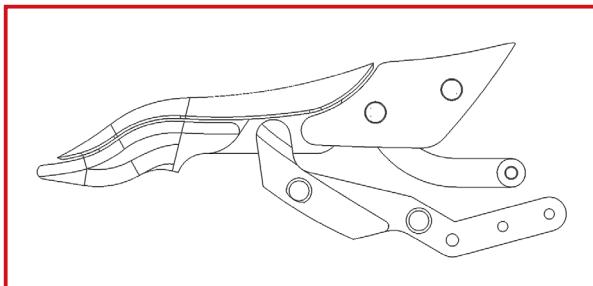
[2] Install the RO-02 and RO-03 as shown in the figure below.



[3] to secure the RO-04 and RO-05 with four screws (M2L10).

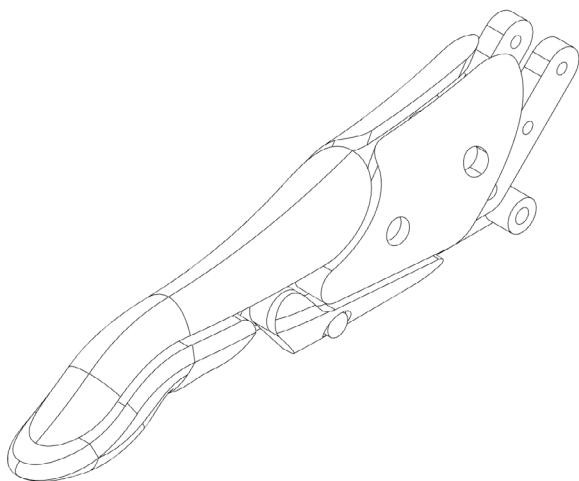


✗ good example



✗ bad example

[4] Assemble three the same thing. This middle finger, ring finger, little finger is completed.

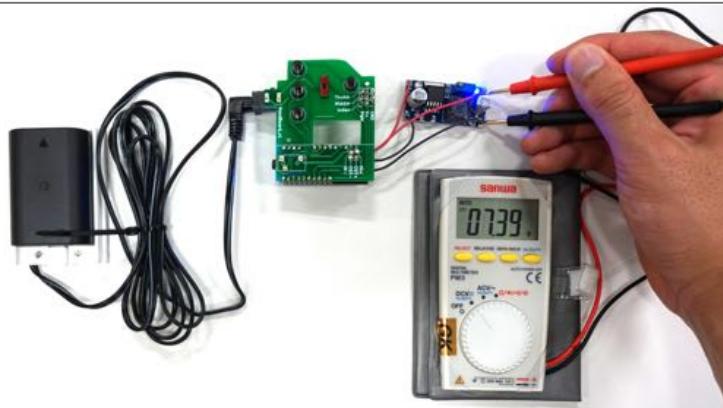


Assembling

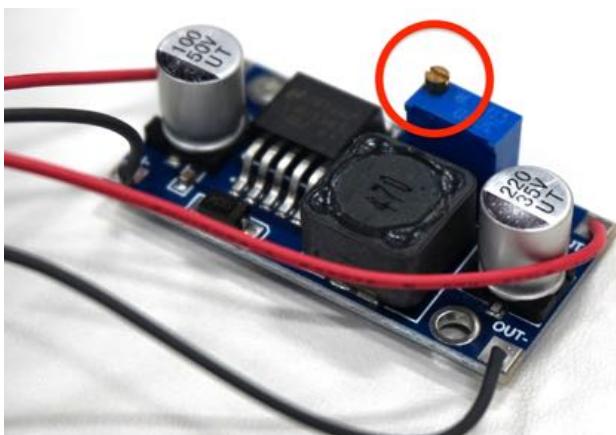
Ten Initial position setting of the voltage adjustment and the servo motor

Set the angle of the servo motor before the assembly of the hand. HACKberry If [1] [2] to use the hand board Mk2 is not required.

[1] HACKberry insert the DC plug into the hand board Mk1, you turn on the power pushes up the slide switch on. DCDC converter OUT + and OUT - Measure the voltage by applying a tester. Voltage of the battery in the state of unadjusted has been output as it is.



[2] This **The output voltage 5V** In order to step down to, we will turn the golden parts on the DCDC converter by using the minus dry bar in a counter-clockwise. Voltage gradually from around were 5, 6 rotation beginning to turn will come lower. Adjustment Turn off the power once you have finished.



[3] to the pin header on the board refers to the connector of the servo motor . Please be so that attention such on the outside cable of black (or brown). Servo motor size to pin header that says Index, to pin header that says Middle and Thumb points to the servo motor small connector.

Mk1 case of a substrate, the black (or brown) GND, red V +, white (or yellow) will lead to PWM. Mk2 case of a substrate, the black (or brown) GND, red VCC, white (or yellow) will lead to SIG.



After the connection, the adjustment After the changes the angle of the motor on the power to the substrate is completed. Servo type is the same And mark the Middle and Thumb of the servo motor , Do not Chigae between when you later re-connection.

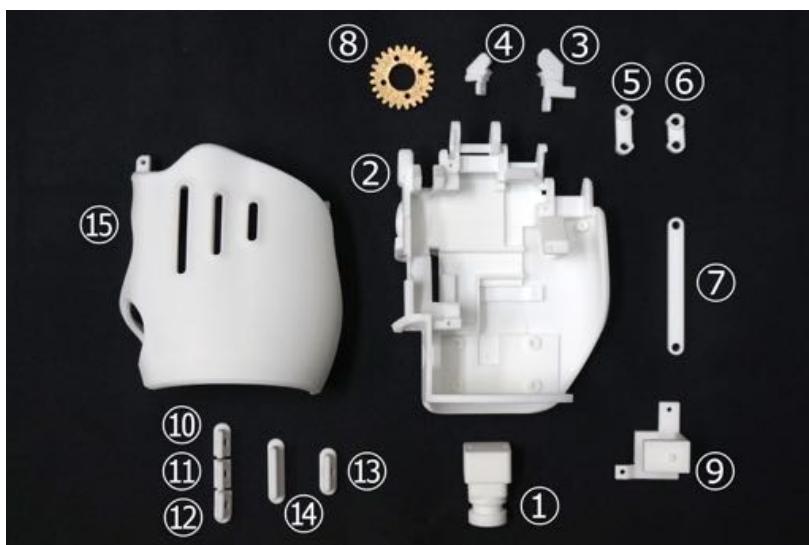
As semb li ng

11 Assembly of the palm



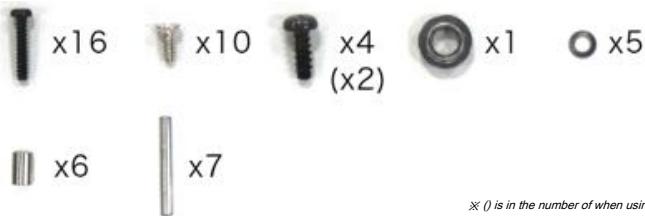
- Used parts -

- | | | |
|-----------|-----------|-----------|
| 1. RH-01 | 2. RH-02 | 3. RH-03 |
| 4. RH-04 | 5. RH-05 | 6. RH-06 |
| 7. RH-07 | 8. RH-08 | 9. RH-09 |
| 10. RH-10 | 11. RH-11 | 12. RH-12 |
| 13. RH-13 | 14. RH-14 | 15. RH-15 |



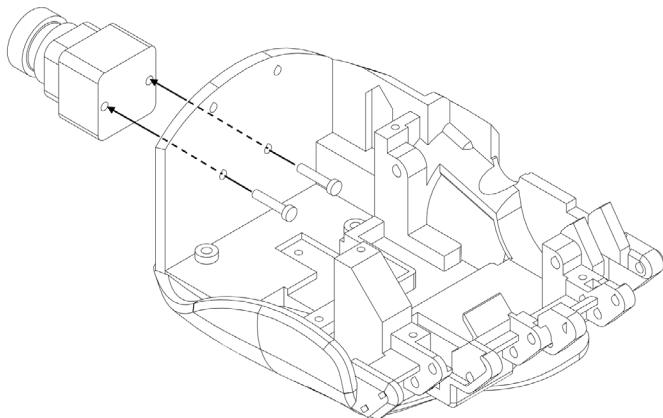
※ RI-03 of the photo was 3D printed using a metal material in order to increase the strength. Strength and durability is inferior, but it is also possible to receive your the Kano parts as well resin material ho.

- Use a general-purpose parts -



$\times ()$ is in the number of when using the Mk2 board.

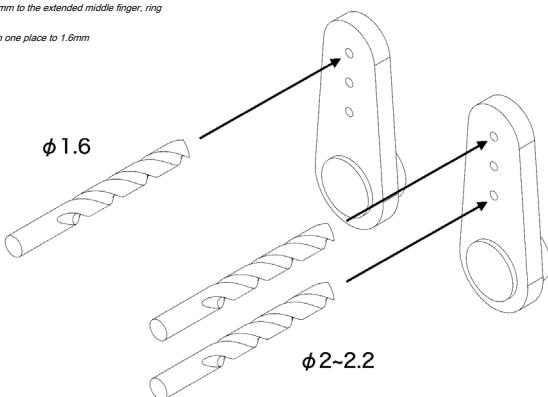
[1] to secure the RH-01 in the RH-02 with two screws (M2L10).



[2] to extend by using the pin vise the hole of the servo horn (as shown in the figure below the form) that comes with the servo motor small. **Be careful not to mistake the place and the diameter of the hole.**

Thumb: two places the 2 ~ 2.2mm to the extended middle finger, ring

finger, little finger for: extension one place to 1.6mm



01 HACKber ry World The goal of



[1] What is the HACKberry?

HACKberry is electric prosthetic hand that was announced in 2015 design ex iii Corporation. The housing is produced by 3D print, also, all the design data has been published on the web as open source. Since September 2016, taken over by the NPO Mi ssi on ARM J apan, it has now also been promoted improvements and dissemination activities.

The electric prosthetic hand, is the artificial arm of the electric to manipulate via a muscle of the electrical signal. And myoelectric sensors against the skin surface, reading the user's intention from the pattern of the signal to be measured, it is the built been the motor moves the prosthetic hand accordingly. The user is a little on the arm

Just put the force, it can be moved intuitively artificial arm in the same way as a healthy person.

The history of the development of electric prosthetic hand is long, it has already been commercialized in the 1960s. However, in the conventional manufacturing and distribution of structured it is difficult to lower the price, it is still very expensive and 1.5 million yen or more. Therefore, can you get an electric prosthetic hand is limited to people of the part of the developed countries. HACKberry is by causing I set the 3D printing and open source, and the electric artificial arm aims to be a "casual choices." 3D printing does not take the initial cost of such as gold die cost, also, you can start making on the spot immediately if access to the open-source data through the web. HACKberry



You can join in as well by becoming one of the people that helps HACKberry grow.

Spread to the world of HACKberry

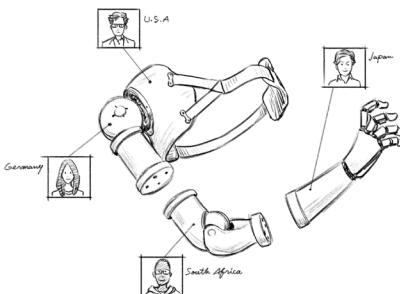
It will reduce the costs associated with manufacturing and distribution in this way, if you pay the material costs of about 50,000 yen, can have anywhere in the world has created a mechanism that can own an electric prosthetic hand. It does not reach it yet practical quality, such as the commercially available products, but a variety of people who in the world have started to make HACKberry.

[2] HACKberry of vision

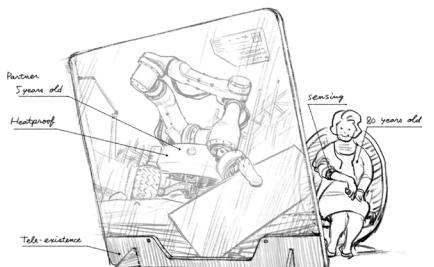
Vision of the HAC K berry is the "casual choices." This has set in relation to two aspects of "price" and "design". As described above, the electric artificial arm of the status quo is very high, it will not spread widely if not drop the price. However, not only lower the price, also be important to widen the width of the design. Our hobbies and life style is infinite variety. Until now artificial arm is a design that resembles the flesh and blood of the hand as welfare equipment was common, artificial arm shoes, Western clothing, considering glasses and the like just as a part of the fashion, spread the possibility of the design of the artificial arm you. HACKberry as an example, has a stylish design not dare such to skin color is decorated. In addition, in order to continue to the artificial arm to "feel free choice" is, the focus is also to "use people" not just "people who make" must be those not. Hand to make the consumer of artificial arm is located at the two sides of the same coin. In order to increase the chance to use a prosthetic hand, we do not do unless we increase the chance of making an artificial arm. Then, in order to increase the chance to make the artificial hand is we believe it is important that we tell the "fun to make." For example, as of the time to create a cuisine, while imagining the life style of the people who use prosthetic limbs, artificial arm of a variety of design and elaborate ingenuity is pointing to the eyes of the world, such as are made one after another.



Customization of the artificial arm



Development by the scan community - open source



Applications other than artificial arm

Based on HACKberry of such a vision was given the name. Hackberry is the English name of Enoki is a broad-leaved elm family. Enoki will put a lot of leaves and fruit stretched branches widely. HACKberry also, "Ri improvements branches and leaves of the way to enjoy by (HACK) spread, the real reach to the user's hand (be rry) connecting the" put the feeling that, in Taiki to bear a variety of artificial arm in the world I want to grow.



Pinch the leaves HACKberry

02 specification

[1] HACKber ry Works

First of all, it shows a typical specification of HACKber ry to the table on the next page. Size and weight are related to the hand, it does not include the socket part. Sensor to be used in HAC K berr y is one simple pressure sensor. This sensor, an inexpensive distance sensor called a photo-reflector, overlapping the sponge Oh Ru 10mm thickness of the cavity in the interior, to create. Place the sensor on the user's arm (as much as possible parts min with muscle), which by fixing around the arms non-elastic band, it is possible to read the user's arm muscle movement in physical you. (This technology has been in reference to the technology developed by Masahiro Yoshikawa teacher of Osaka Institute of Technology.)

There are three angle of the servo motor will change depending on the value of reading a simple pressure sensor. Information processing in this case is done by the microcomputer. When the user put a force on the arm hand is closed, hand and pull out the forces opens. In addition, the speed of closing put the force of the hand as strong is faster. Programs that are open public as open source has become such a setting, but be Rukoto (for example, such as reversing the opening and closing of the hand) to a different rewrite the program set is also available.

[2] feature design of the HACKber ry

Difficult to reproduce perfectly the skillful hands of the native is now in science and technology, when designing the artificial arm will be required to sift through the Function. HACKber ry bearing in mind the practical use in daily life in ry, have brought good UNA the following features.

By employing the link mechanism, such as a page view, you have little ones to "pinch" function as "that grip" the big thing was both function. In this link mechanism, intended for is sent to hit the base of the joint of the rotating force of the tip joint middle finger, among motors 1, knob for smaller and for larger ones to grasp you can switch to passively.

(2) Ease of assembly

Artificial arm has a complex aircraft structure as compared with the general appliances. There is also a higher risk of failure because they are used in a variety of environments. In addition, HACKber ry is based on the assumption that the third party as open source is raised but not assembled. For these reasons, easy to assemble is HACKber ry, also, it is important that easy to fix set seen. All configuration parts of HACKber ry is using those available in the world. In addition, we adopted a gear without using a wire to drive the finger joint. Wire is easy to express the soft movement similar to the tendon attack, but more easy to loose in reverse, requires frequent maintenance. On the other hand, it will become a firm movement that's gear, but it is also easy to repair when it failed rather loose.

(3) wrist mechanism

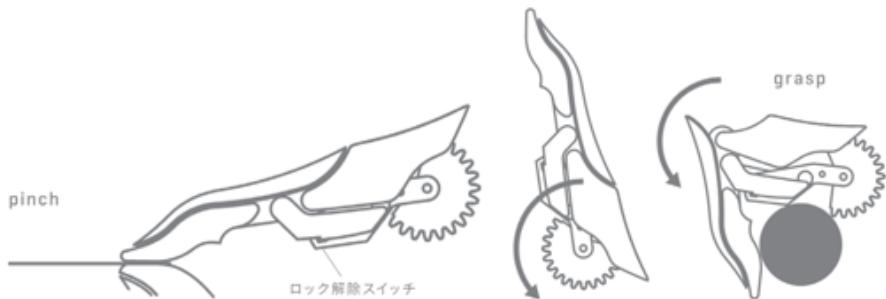
Given your Kuru convenience of in everyday life, you can not neglect the movement of the wrist, not hand destination only. Wrist of HAC K berr y is you can adjust the angle manually. When you press the button, which is placed on the wrist part, or rotate the wrist, and you can tilt. Also, to attach and detach the hand portion and a wrist portion, it can be adjusted placed every 90 degrees. These three degrees of freedom with the Kumiaiwaru and wrist (pronation / supination, Tenohira屈 / dorsiflexion, 糸屈 / Shaku屈) can be reproduced. For more information, refer to "3. More to enjoy it a HACKber ry" (P145).

(1) Compatible with the "pinch" in the "hold"

People when you take things in hand, you can and skilfully adjusted child the attitude of the finger and wrist to match the shape of things of interest. However, in the case of artificial arm, because the number of the motor is limited, it can not be performed free adjusted as innate hand. So, HACKber ry the index finger next

Size	225 x 150 x 60 (mm) × If the thumb is in the collateral position
Weight	Change by 450~500g × material
Se down service simple pressure sensor x1	
Motor over servo motor (large) x1 × flexion of the index finger	Servo motor (small) x2 × inside and outside rotation of the thumb, of medium / medicine / little finger bent
Bas Tsu te rie L i - ion battery (. 7 2V, 2200mAh) Ma Yi co-down	
Mk1: Arduino mi cro	Mk2: Arduino nano-compatible products

HACKberry specification



HACKberry of the index finger of the link mechanism

Introduc ti on

03 License form

If you are using the HACK berry as open source, you must adhere to the following conventions exiii Co., Ltd. was established.

====

HACKber ry Open Sour ce Proj ect Pol i cy

Ikushi (hereinafter referred to as "Company") Co., Ltd., in the present policy, (hereinafter referred to as the "project") "HACKber ry" published such as source code and data relating to the contents and the use conditions of the It dictates.

1. Purpose

1.1. The purpose of this project is, (hereinafter referred to as "user".) The Company has all of the users of this project for, to publish the source code and data in accordance with the present policy, about our invention by the use license, it is to promote research and development and widespread use of artificial arm.

1.2. This policy source code and the data has been published on the basis of, or for the use Licensed inventions on the basis of this policy, and to prohibit the use of the purpose of the provisions in each item below.

1. 2.1. Use for of military purposes

1. 2.2. Use for the purpose contrary to public order and morals

1. 2. 3. Use for the purpose of honor or disparagement of the Company or HACKber ry

1. 2. 4. Company use by the purpose of determining that there is a risk corresponding to the above items

2. Source Code

Source Code on HACKber ry will be published based on the following license. If you wish to use the source code in different conditions and each license (commercial use, etc.), contact your up to the following address.

[Info Atto Ex . iii Jp] (Ma ll To: Info Atto Ex . iii Jp)

Source Code License

2. 1. A r du i no sketch (which means the source code for writing to A r du i no Mi cro with a built-in artificial arm.) GNU Genera l Publ ic L i cense ver s ion 3

3. Data about the hardware

Each data about the hardware on HACKber ry will be published on the basis of each license or the following conditions. If you are with each license you wish to use the data under different conditions (commercial use, etc.), please contact us at the following address. [Info Atto Ex . iii Jp] (Ma ll To: Info Atto Ex . iii Jp)

Data license

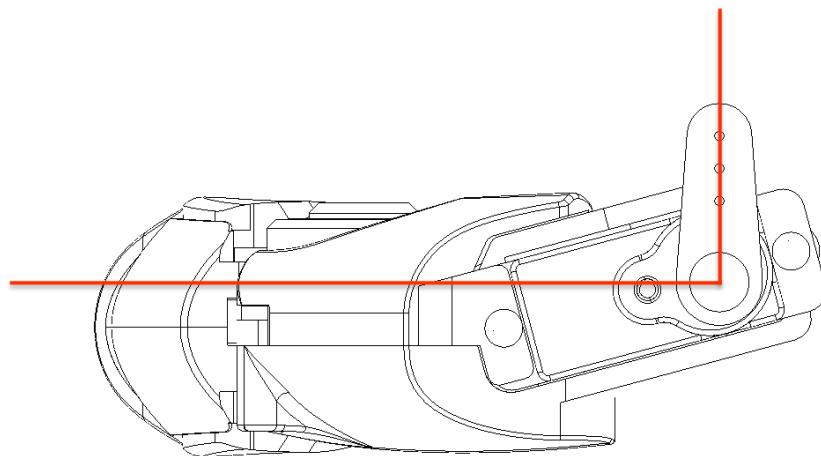
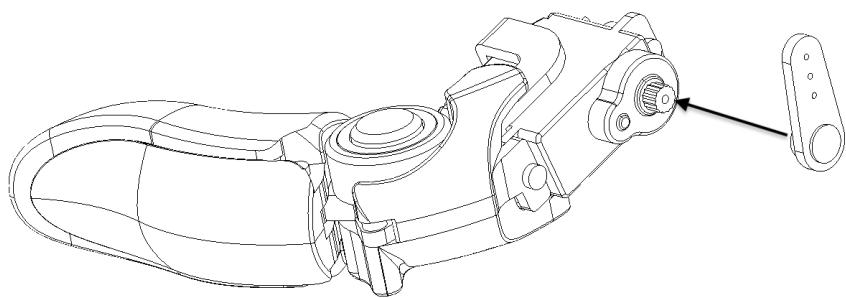
3.1. (Meaning the shape data of the components used in the prosthetic hand.) 3D data Creat i ve Commons L i cense BY-NC-SA 4. 0 Internat iona l

3.2. Hand board data (microcomputer, means a circuit board for connecting the motor, the sensor and the battery. Cr ea ti ve Commons L i cense BY-NC-SA 4. 0 Internat iona l

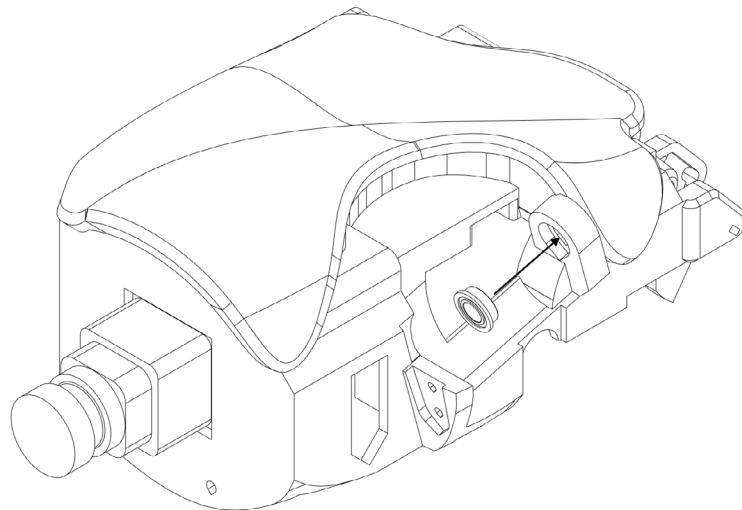
3.3. (Means a circuit board for mounting the reflection type optical sensor for detecting a raised muscle (photo-reflector.) Sensor substrate data Creat i ve Commons L i cense BY-NC-SA 4. 0 Internat iona l

3.4. (Means a circuit board incorporated in the battery box.) Cell substrate data C r ea ti ve Commons L i cens e BYNC-SA 4. 0 Internat iona l

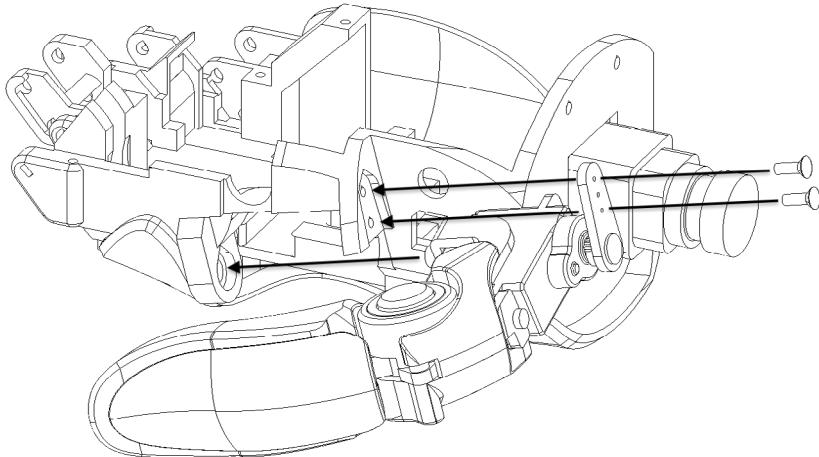
[3], taking care not to rotate the shaft of the servo motor from the set state at "10 voltage adjustment and the initial position setting of the servo motor" (page 92) to attach the thumb unit and the servo horn at right angles.



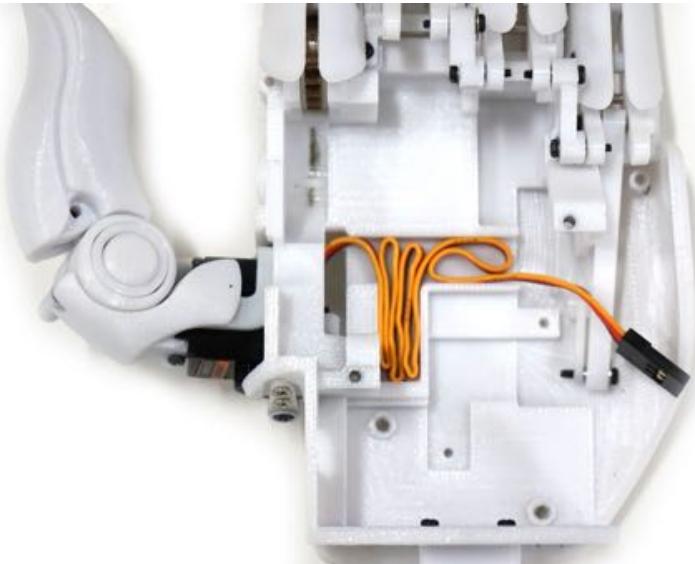
[4] Push the bearing to the RH-02.



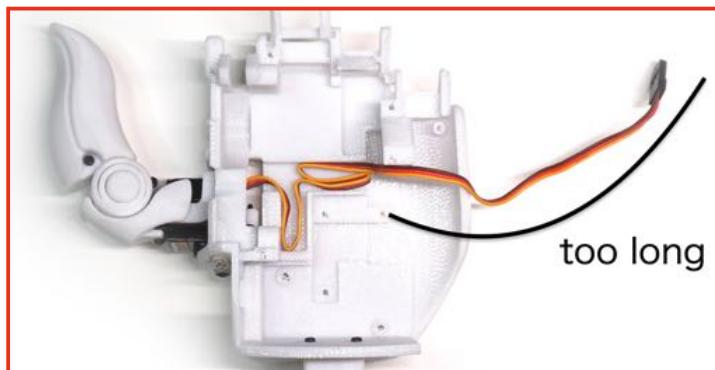
[5] and secure using the two screws the thumb (M2L6).



[6] of the servo motor cable is folded from crowded into the RH-02 as shown in the figure below.

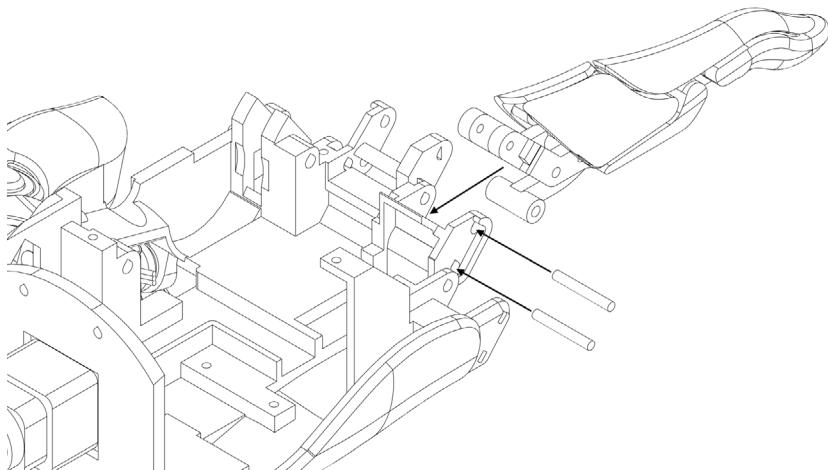


✗ good example

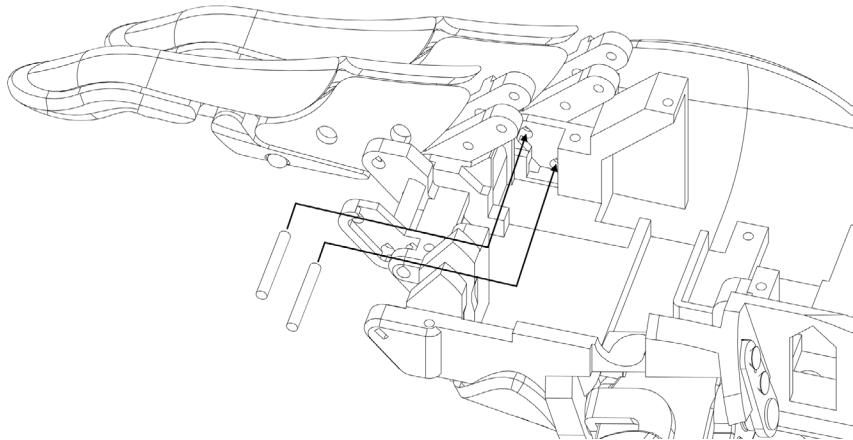


✗ bad example

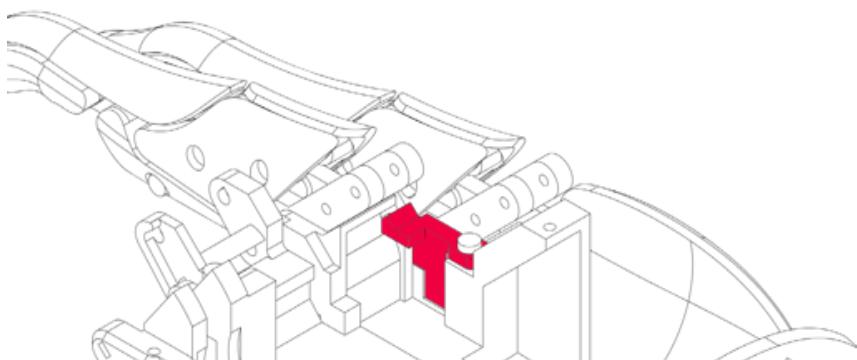
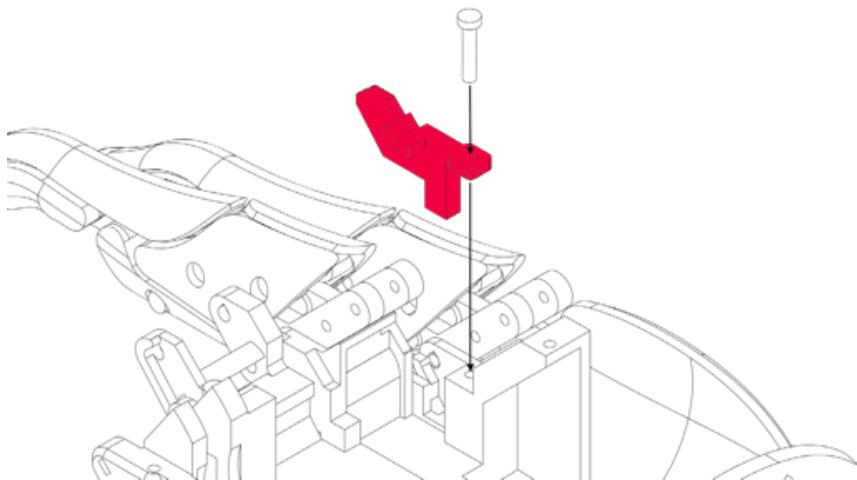
[7] and then attach the ring finger unit through the shaft (15mm) of the two as shown in the figure below.



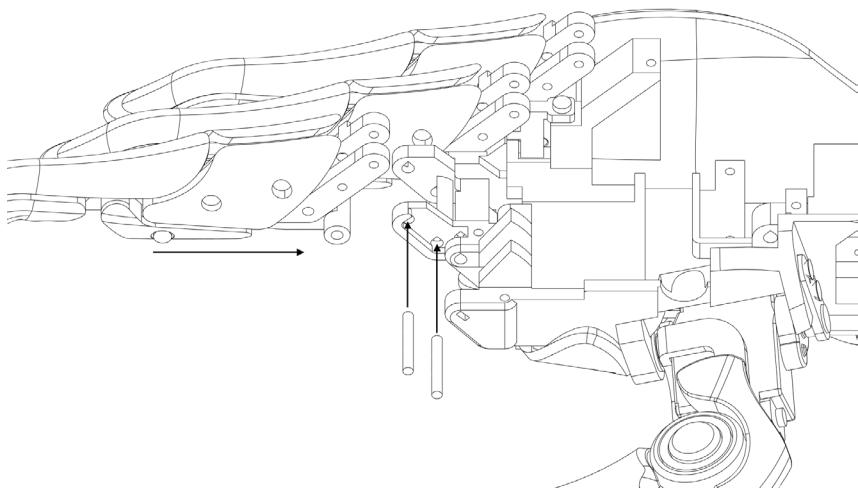
[8] little finger unit in the same way also the mounting using two of the shaft (15mm).



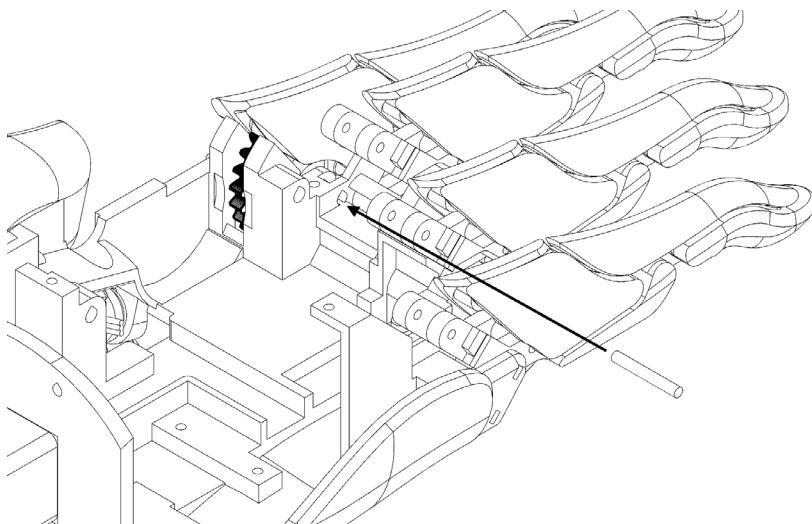
[9] Replace the RH-03 with screws (M2L10) as shown in the figure below.



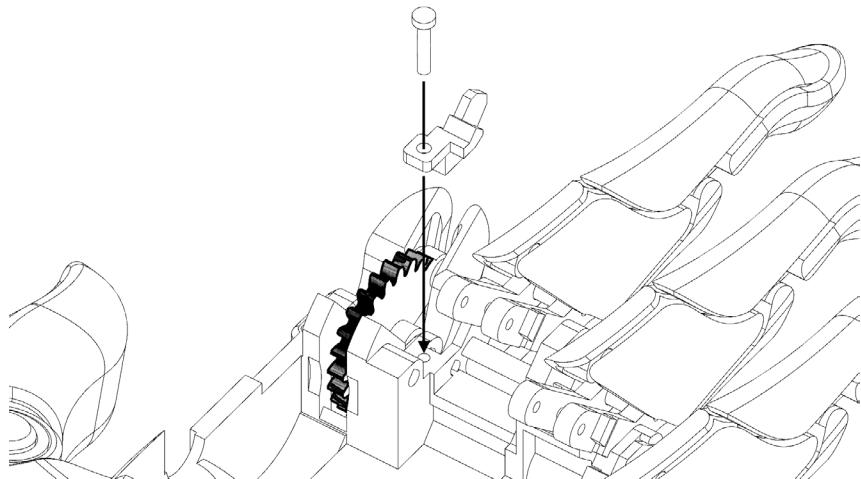
[1 0] middle finger by using the two shafts (15mm) to attach as shown in the figure below.



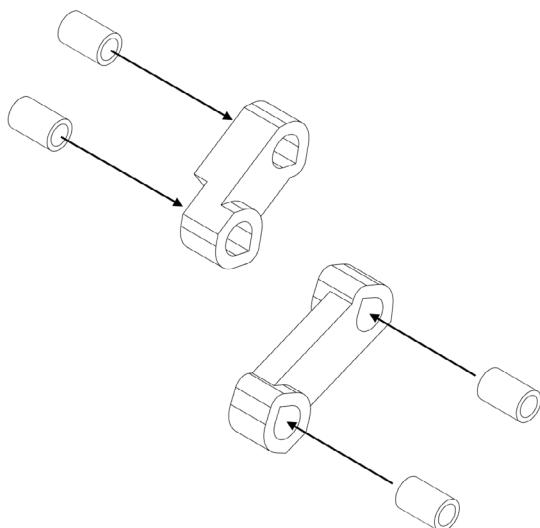
[1] The index finger unit by using a shaft (15mm) Attach as shown in the figure below. At this time, the shaft will be pass through the holes in the gear.



[1 2] the RH-04 by using a screw (M2L10) Attach as shown in the figure below.

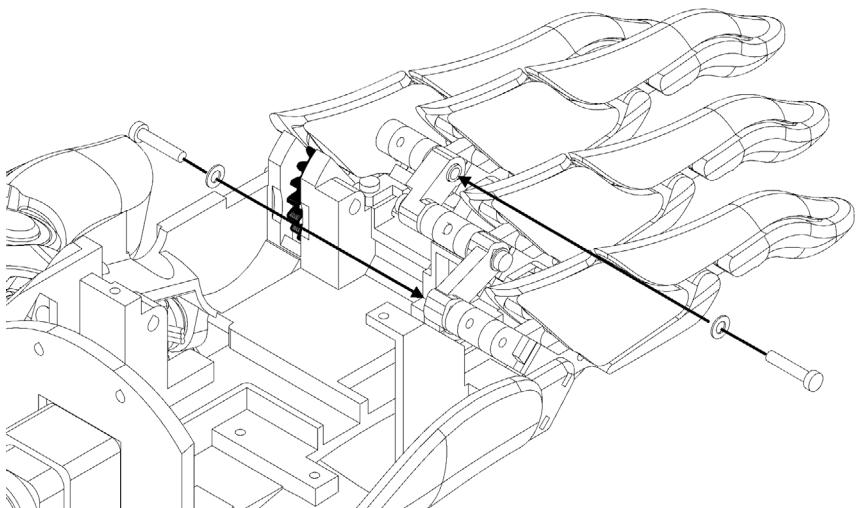
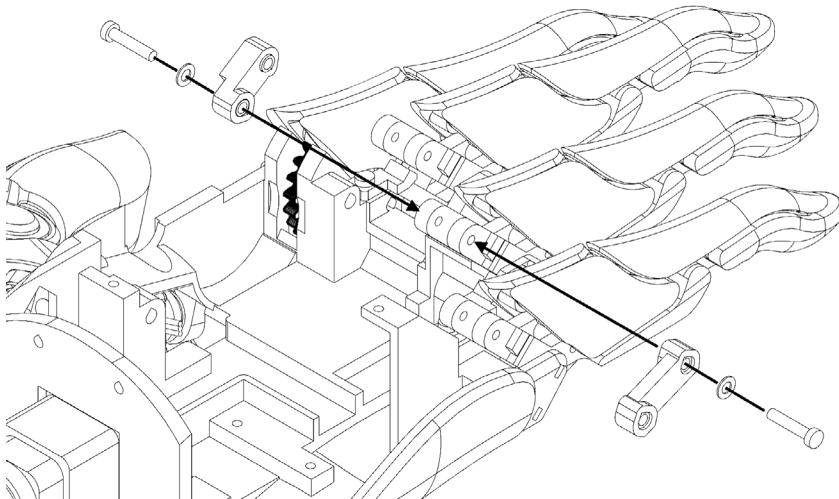


[1 3] Plug into two by a spacer to RH-05 and RH-06.

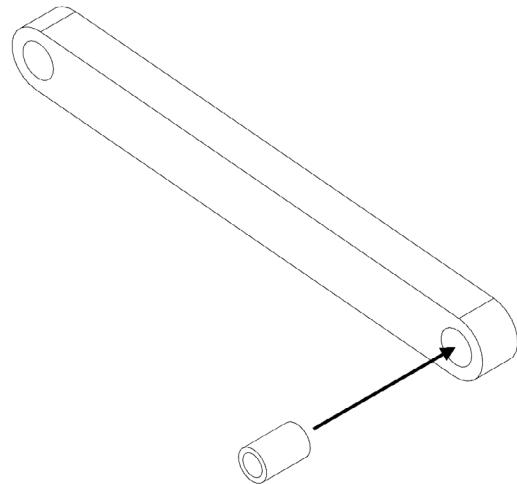


[1 4] to secure RH-05 and RH-06 the two places through (a total of four places) washer with screws (M2L10).

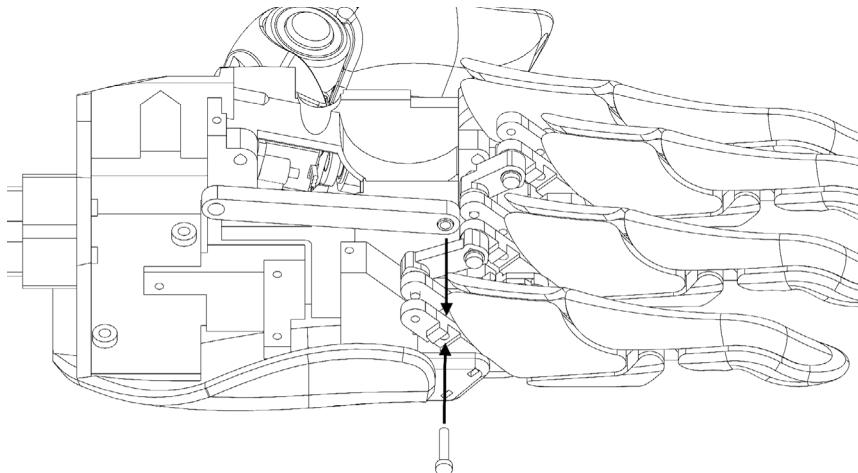
※ RH-05 (the longer parts of) the Note to be mounted between the little finger and ring finger.



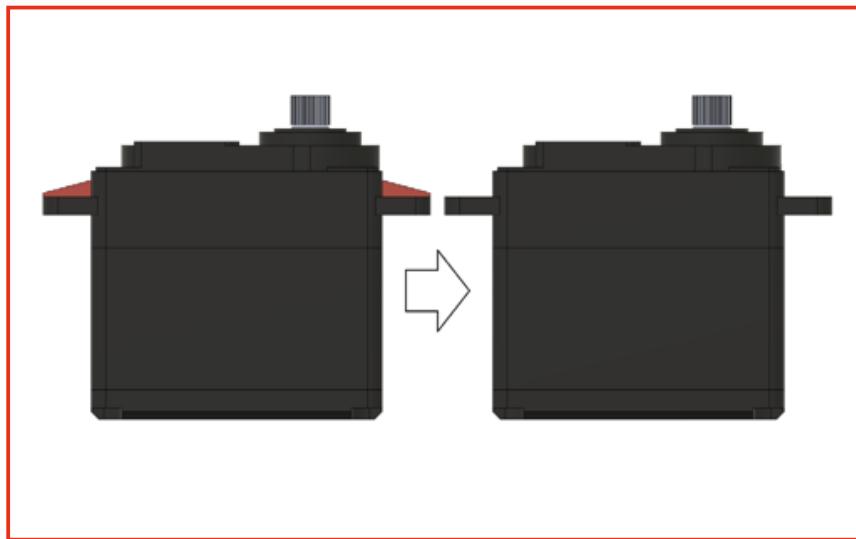
[1 5] and insert it into one of the holes in the RH-07 a spacer.



[1 6] and attach it to the little finger unit to the RH-07 with screws M (2L10).

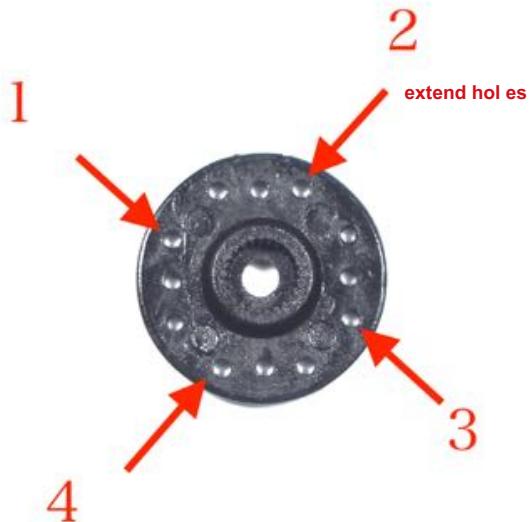


[1 7] Cut the part that has been shown red in the servo motor size in the figure below in the nippers and the like.

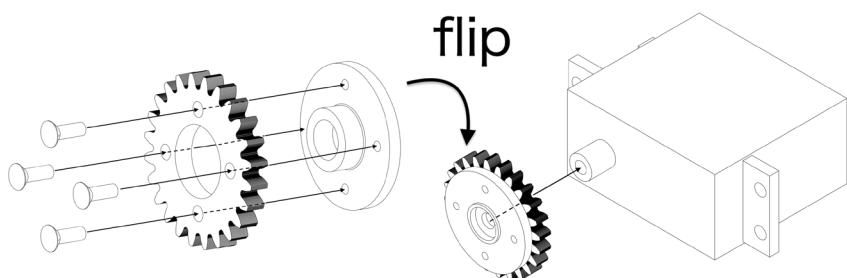


Side view

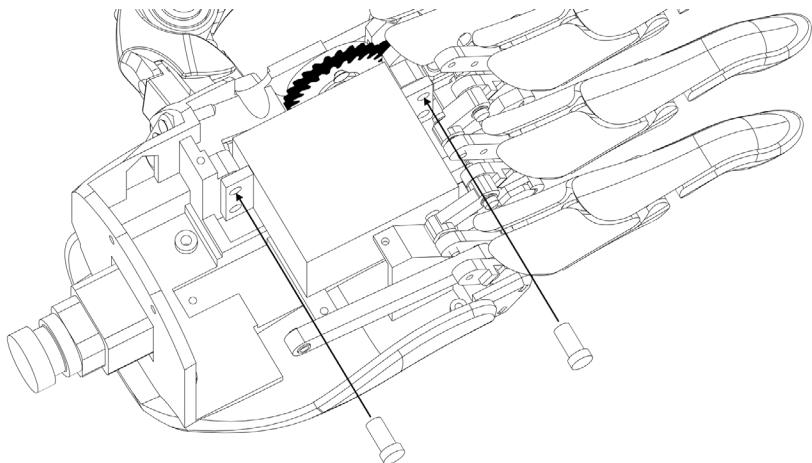
[1 8] of the servo horn that came with the servo motor large hole (**The right end of the triplicate hole of**) By using the four locations pin vise you extended to 1. 6mm.



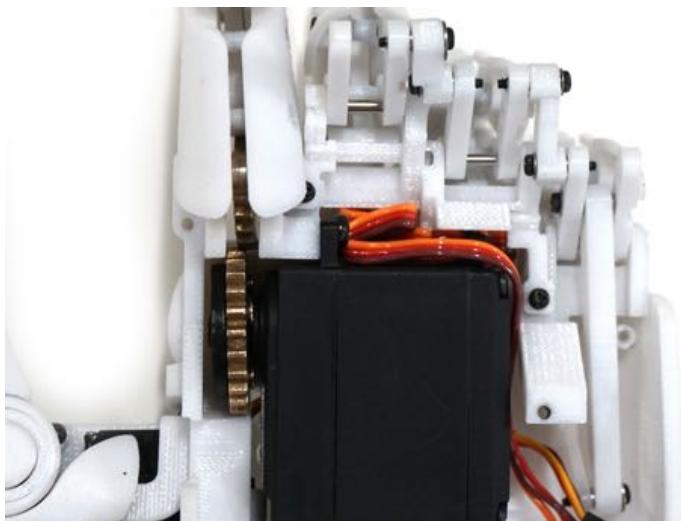
[1 9] and attach it to the servo horn using the RH-08 the four screws (M2L6).



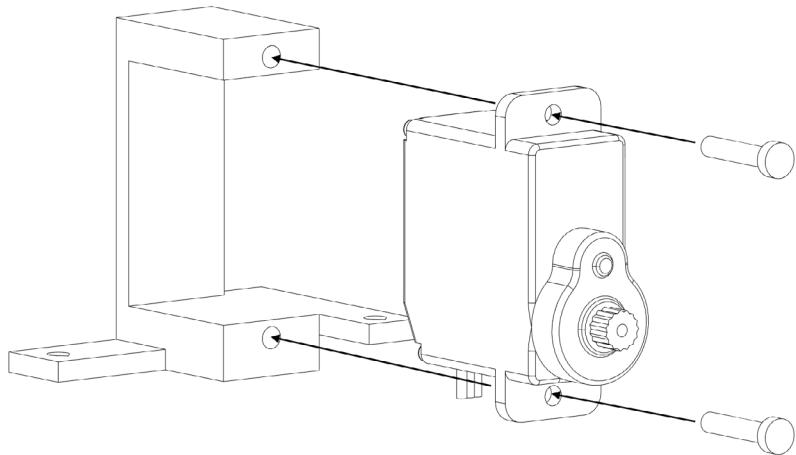
[2 0] Taking care not to rotate the shaft of the servomotor, with the index finger extended RH- 02 in the Sir Bomota large Attach with the two screws (M3L8).



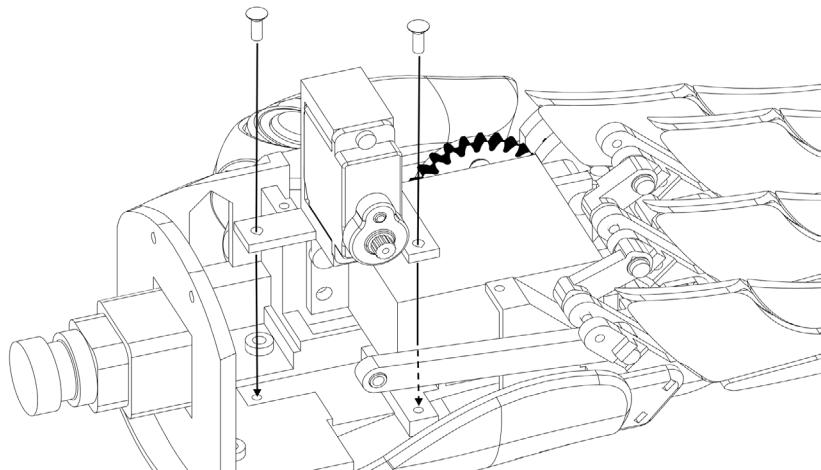
[2 1] summarizes the cable as shown in the figure below.

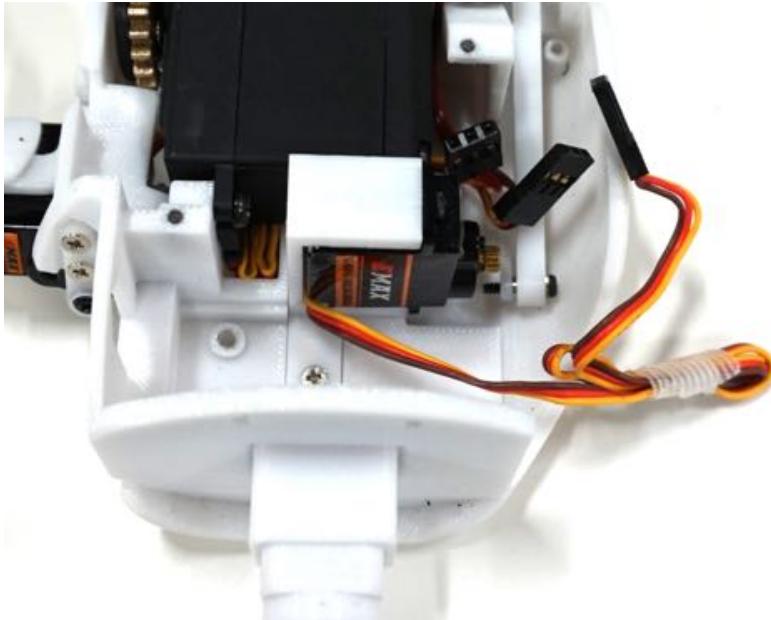


[2 2] to the RH-09 servo motor small and secure it with two screws (M2L10). In this case, cables, please be careful to put out on the left side.

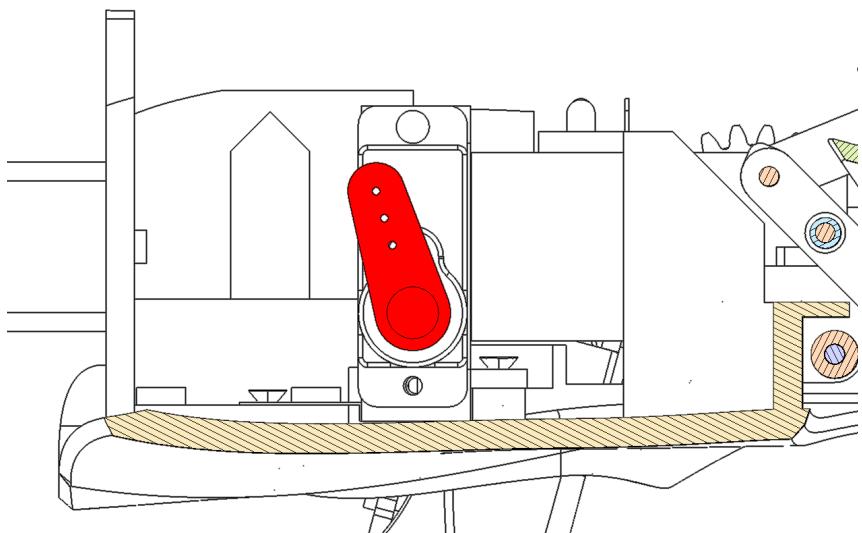
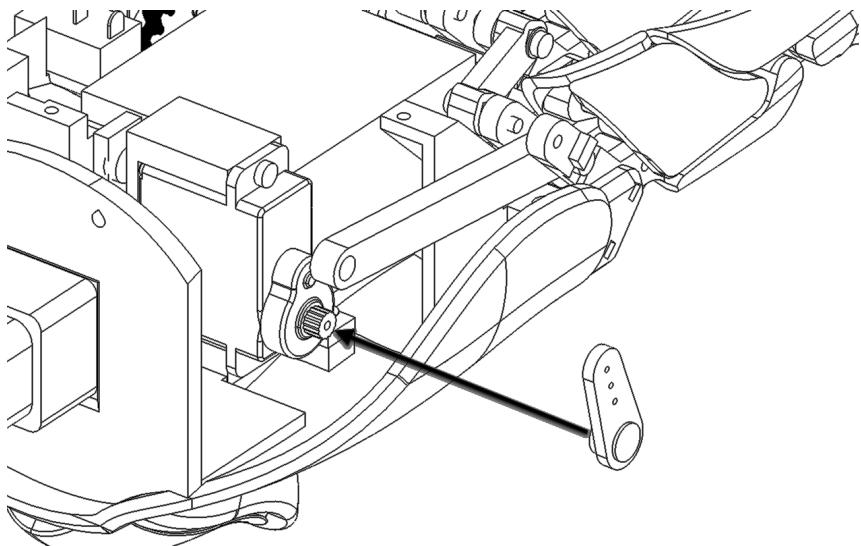


[2 3] This was fixed with two screws (M2L6), and handling the second piece of the cable as shown in the photograph. Please be careful because that would here accidentally use the screws (M2L10) and protruding screws from the palm.

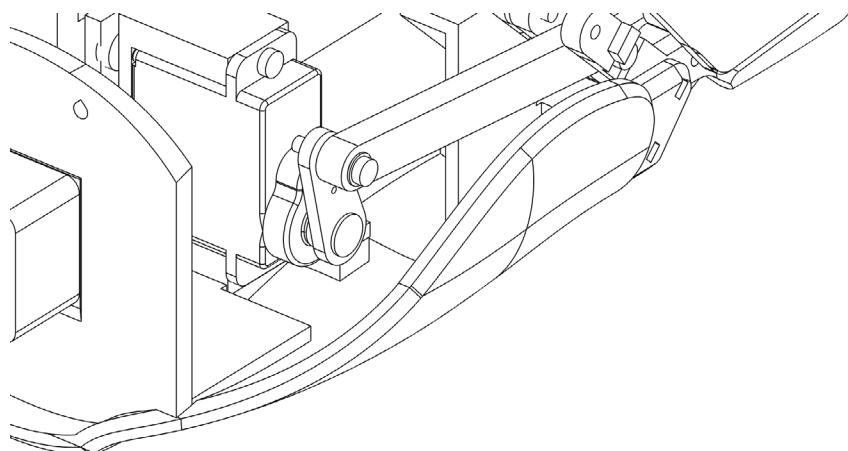
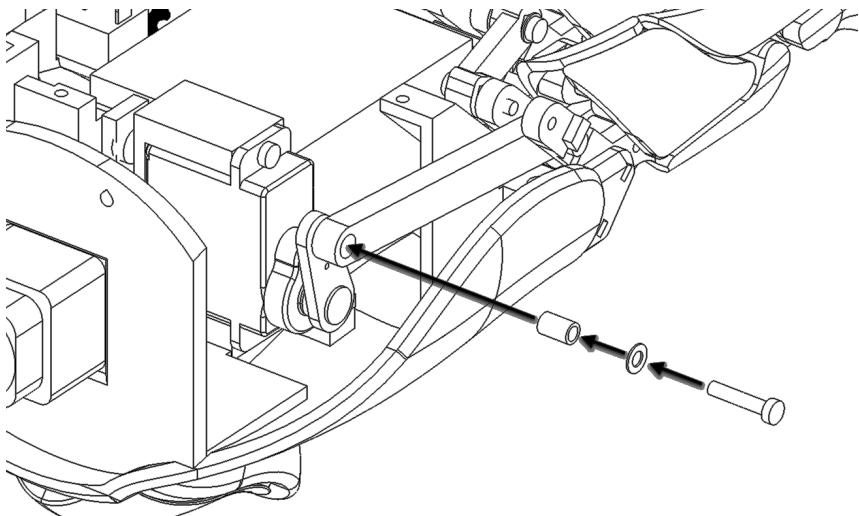




[2 4], taking care not to rotate from the state in which axes of the servo motor is set at "10 voltage adjustment and the initial position setting of the servo motor" (page 92), mounted at an angle of FIG servo horn servomotor you.



[2 5] the RH-07 to the servo horn through the washer and spacer and attach with screws (M2L10).

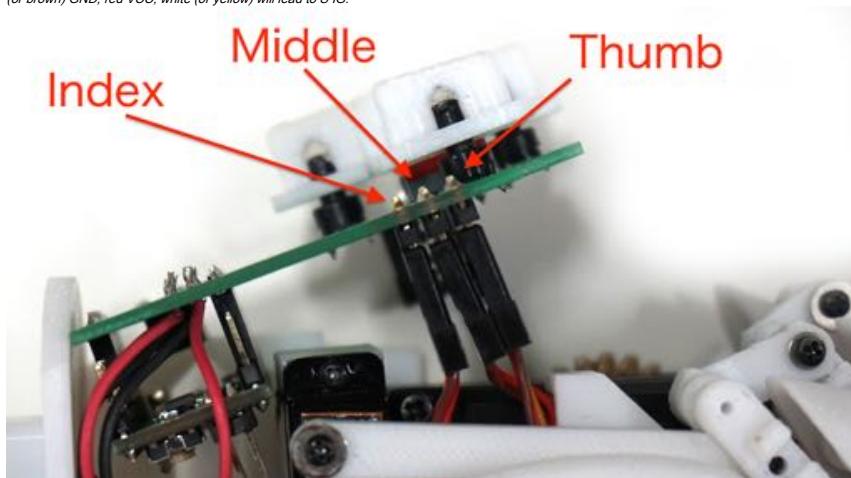


[2 6] of the servo motor cable through as shown in the photograph.



[2 7] to the pin header on the board refers to the connector of the servo motor. **Please be careful so as to be outside the cable of the black (or brown).** Servo motor size to pin header that says Index is, the pin header that says Middle and Thumb you can also plug the servo motor small connector.

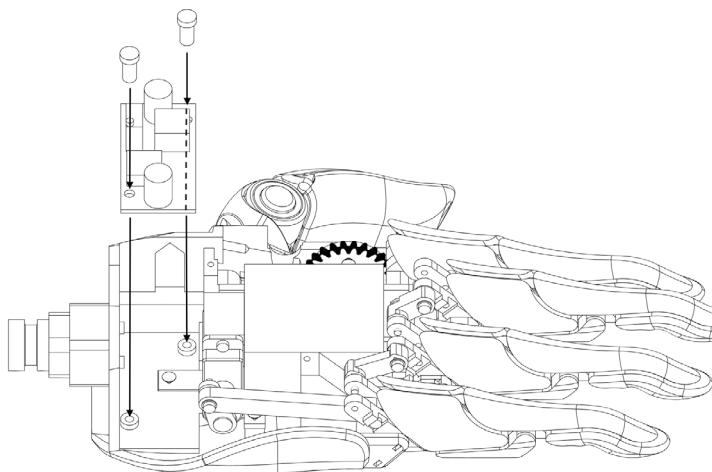
Mk1 case of a substrate, the black (or brown) GND, red V+, white (or yellow) will lead to PWM. Mk2 case of a substrate, the black (or brown) GND, red VCC, white (or yellow) will lead to SIG.



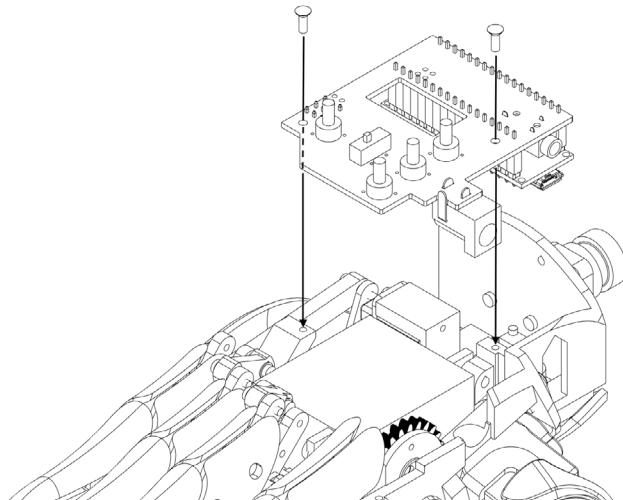
» Is the next installation of the board.

From [28] In the case of Mk1, please refer to [33] and later in the case of Mk2 board.

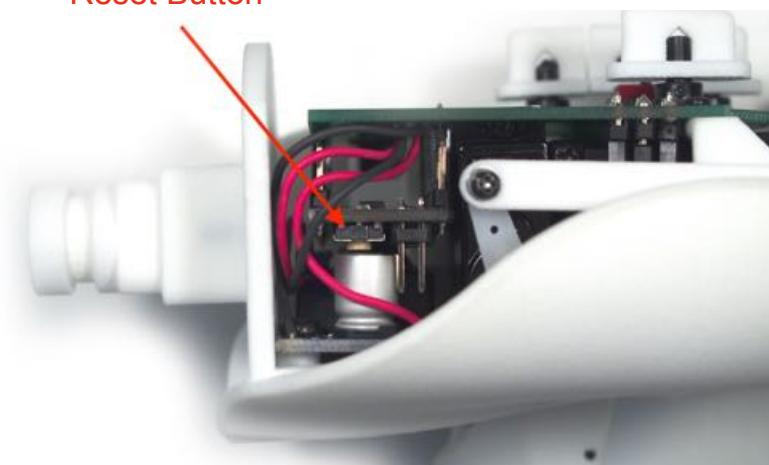
[28] the DCDC converter and secure it with two screws (M3L8).



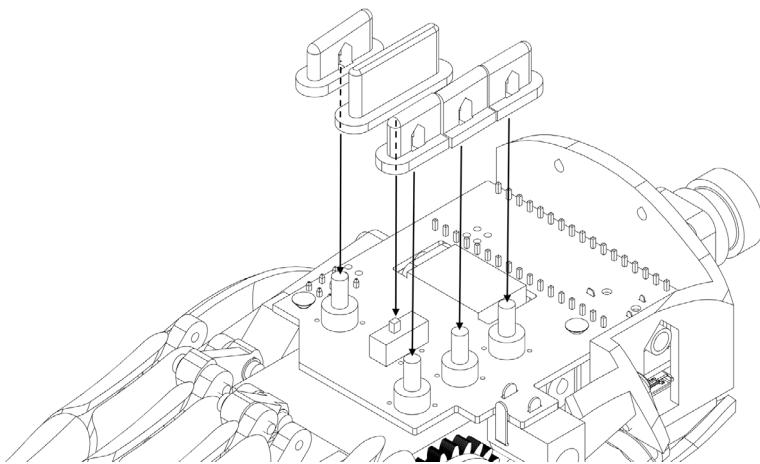
[2 9] and secure using the two screws of the substrate (M2 L 6). At this time, or not Tsu inserted Arduinno Micro is as far as it will go, and the screw for the substrate fixed tightened too strongly, Arduino Micro of the reset button is held down HACKberry work correctly please note that not.



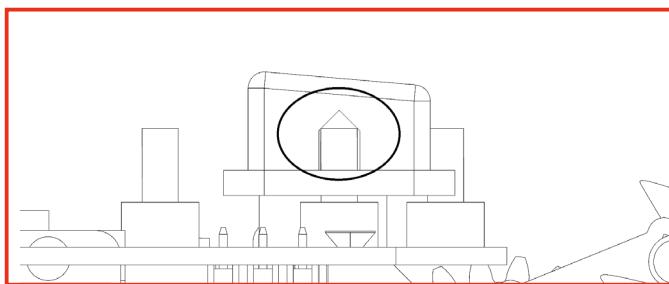
Reset Button



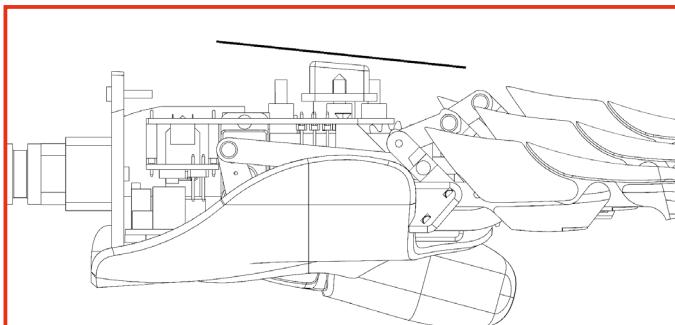
[30] Attach the RH-10, RH-11, RH-012, RH-13, RH-14, as shown in the figure below.



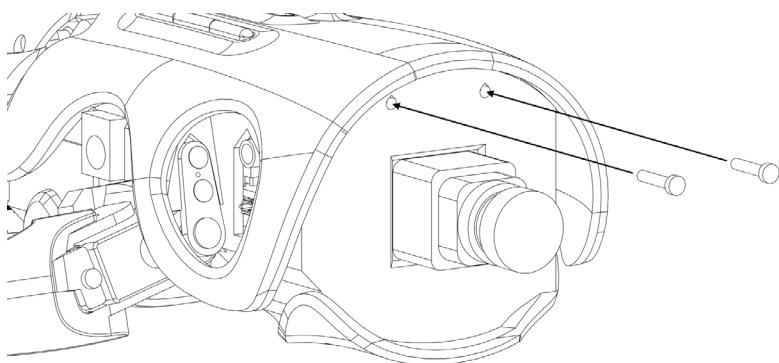
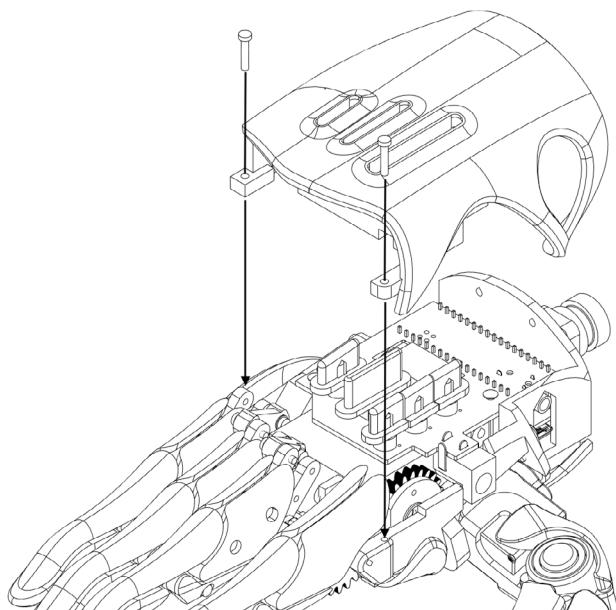
※ Please firmly inserted until all back.



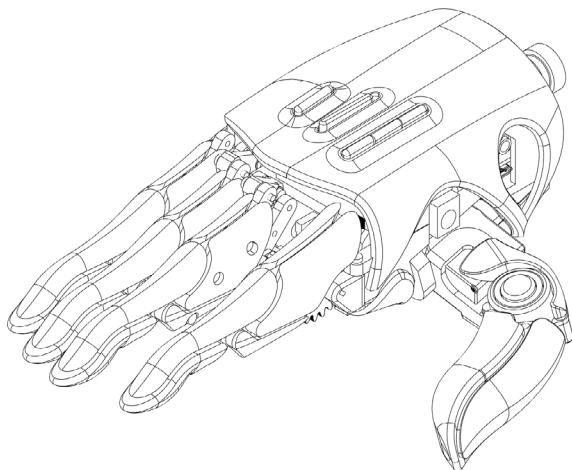
RH-13 ※ The side shorty will be facing a fingertip.



[3 1] and secure it using the RH-15 the four screws (M2L10). It is mounting easy this time are bending the finger.

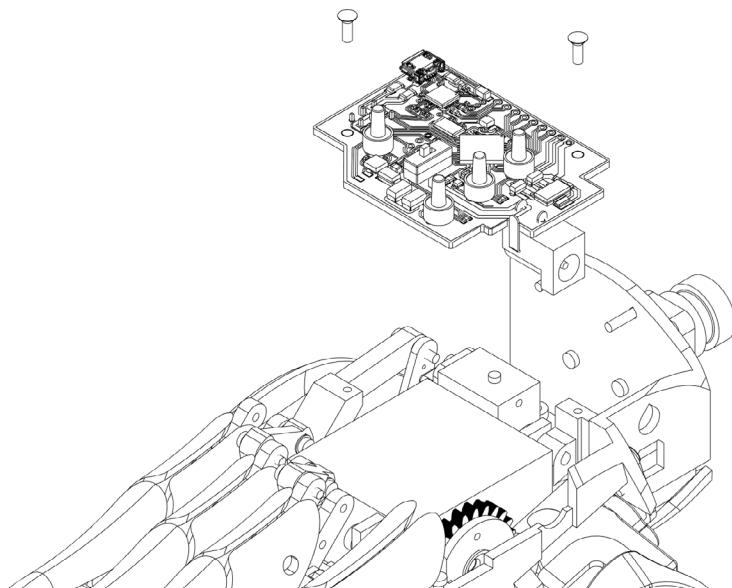


[3 2] This completes the palm of the assembly. Please proceed to the next chapter.

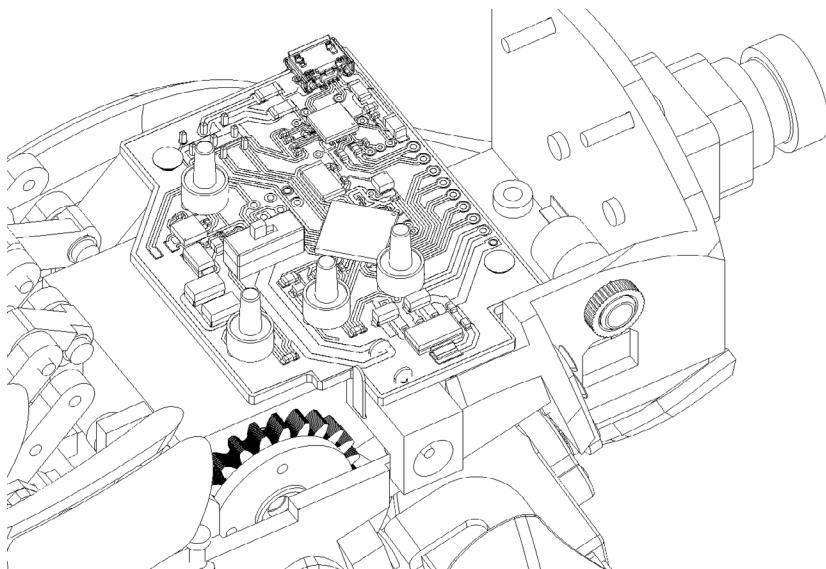
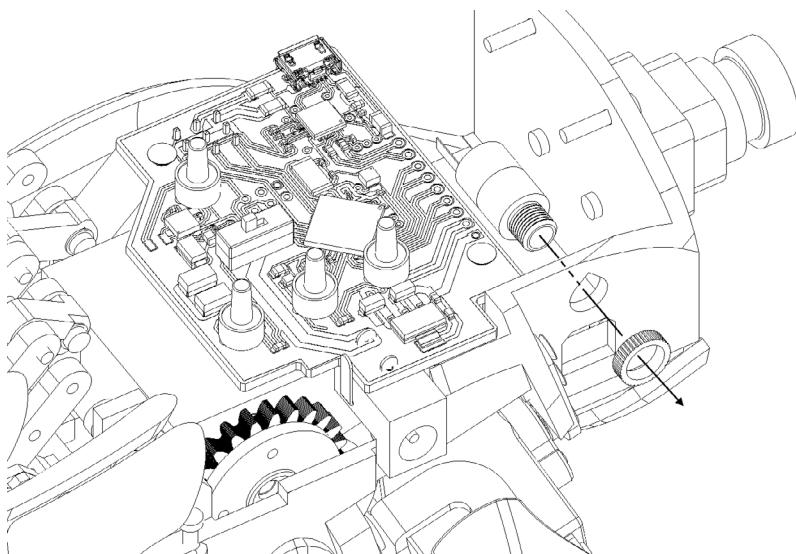


from here.

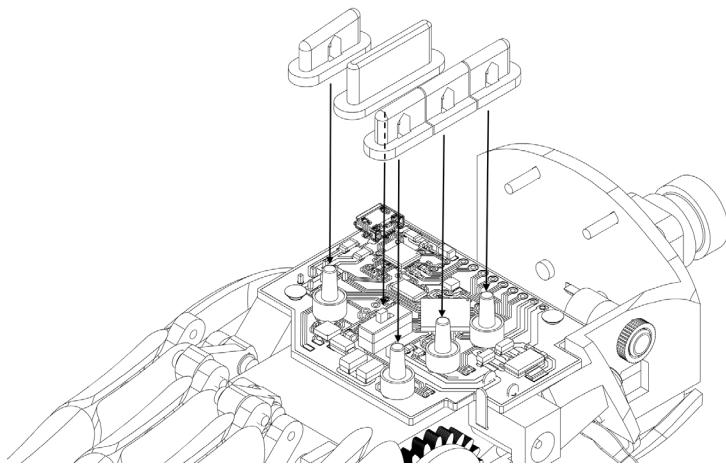
[3 3] HACKberry hand board Mk2 it was fixed with two screws (M2L6). »Mk2 is the case of the board



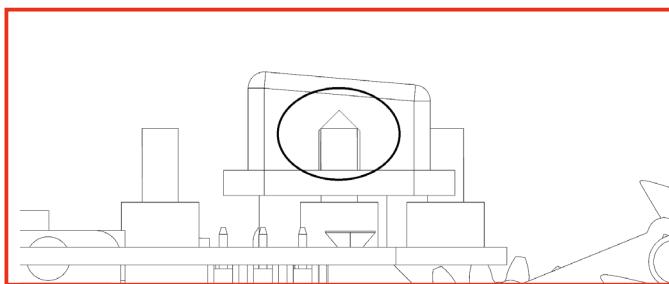
[3 4] Remove the stereo jack of nut once, and attach again to then sandwich the RH-01.



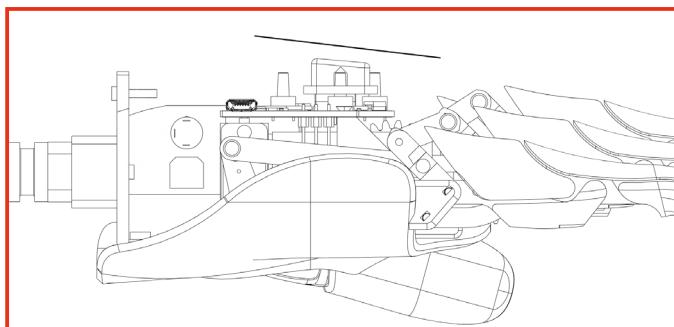
[3 5] Attach the RH-10, RH-11, RH-012, RH-13, RH-14, as shown in the figure below.



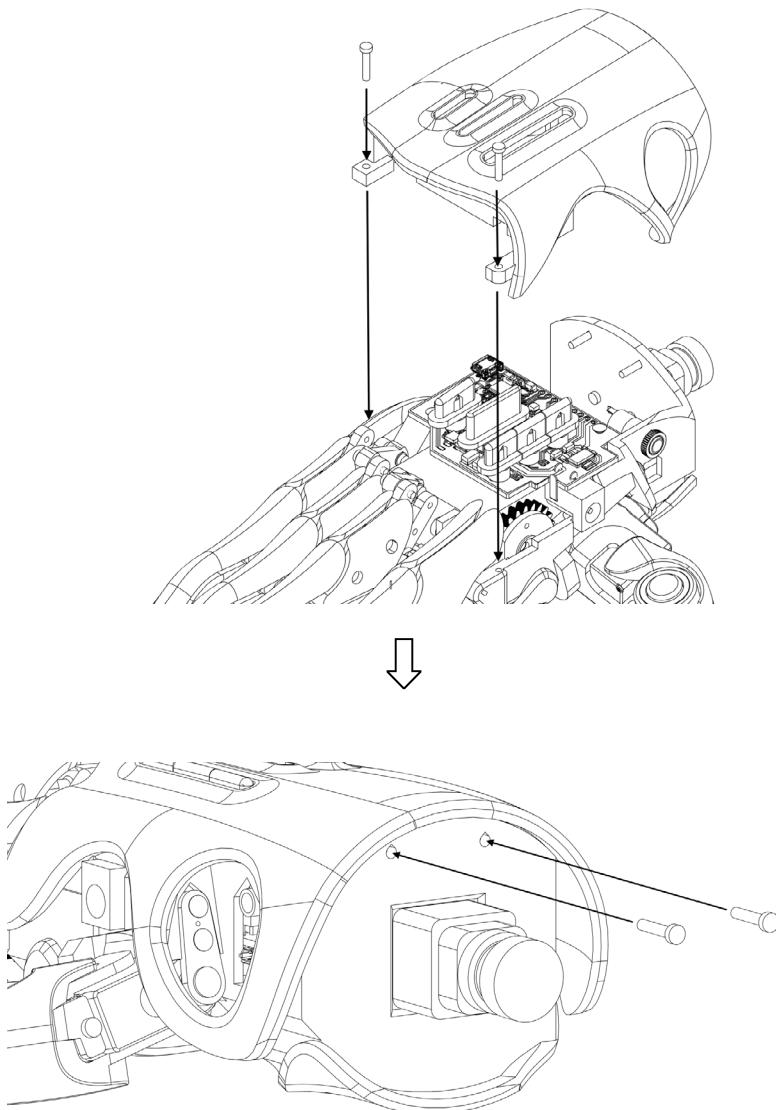
※ Please firmly inserted until all back.



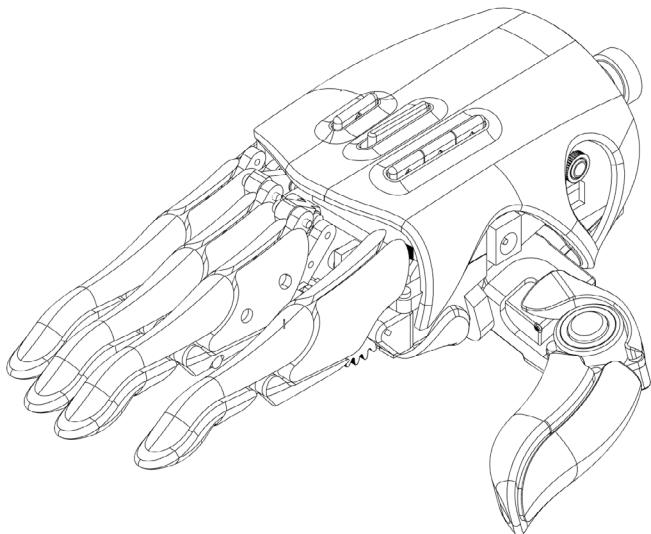
RH-13 ※ The side shorty will be facing a fingertip.



[3 6] and secure it using the RH-15 the four screws (M2L10). It is mounting easy this time are bending the finger.



[4 7] This completes the palm of the assembly.



Assembly

11 Assembly of the wrist

※ do the assembly of the wrist unit in this section. Please note that the components connected to the wrist unit is different in the case of there when the dummy socket without the dummy socket.

In the case of no dummy socket

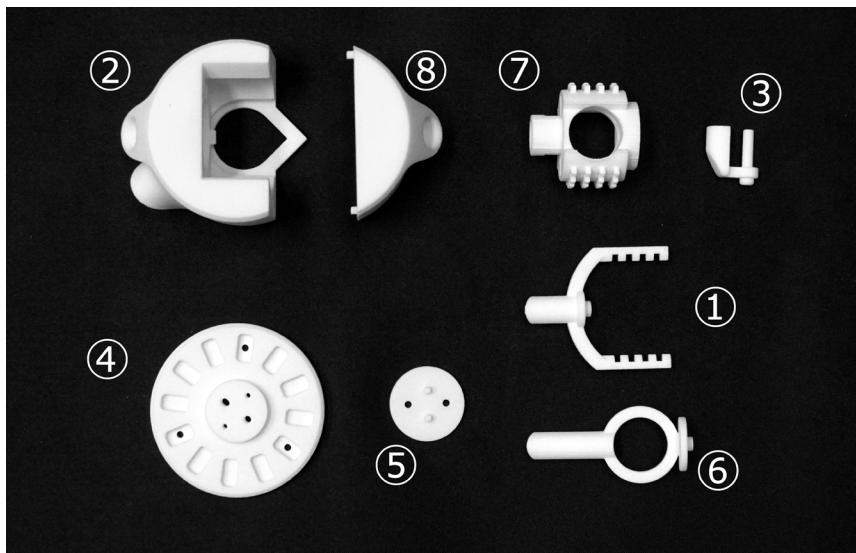


If there is a dummy socket



- Used parts -

- | | | |
|----------|----------|----------|
| 1. RW-01 | 2. RW-02 | 3. RW-03 |
| 4. RW-04 | 5. RW-05 | 6. RW-06 |
| 7. RW-07 | 8. RW-08 | |

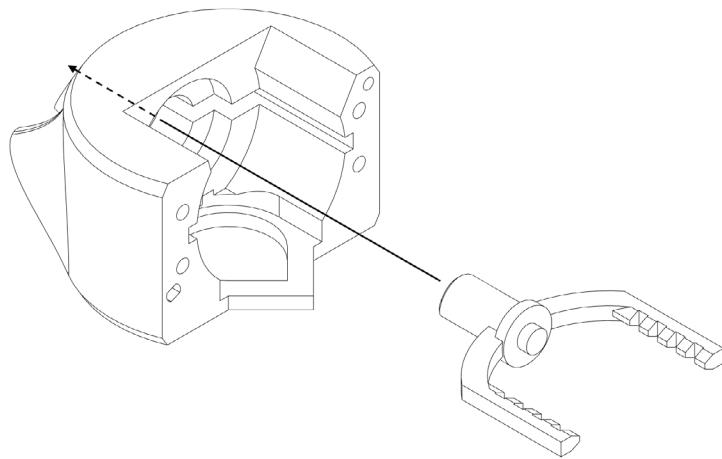


- Use a general-purpose parts -

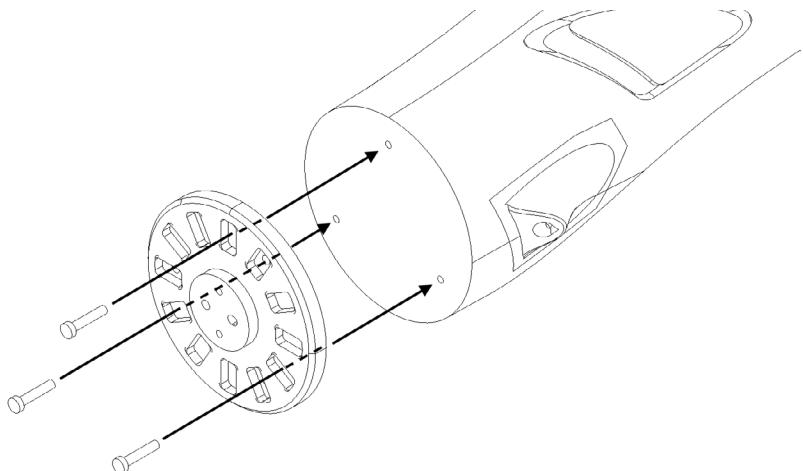


x () is the quantity of the case without the dummy socket in the.

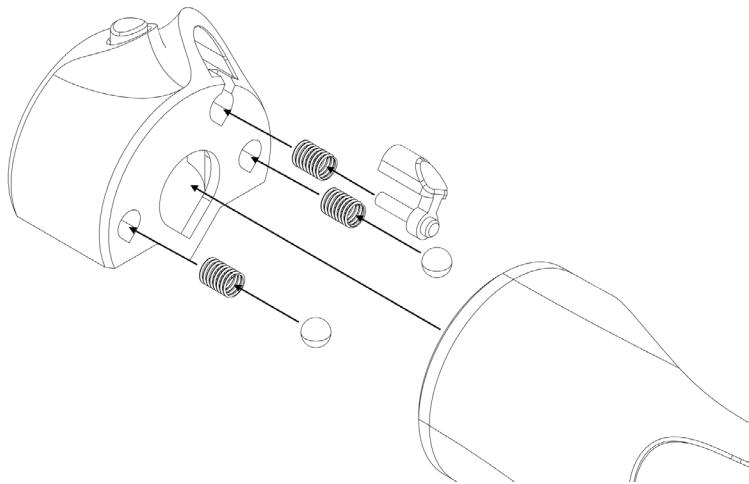
[1] Insert the RW-01 in RW-02. **Button surface of the RW-01 is turned at an angle, but, the longer will be under.**



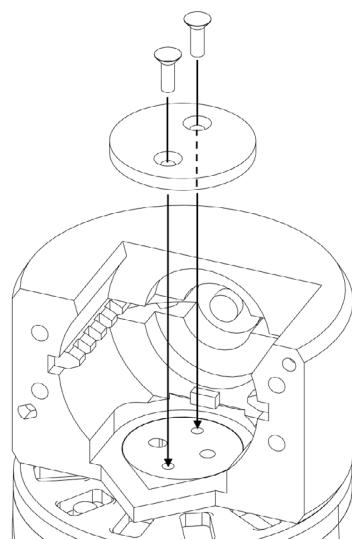
[2] *(In the case of a no dummy socket, this step is not required)* The RW-04 by using the three screws (M2L10) Install the dummy socket.



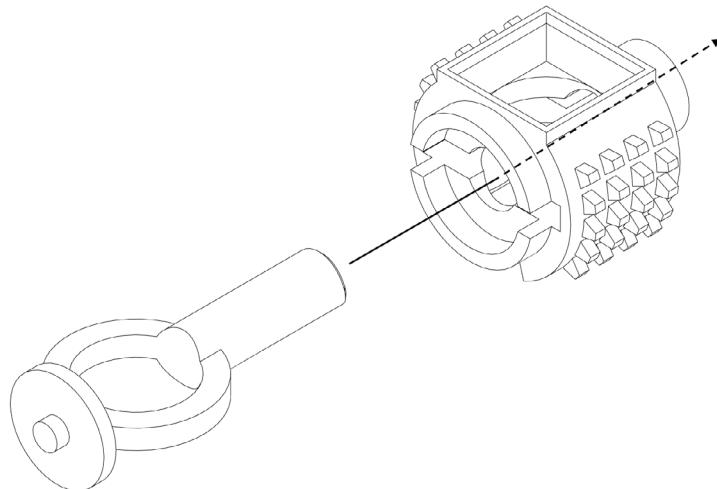
[3] RW-02 and RW-04 in three of the coil spring and the two steel balls, it pinches the RW-03.



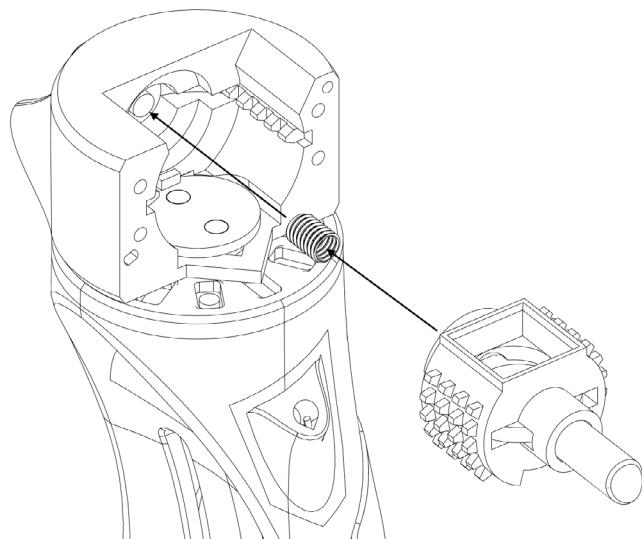
[4] and secure it with the RW-04 and RW-05 the two screws (M2L6).



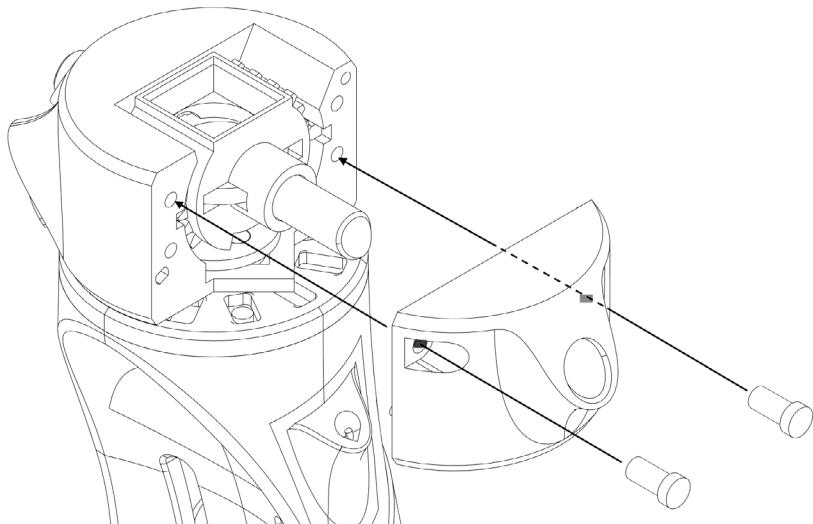
[5] Insert the RW-06 in RW-07. **Button surface of the RW-06 is turned at an angle, but, the longer will be under.**



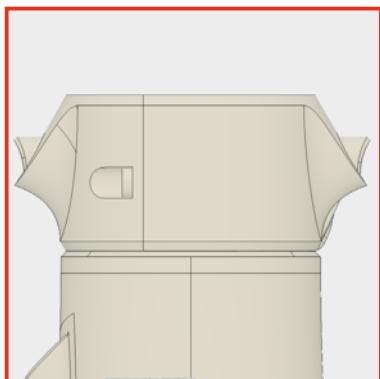
[6] Insert the coil spring and the parts that teamed up earlier, as shown in FIG.



[7] mount the RW-08, and secure it with two screws (M3L8).

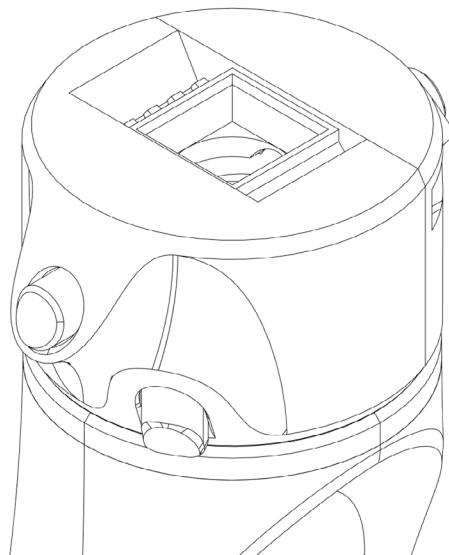


* good example



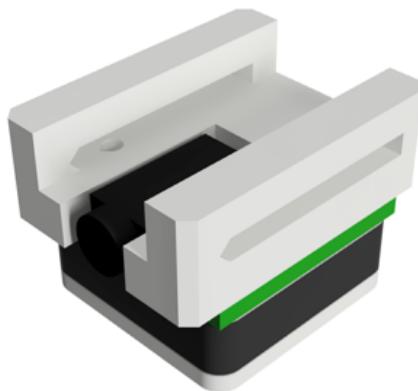
* bad example

[8] This assembly of the wrist unit is completed.



Assembling

13 Assembly of the sensor



- Used parts -

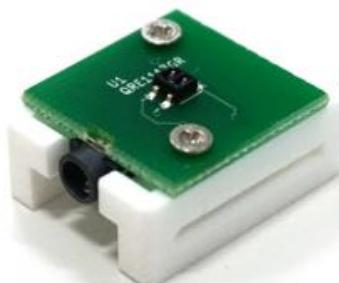
- | | | |
|-----------------|-----------------|-------------------|
| 1. C-SE-01 | 2. C-SE-02 | 3. Sensor board |
| 4. Velcro strap | 5. Stereo cable | 6. Sensor cushion |



- Use a general-purpose parts -



[1] The Sensor board assembled in photo orientation to C-SE-01, and secure it with two screws (M2L6).



[2] peel off the release paper of the sensor cushion and paste as shown in the photograph to the Sensor board.



[3] Prepare the other side of the release paper, and then paste the C-SE-02 as shown in the photograph on the sensor cushion.



[2] through a Velcro strap to the C-SE-01 as shown in the photograph. This assembly of the sensor is the end.



Assembling

14 Method of initial position setting

※ In this section, make the motor initial position setting. By the shift at the time of the motor or individual differences and mounting, there is a case where the angle of the finger is shifted slightly, and adjust it by changing the value of the program. From this page in the case of the right hand, in the case of the left hand please complete from 139 page.

In the case of the right hand

[1] Insert the DC plug of entering the battery case or dummy socket of the battery to the DC jack on the palm unit.



[2] push the button in the middle of the back of the hand, and then turn on the HACKberry. Immediately after the power is turned on is open on the side thumb of the hand as shown in the figure, the other of the finger will remain open. However, **Ri by the shift at the time of the motor of individual differences and mounting, or not extended fingers, you may hear a "Jiji!" in an attempt to unduly stretch to the contrary would continue to sound. If this is the case off the power immediately.**

※ Mk2 board is a little long time to start moving the servo motor from to power-up compared with the Mk1 board.



As an example, in this section, too bend the index finger as shown in the figure below, on the other hand, you example considered a case where the thumb was gone too open.



[3] Open the program that was used in the "5 program upload of" (5 page 2). Adjustment clause of the angle of the finger is done by changing the six numbers as shown in FIG.



```
1 /*
2 *  Arduino micro code for HACKBERRY.
3 *  Originally created by exiii Inc.
4 *  edited by Genta Kondo on 2017/6/11
5 */
6 #include <Servo.h>
7
8 //Settings
9 const boolean isRight = 0;//right:1, left:0
10
11 //For right hand, find optimal values of ThumbMin, IndexMax and OtherMax first.
12 //For left hand, find optimal values of ThumbMax, IndexMin and OtherMin first.
13 //Then, calculate the remaining values by following rules.
14 //Difference of ThumbMin and ThumbMax is 86
15 //Difference of IndexMin and IndexMax is 117
16 //Difference of OtherMin and OtherMax is 55
17
18 const int outThumbMax = 150;//right:open, left:close
19 const int outIndexMax = 150;//right:open, left:close
20 const int outOtherMax = 150;//right:open, left:close
21
22 const int outThumbMin = 30;//right:close, left:open
23 const int outIndexMin = 30;//right:close, left:open
24 const int outOtherMin = 30;//right:close, left:open
25
26 const int speedMax = 6;
27 const int speedMin = 0;
28 const int speedReverse = -3;
29 const int thSpeedReverse = 15;//0-100
```

[4] angle the value with the Max the finger is opened, the value with the Min is shows the angle at which the finger is closed. This time, because the index finger in the state of should have opened had been bent, will continue to increase the value of Max little by little in order to open more.

In the present case,

const int outIndexMax = 150;

What was

const int outIndexMax = 161;

When you upload a program to to, finger is now in the correct angle.

```
17  
18 const int outThumbMax = 150;//right:open, left:close  
19 const int outIndexMax = 161;//right:open, left:close  
20 const int outOtherMax = 150;//right:open, left:close  
21  
22 const int outThumbMin = 30;//right:close, left:open  
23 const int outIndexMin = 30;//right:close, left:open  
24 const int outOtherMin = 30;//right:close, left:open  
25
```



[5] is the next adjustment of the thumb. Since the state thumb is you are too open, it will reduce the value of Max little by little.

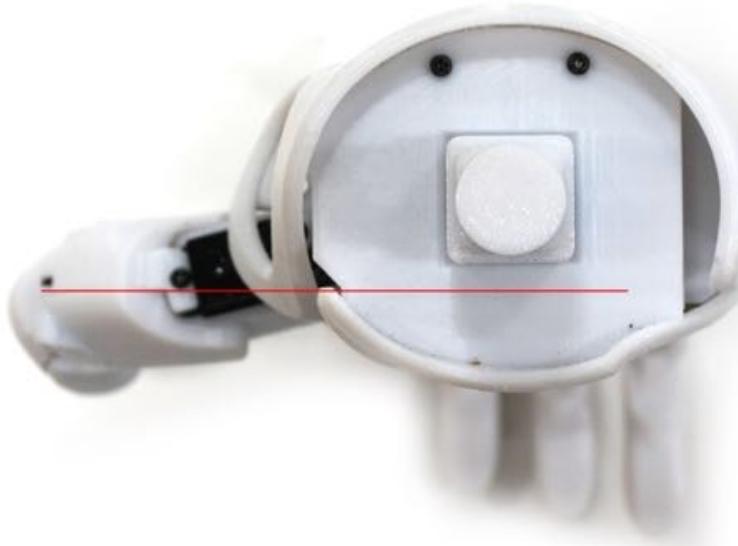
constintout T thumb Max = 150;

What was

constintout T thumb Max = 136;

When you upload a program to to, finger is now in the correct angle.

```
17  
18 const int outThumbMax = 136; //right:open, left:close  
19 const int outIndexMax = 161; //right:open, left:close  
20 const int outOtherMax = 150; //right:open, left:close  
21  
22 const int outThumbMin = 30; //right:close, left:open  
23 const int outIndexMin = 30; //right:close, left:open  
24 const int outOtherMin = 30; //right:close, left:open  
25
```



[6] next finger will set the value of the closed state. Angle difference between an open state and a closed state, in each of the motor, please refer to the following values to reference.

- thumb: 86
- index: 117
- other: 55

For example, we've set the angle of the open state of the earlier thumb 136, it will fill with 136-86. Other values will also upload the program was set in the same manner.

```
21
22 const int outThumbMin = 136-86;//right:close, left:open
23 const int outIndexMin = 161-117;//right:close, left:open
24 const int outOtherMin = 150-55;//right:close, left:open
25
```

In the case of the left hand

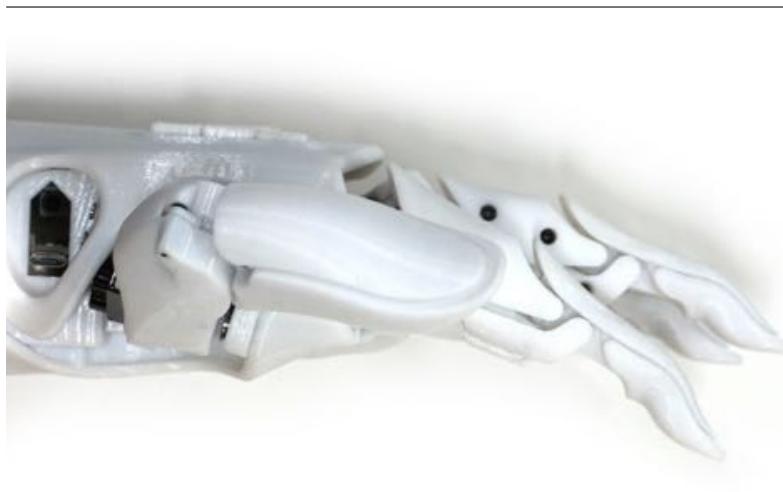
[1] Plug and inserted the battery case or the DC plug of the socket containing a battery to the DC jack of the palm unit.



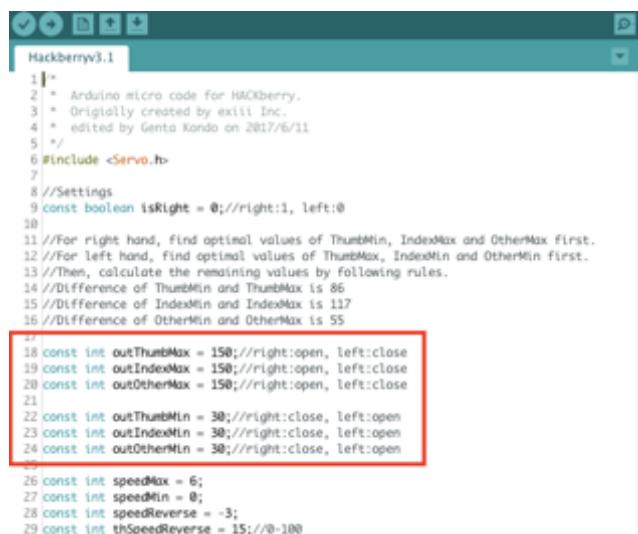
[2] push the button in the middle of the back of the hand, and then turn on the HACKberry. Immediately after the power is turned on is open on the side thumb of the hand as shown in the figure, the other of the finger will remain open. **However, If by the shift at the time of the motor of individual differences and mounting, or not extended fingers, you may hear a "Jiji" in an attempt to unduly stretch to the contrary would continue to sound. If this is the case off the power immediately.**



As an example, in this section, too bend the index finger as shown in the figure below, on the other hand, you example considered a case where the thumb was gone too open.



[3] Open the program that was used in the "5 program upload of" (5 page 2). Adjustment clause of the angle of the finger is done by changing the six numbers as shown in FIG.



The screenshot shows the Hackberryv3.1 software interface with the Arduino code for the robotic hand. The code is as follows:

```
1 /*
2 * Arduino micro code for HACKBERRY.
3 * Originally created by exiii Inc.
4 * edited by Genta Kondo on 2017/6/11
5 */
6 #include <Servo.h>
7
8 //Settings
9 const boolean isRight = 0;//right:1, left:0
10
11 //For right hand, find optimal values of ThumbMin, IndexMax and OtherMax first.
12 //For left hand, find optimal values of ThumbMax, IndexMin and OtherMin first.
13 //Then, calculate the remaining values by following rules.
14 //Difference of ThumbMin and ThumbMax is 86
15 //Difference of IndexMin and IndexMax is 117
16 //Difference of OtherMin and OtherMax is 55
17
18 const int outThumbMax = 150;//right:open, left:close
19 const int outIndexMax = 150;//right:open, left:close
20 const int outOtherMax = 150;//right:open, left:close
21
22 const int outThumbMin = 30;//right:close, left:open
23 const int outIndexMin = 30;//right:close, left:open
24 const int outOtherMin = 30;//right:close, left:open
25
26 const int speedMax = 6;
27 const int speedMin = 0;
28 const int speedReverse = -3;
29 const int thSpeedReverse = 15;//0-100
```

A red rectangular box highlights the lines of code from 18 to 24, which define the maximum and minimum servo positions for the thumb, index, and other fingers.

[4] angle value with the Min is finger is opened, the value with the Max will show the angle at which the finger is closed. This time, because the index finger in the state of should have opened had been bent, will continue to reduce the value of Min little by little in order to open more.

In the present case,

const int outIndexMin = 30;

What was

const int outIndexMin = 12;

When you upload the program, the finger is now in the correct angle.

```
17
18 const int outThumbMax = 150;//right:open, left:close
19 const int outIndexMax = 150;//right:open, left:close
20 const int outOtherMax = 150;//right:open, left:close
21
22 const int outThumbMin = 30;//right:close, left:open
23 const int outIndexMin = 12;//right:close, left:open
24 const int outOtherMin = 30;//right:close, left:open
25
```



[5] is the next adjustment of the thumb. Since the state thumb is you are too open, it will increase the value of Min little by little.

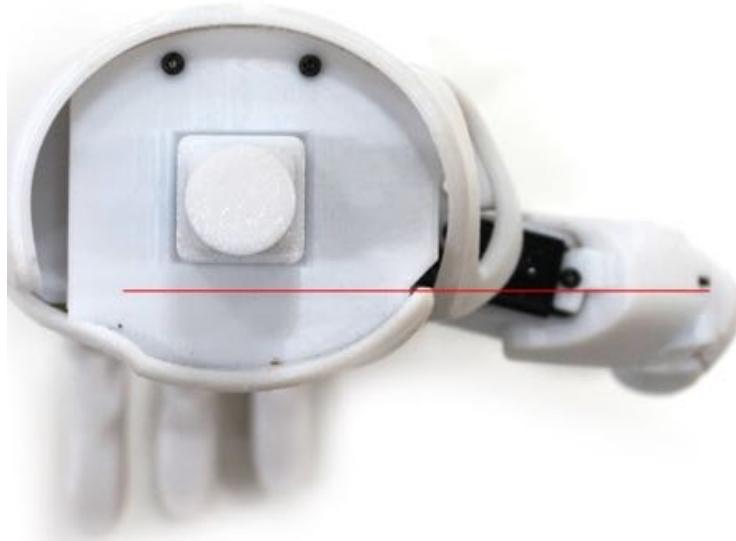
constintout T thumb M in = 3 0;

What was

constintout T thumb M in = 5 5;

When you upload a program to to, finger is now in the correct angle.

```
17  
18 const int outThumbMax = 150;//right:open, left:close  
19 const int outIndexMax = 150;//right:open, left:close  
20 const int outOtherMax = 150;//right:open, left:close  
21  
22 const int outThumbMin = 55;//right:close, left:open  
23 const int outIndexMin = 12;//right:close, left:open  
24 const int outOtherMin = 30;//right:close, left:open  
25
```



[6] next finger will set the value of the closed state. Angle difference between an open state and a closed state, in each of the motor, please refer to the following values to reference.

- *thumb*: 86
- *index*: 117
- *other*: 55

For example, since the angle of the open state of the earlier thumb is set to 55, it will fill the 55 + 86. Other values will also upload the same manner as in setting the program.

```
17  
18 const int outThumbMax = 55+86;//right:open, left:close  
19 const int outIndexMax = 12+117;//right:open, left:close  
20 const int outOtherMax = 30+55;//right:open, left:close  
21
```


3. Let's move

01 Nomenclature	P146
02 Battery mounting	P147
03 calibration	P148
04 Hand attachment of	P150
05 wrist Shiwashaku屈	P151
06 internal and external rotation of the wrist*	P151

4. Patent

4.1. Company user to, 2. And 3. And a range required when authoring a prosthetic hand using the source code or data based on the license that defines one. 2. Not violate if, and only if, that we implement a patent pending or patent registered Mino invention, free of charge, without limitation of area or time period, non-exclusive license (sublicense is excluded.) to you.

4.2. 4.1. To determine invention relates to a joint mechanism, is intended to be realized the operation close to the operation of the human hand with a simple structure. It is currently patent pending, but, depending on the progress of the application procedure, you notice in an appropriate manner in the present policy or forum, such as the information about a particular aspect of the present invention.

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5.1. The following trademarks are, we are trademarks registered in Japan. Trademark: ex iii

Registration Number: 5786270

5.2. The following trademarks are trademarks of pending Company in Japan. Trademark:

HACKber ry

Application number: 2016-042844, 2016-042845

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10.2. This was due to the policy, or for the relevant any of the conflict, according to the Sogaku, and the Tokyo District Court or Tokyo Summary Court of first instance exclusive jurisdiction of the courts.

====

More will be the convention should be followed when using the HACK berry as open source. It should be noted that, in relation to the HACK berry, exiii - Hackberry forums and G it H uploaded have been content to ub on the com is not limited to program code, bug reports, opinions, ideas, how or other content, regardless of commercial or non-commercial use, are used in the development of "HACK berry", not Creative Commons license only, be exiii Co., Ltd. is distributed under a closed-source line cell Nsu to set its own Yes you.

Introduc ti on

04 With respect to security and responsibility

HACK berry is to take advantage of the 3D printer and open source, everyone has to be able to make your own easy to power dynamic prosthetic hand around the world. The reason for providing the HACK berry in this way is because people who use the artificial arm is can try an electric prosthetic hand, want to increase the opportunities for people to make artificial arm has become known for its fun, even a little.

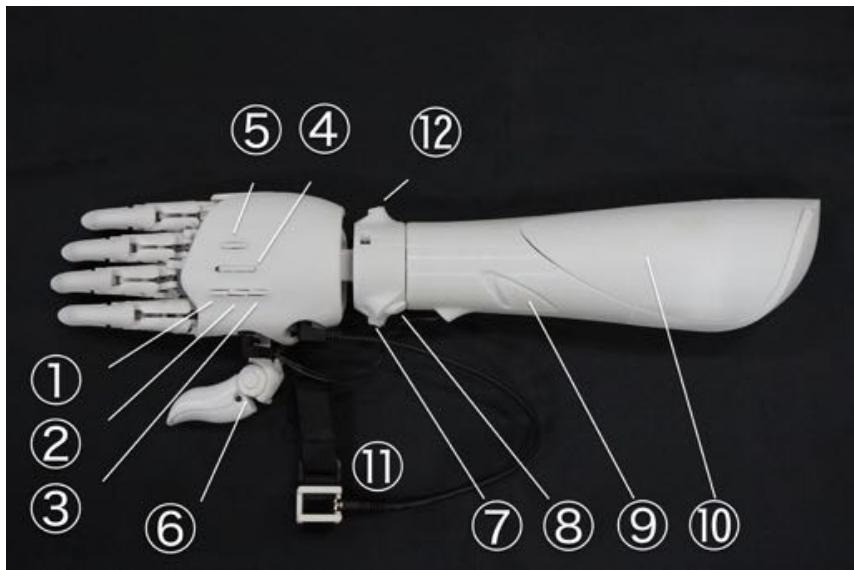
However, HACK berry sufficient safety, such as the commercially available electric prosthetic hand is rather have been secured, also, not doing the sales and quality assurance as a finished product. When using the HACK berry as artificial arm is beyond the scope of research and trial, fully understand the performance and accuracy of the HACK berry, please also carried out the self-responsibility. HACK berry for damages is all was dispute or caused to the user or a third party using, exiii Co., Ltd. and certain non-profit organization Mission ARM Japan is not responsible for one off.

2. Let's assembly

Do you assemble the 01 which HACKberry	P016
02 parts How to Obtain	P019
03 assembled before	P022
04 basic soldering	P026
05 program upload	P052
06 assembly of the battery case socket	P058
07 thumb assembly of	P074
08 index finger assembly of	P080
09 Mitsuyubi assembly of	P088
10 voltage adjustment and the initial position setting of the servo motor	P092
11 palm of assembly	P094
12 assembly of the wrist	P122
13 assembly of the sensor	P130
14 initial position setting	P134

How to Use HACKberry

01 Nomenclature



1. Calibration button

2. Button for expansion

3. Thumb rotation button

4. Power switch

5. Mitsuyubi fixed button

6. Thumb lock button

7. Wrist Shiwashaku-Tenohirase button

8. Wrist rotation button

9. Battery door lever

10. Battery Door

11. Simple pressure sensor

12. Wrist release button

02 Battery mounting

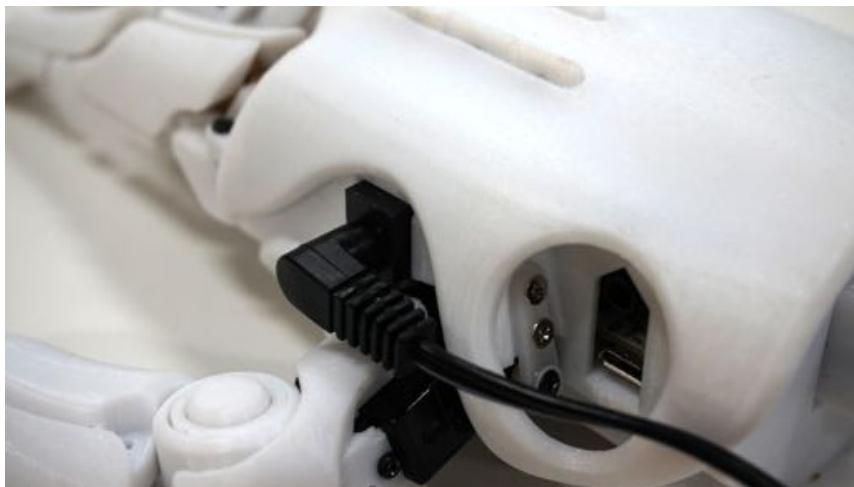
The battery door lever and slide open the battery door, and insert the battery. Slide along the groove, please make sure that it clicks into place. (Please slide in the opposite direction while holding down the CB-02 is when removing.)



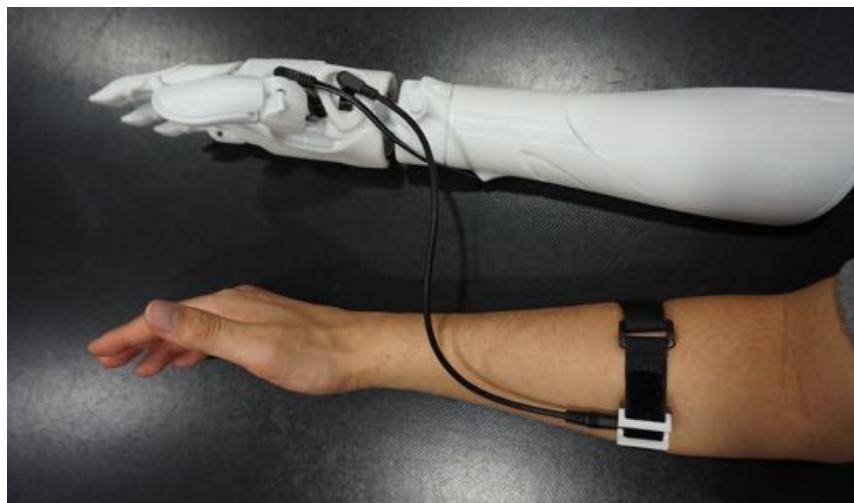
How to Use HACKberry

03 Calibration

And insert it into the DC jack as shown in the illustration DC plug.



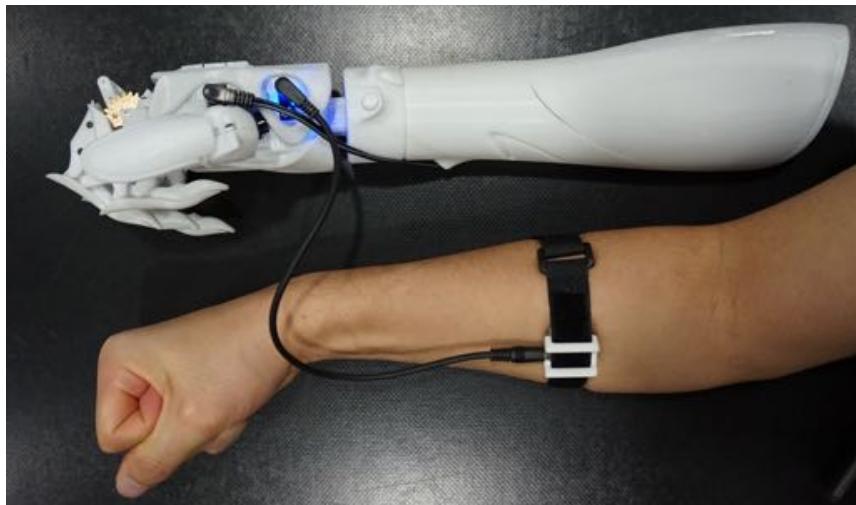
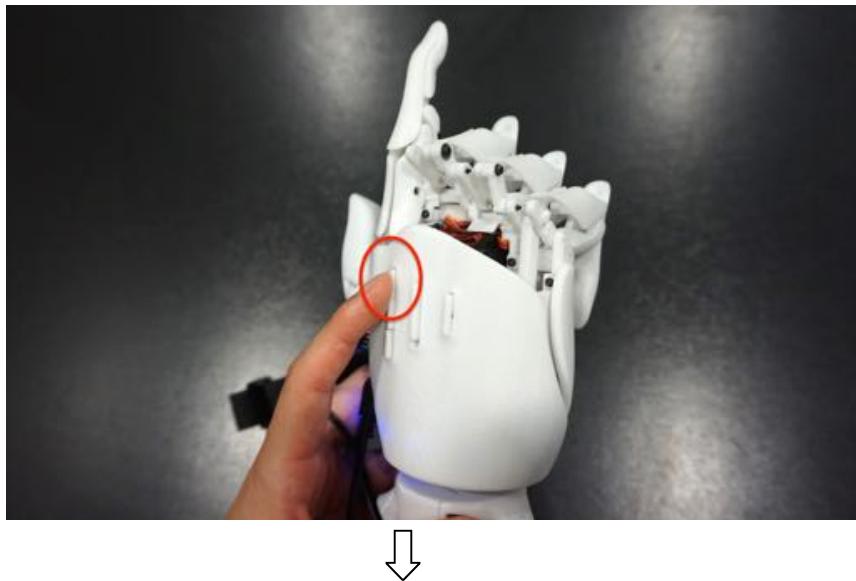
The planar portion of the sensor against the skin (as much as possible part of the muscle), and secure it to the arm to tighten lightly with a Velcro strap. Then, connect the HACKberry and a sensor with an audio cable. **Please be careful to insert to firmly back.**



Then do the calibration.

In the calibration will teach a raised amount of different muscles for each user to HACKber ry.

Press the calibration button in a state in which the power is on, 4 seconds period of, "seize the fist" → and repeat several times the action of "pull out the power".



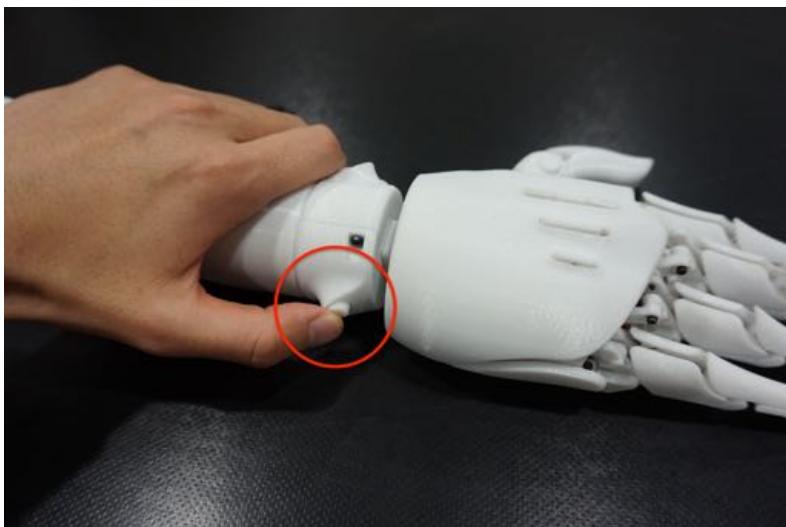
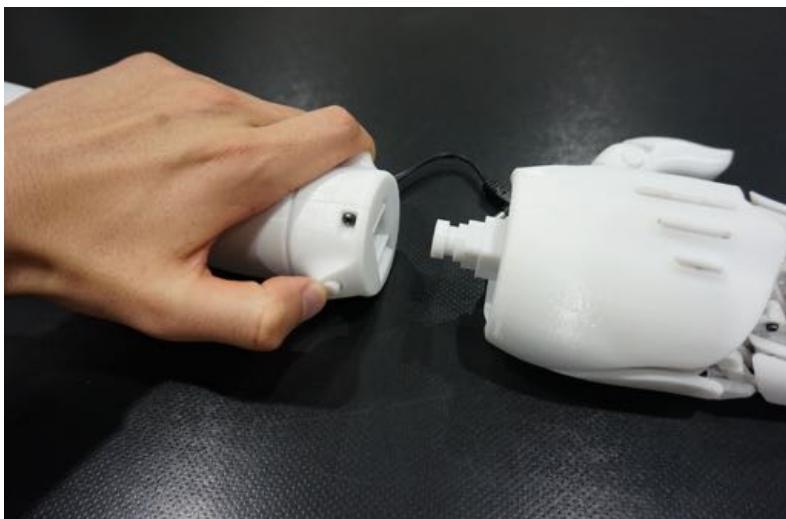
When the calibration is complete, will move from the index finger to the little finger is complete.

How to Use HACKberry

04 Attachment and detachment of the hand

When you press the hand part release button, you can attachment and detachment of the hand and wrist.

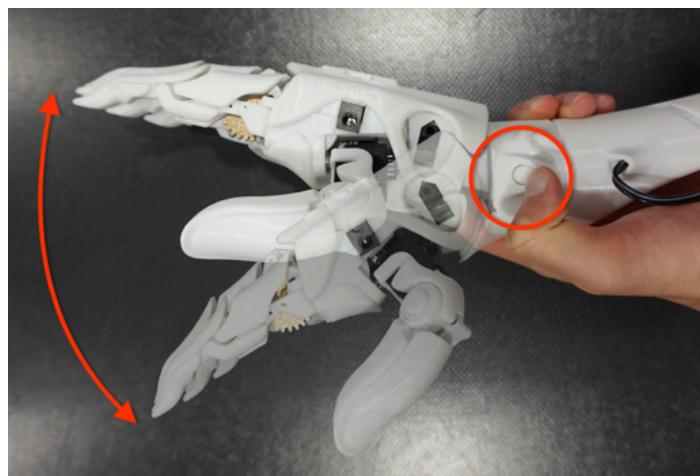
Placement of the hand and the wrist portion can be adjusted every 90 degrees.



How to Use HACKberry

05 Buckling Tenohirase- radioulnar of the wrist

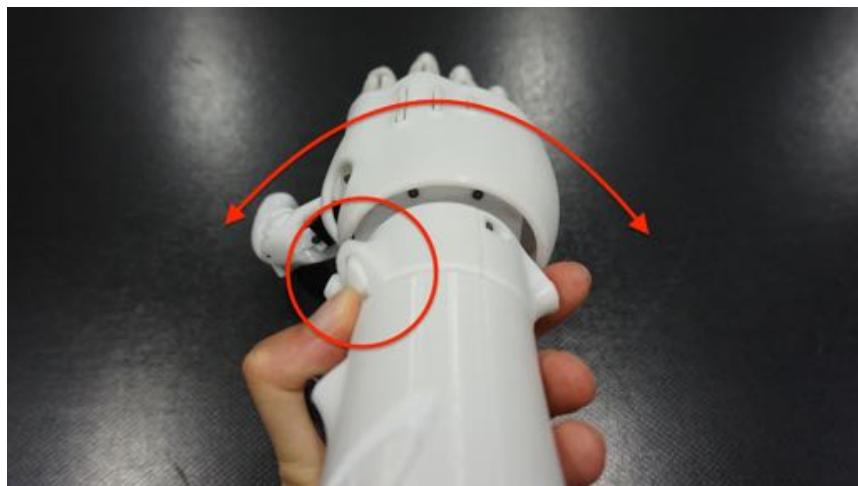
When you press the wrist Shiwashaku-Tenohirase button, you will be tilting the wrist bending Tenohirase direction or radioulnar.



How to Use HACKberry

06 Inside and outside rotation of the wrist

When you press the wrist inside and outside the rolling button, you can rotate the hand in the direction of FIG.



Four. HACKberry More to enjoy it the

01 Introduction	P154
02 HACKberry Handboard Mk2 specification	P155
Operation of HACKberry by 03 muscle photoelectric sensor	P158
04 acetone surface treatment	P162
05 nylon dyeing	P168

Cus tomi ze

01 Introduction

This chapter will introduce a customized case of HACK berry.

In Section 1, customizability was improved compared to the M k 1 board

This section describes the features and specifications of HACK berryhandboard M k 2 board.

In Section 2, actually using a commercially available myoelectric sensor and M k 2 substrate (2 ch), we will introduce how to operate the HACK berry as a myoelectric hand.

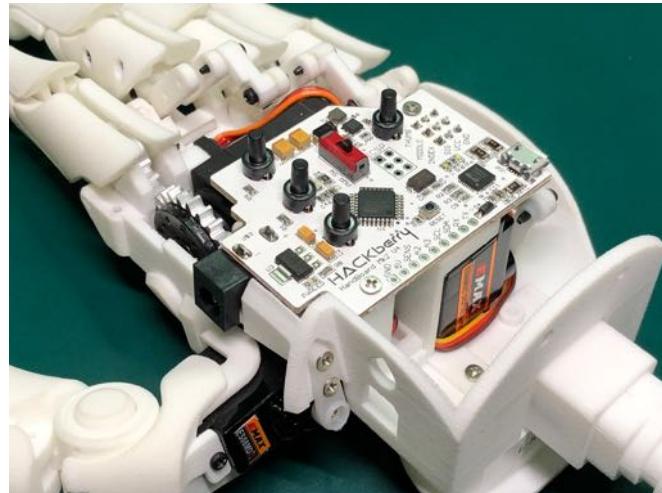
In Section 3, we introduce the surface treatment method of acetone to improve the 3D printing parts of household appearance quality.

In Section 4, we introduce a method for dyeing a 3D printed parts of nylon material that was printed by using an external of 3D printing services.

02 HACKberry hand board Mk2 specification

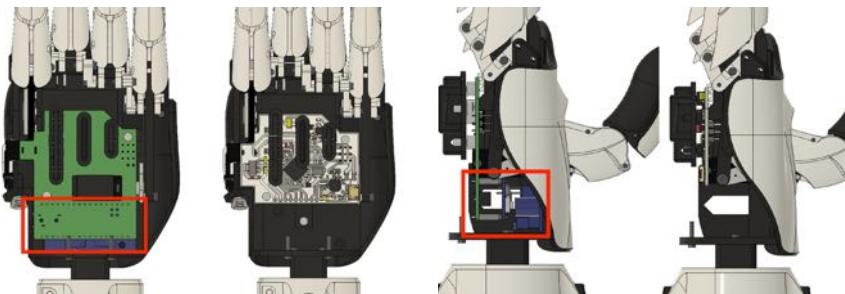
HACK berryhandboard M k 2 is mainly has been developed the customization of direction over from M k 1 for the purpose. The next two are the main improvements.

1. Space secured by the substrate integrated
2. Simplification of customization by the expansion port expansion



[1] space secured by the substrate integrated

The function of the A rduino M icro and DCDC converter, which was divided in M k 1 has been implemented on a single substrate. This reduces the occupied space of the electrical circuit in the housing, on the contrary, have more space to mount additional sensors and modules.



✗ space compared to top view (Left Mk1, right Mk2)

✗ space comparison side view (Left Mk1, right Mk2)

[2] simplification of customization by the expansion port expansion

Input port and a communication port for customization substrate lower (analog input, I 2 C communication, serial communication) was added to.

Therefore, it should be able to easily connect with other sensors and modules.



※ input and communication port for customization of the lower portion of the substrate

It lists the specifications of the detail below. Mk 2 substrate is a Arduino compatible machines, the processor AT mega 3 2 8 P - for adopting the AU, pin assignment is the same as the AT mega 3 2 8 P.

ピンアサイン	入力ピン	キャリブレーションボタン	A6
		拇指内外転ボタン	A0
		三指駆動ボタン	D10
		エクストラボタン	A7
		センサ入力	A1
	出力ピン	人差し指用サーボモータ	D5
		三指用サーボモータ	D6
		親指用サーボモータ	D9
	拡張ピン	5V	5V
		GND	GND
		SENS(A1)	
		アナログ入力ピン	A2
			A3
		I2C通信ピン	SDA
			SCL
		シリアル通信ピン	RX
			TX
書き込み時の設定	ボード	Arduino Nano	
	プロセッサ	Atmega328P-AU	
	書き込み装置	AVRISP mkII	
入力電圧	推奨入力電圧	7V~12V	
	最大入力電圧	20V	
	DCDCコンバータ定格入力電圧12V, 最大24V		
サーボピン	三端子レギュレーター最大入力電圧20Vより		
	PPTCにはthumbには入っていません		
	IndexとMiddleは500mAが限度です。		

※ HACKberry hand board Mk2 detailed specifications

Cus tomi ze

03 By myoelectric sensors HACKberry Operation of

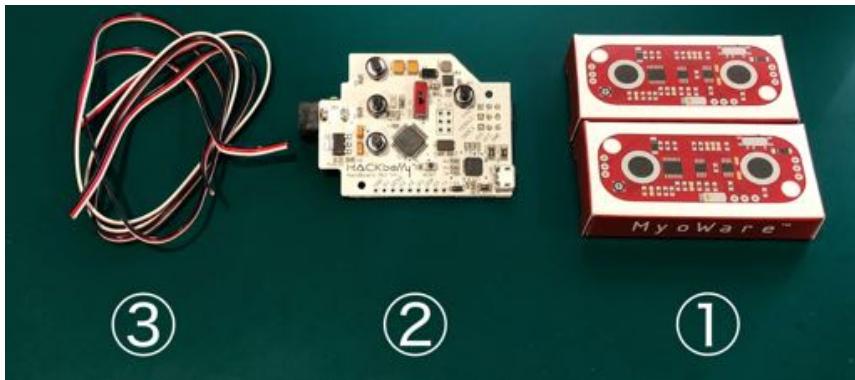
[1] First of all

Whereas in many commercially available prosthetic hands are used a myoelectric sensor, we use a simple pressure sensor in HACKberry. Features of the simple pressure sensor, easy to operate with low noise, is that a very low price. On the other hand, only a simple signal of 1 channel multi-channel is difficult there is also a disadvantage that can not be measured. If you want to operate using commercially available artificial arm as well myoelectric sensor HACKberry, please customize this section as a reference.

[2] myoelectric and (Myoelectricity) is

When a person moves a muscle, you will be told electrical signals emitted from the brain via the nerves to the muscles. This electrical signal comes out slightly leaks to the skin surface. Signal which was observed by electrodes stuck to the skin surface is the myoelectric.

[3] used parts



1. MyoWare 2 pieces

Advanced Technologis manufactured by myoelectric sensors. A built-in amplification and smoothing circuit myoelectric potential, relatively easy to measure the myoelectric signal.

2. HACKberry hand board Mk2

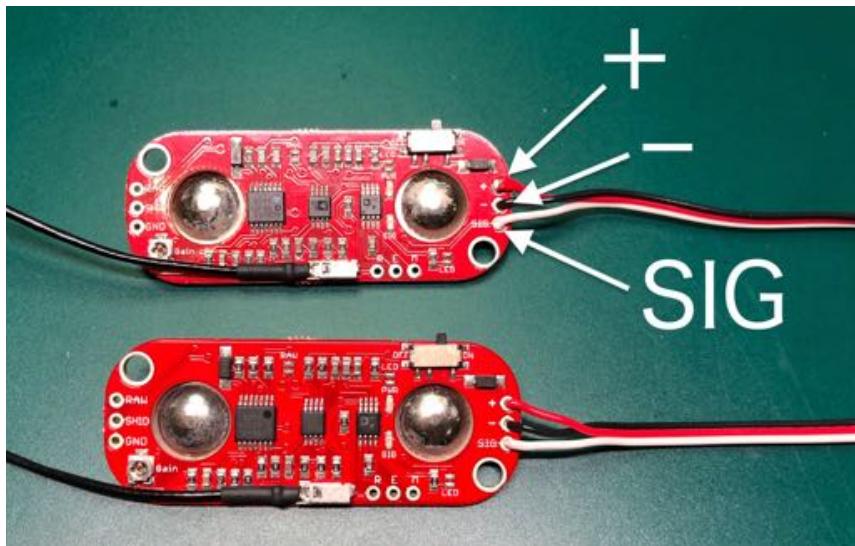
Audio jack is used without connection.

3.3-row flat cable 50cm 2 this

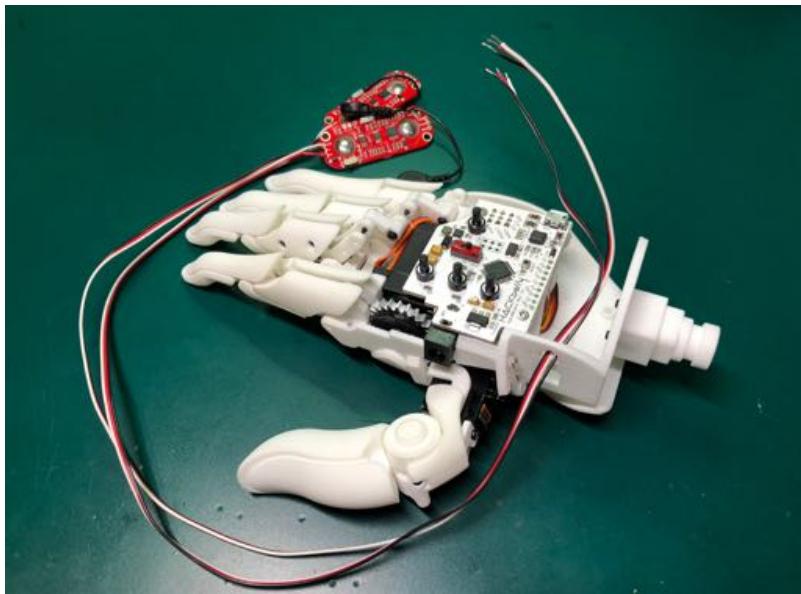
In this section, MyoWare are used two, respectively (bending the wrist on the palm side) Tenohira arms and dorsiflexion detects the movement of the (bending wrist back side of the hand), the HACKberry by 2 channels to achieve the operation.

[4] how to implement

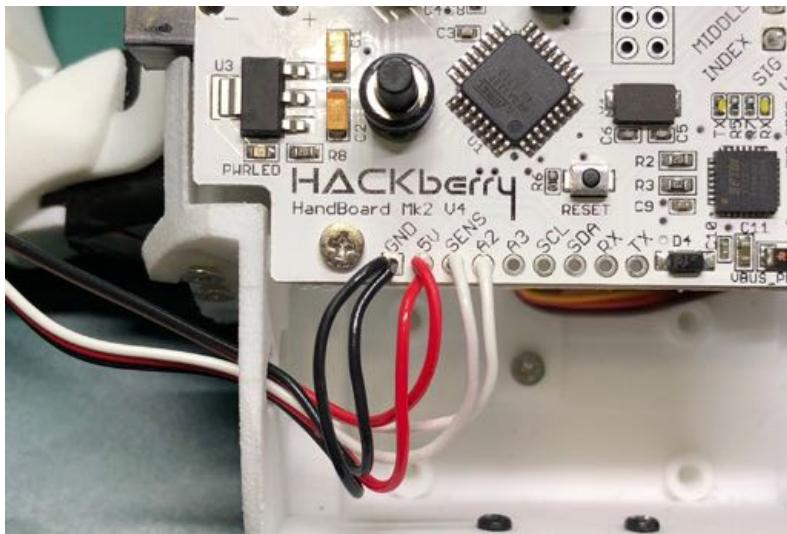
+ Of MyoWare, over, and then soldered red, respectively at three positions of SIG, black, a line of white.



Attach the HACKberry hand board Mk2 to HACKberry, and through the flat cable into the hole in the audio jack, as shown in FIG.



HACKberry to solder the flat cables to the expansion port of the hand board Mk2. As shown in the figure, to GND the two black lines, the two red line to 5V, one of the white line to SENS, and connect the other end of the white line to the A2.



This work of the hardware is completed.

Then download the program for a myoelectric operation from GitHub.

[02 parts of how to obtain] (19 pages) to access the GitHub page of HACKberry in the reference, please download under Program distribution "HackberryV3.1_Mk2_EMG_180412".

mission-arm / HACKberry

Code Issues (3) Pull requests (3) Projects (0) Insights

Branch: master HACKberry / HACKberry_program / Extra /

sktometomo add arduino software for EMG Latest commit cadd29e 5 hours ago

HackberryV3.1_Mk2_EMG.ino add arduino software for EMG 5 hours ago

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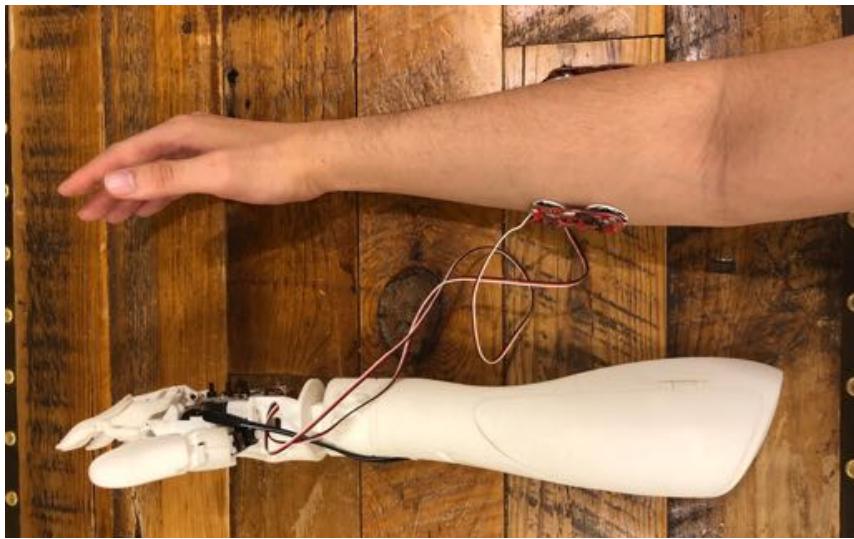


Contact GitHub API Training Shop Blog About

Then, you write a program that you downloaded earlier by reference to [05 program upload] (5 page 2) to HACKberry hand board Mk2.

[5] method of operation

In the MyoWare the white cord is connected to HACKberry hand board Mk2 SENS external port flexor (muscle swells at the time of Tenohira屈), Attach the other end of the MyoWare in extensor (muscle swells at the time of dorsiflexion) only you. Please mounting position of the detailed sensor with reference to the instruction manual of MyoWare.



Turn on the HACKberry, press the calibration button. Since 4 seconds calibration press the button is carried out, put a force alternately to flexor and extensor muscles in the meantime, you preset the width of the myoelectric signal to HACKberry. After calibration the end of the finger is bent If you put a force on the flexor, finger will stretch if you put a force on the extensor.



YouTube EMG operation videos

<https://youtu.be/pDvJqjNLdBo>

03 Surface treatment due to vaporization acetone

[1] First of all

Although a home 3D printer FDM, which is generally used (fused deposition modeling) can be printed at low cost three-dimensional shape, its nature stacking one layer, conspicuous roughness of the surface layer it will get. In that case, by making the surface treatment due to vaporization acetone, it can be used to smooth the surface. The benefits and disadvantages of this approach are listed below.

merit

- Required time is short (approximately one-tenth degree as compared with the method to smooth cutting surfaces by using a sandpaper.)
- Also it can be processed fine portion difficult with sanding.
- Since stacking pitch during 3D printing is largely changed even effect, it can significantly reduce the printing time.
- Since to Hitoshi (if) by dissolving surface becomes certain molten state, is reduced weakness of the inter-layer bonding force is improved overall strength.

Demerit

- To use an organic solvent, care must be taken to use.
- Overall the property of smooth by dissolving surface, there is a possibility that detail collapses, accuracy required fit of, not suitable for press-fitting.

As a countermeasure to these disadvantages, or a surface treatment only to be come divided portion exposed to the surface of the housing from the other structural-mechanical parts, the part to be surface treated in a position easily hit in acetone (described later) place was R_i, there are methods such as.

[2] Notes

Acetone is an organic solvent. It has been designated as hazardous materials fourth class (first petroleum risk grade 2 water-soluble) by the Fire Service Law. Particularly characteristic of acetone should be noted, " **Strong flammable (flash at room temperature)** "When" **High volatility** "is. Please note the following points.

- In order to prevent the ignition or excessive inhalation , **Handling in well-ventilated areas and ventilation** , So as not to Tamekoma the steam let's do it.
- If spilled from the container during the work, let's wipe quickly cloth.
- If containing the vapor of acetone in the eyes Let's wash quickly with large amounts of water. For example, it is recommended that you undergo a medical examination at also immediately specialized medical facilities and that there was no pain or abnormal.
- Swallowed by mistake, also it is recommended that you consult a doctor when you inhale the gas.
- After using the acetone **Hand wash gargle** Please try to be thorough.

[1] equipment

- The sealed container (material not soluble in acetone. Using a polyethylene container 5L here.)
- Aluminum foil
- Kitchen paper
- Acetone (Hotoku pure acetone 1L <https://amzn.as/4U79i9I>)
- pipette

[1] procedure

[1] Place a aluminum foil on the bottom of the sealed container. Aluminum foil is cut into large so as to extend to the outside of the outside of the container. This is later in time to take out the parts from the container, in order not to touch the parts with the edges of the aluminum foil.



[2] to order the parts on top of the aluminum foil lined. At this time, **And the surface that you want to surface treatment on the upper side**. This is because that befall the parts from the top vaporized acetone, because the person at the top is likely to more soluble.



[3] 3 sheets of kitchen paper, then folded in two sets as shown in the photograph, will soaked with acetone of 15ml using a pipette.





[4] This was then immediately covered with a lid to start the timer. 0. Please be a guideline degrees for about 1 hour long as it was printed in 3mm pitch.



[5] in after a predetermined time, and take out the parts to open the lid. At this time, since the parts are softened,

Retrieves grabbed the edge of the aluminum foil to not touch the components directly.



[6] surface is melted, you can see that has become smooth. like this And leave to 4-5 hours well-ventilated place.



[7] surface treatment has become a roughly smooth at this point if the purpose, but if that shine is anxious to return to the same kind of texture as the original by blow, such as matte spray.



The previous figure matte ×



Figure after matte ×

04 Nylon dyeing



【1. First of all

In this section, as one of the method of coloring the HACKberry, the 3D printed parts in nylon material and stained using a commercial tree fat for the dye.

Nylon 3D printed parts is easy to staining because it is white output. (It not only, for nylon material is a low-price and high-strength, we are standardly employed as a material for HACKberry.) Nylon for home FDM (fused deposition modeling) method of 3D printer Please note do not because it does not correspond to. (The resin of 3D printer for the home, typically will use the ABS or PLA. ABS and PLA is the not suitable for staining.)

Nylon is compatible with 3D printer system for laminated baked powder further more laser or the like is called SLS (powder sintering type) method. Since the 3D printer of the SLS method is not popular in the household, it is recommended that you use an external 3D print services (If you use an external service you can choose a variety of materials other than nylon). We use a 3D printing service of the DMM. Com.

. DMM com 3D print services: <https://make.dmm.com/print/>

In the 3D printing service that deals with nylon, you may have to provide at the same time staining of service. In this case, since you want to adjust the favorite color in dyed condition of taste, will continue to the staining yourself by using a dye for the resin, which is commercially available.

[2] equipment



1. was diluted resin for dye dyed liquid 2. stainless steel colander 3. kitchen paper
4. Rubber gloves 5. measuring cup 6. funnel
7. chopsticks 8. thermometer
9. IH heater (because it is for the heating of dyed liquid also acceptable, such as gas stove)
10. Surenresu pot (size monkey enters)

[3] staining of flow

[1] make a start on the dyed liquid. This time I used the "resin for the dye SDN" of Osaka Chemicals Corporation. And the amount of positions that dyed had parts are immersed in the guide by using a measuring cup and diluted the dye to 20 times. Please note that the concentration of dilution different by the dye.



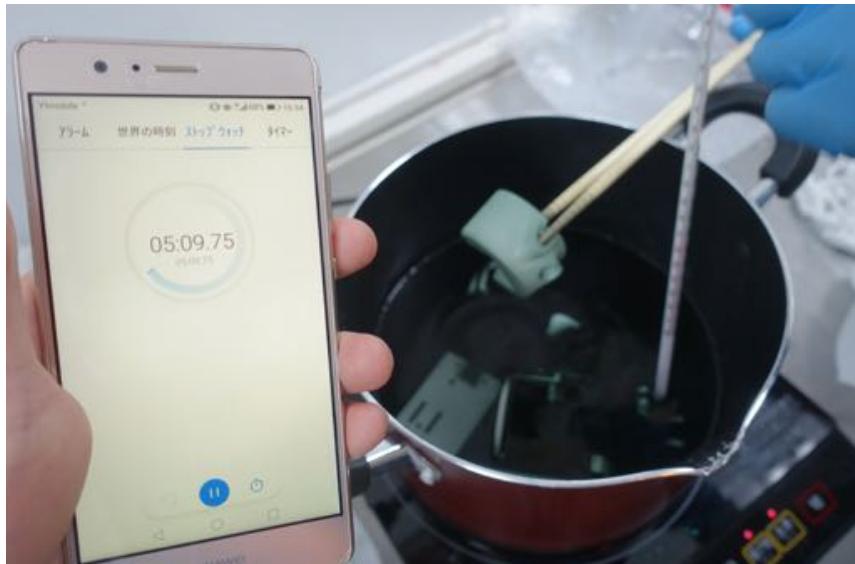
[2] and heat put the dyed liquid in a stainless steel pot.



[3] standard dyeing conditions in the nylon of the "resin dye SDN" is 3 to 5 minutes at $70 \pm 10^{\circ}\text{C}$. The temperature of the dye solution is to start a timer immersed in a solution dyed 3D printing shaped object Once raised to a range of $70 \pm 10^{\circ}\text{C}$ w. While you are staining will continue to keep to $70 \pm 10^{\circ}\text{C}$ of the specified temperature. In addition, it was stirred for a moderately dyed liquid.



[4] presentation of manufacturers staining time is that of a 3 to 5 minutes, but because in our environment did not seem stained mower Mari pulled up after 5 minutes, gave a stained about 20 minutes.



※ after 5 minutes



※ 20 minutes after

[5] to dry side by side in such as kitchen paper to remove the 3D print molded product from the solution dyed Once steeped in favorite color. This staining of 3D printing modeling of the nylon material is complete.



[6] dyed liquid even finished staining because it contains substances harmful to the human body **You can not throw away the sink as it is.** Dyed solution is to keep such as a pet bottle using a funnel because the use screwdriver can be. If you want to dispose of, so that you throw away in such flow is diluted in more than a further 200 times a dyed liquid.



5. Problem Solving? If you think

Troubleshooting

Failure kana? If you think

can not turn on

- ♦ Please make sure the battery is installed correctly.
- ♦ Please make sure the DC plug is inserted firmly to the DC jack of the substrate. ♦ Make sure the soldered position is correct.
→ DC plug of the line is correctly plus side and the minus side or has been soldered. → VCC (or V +) on the substrate and the GND Do not short-circuit. ♦ Please check whether the voltage is displayed correctly by applying a tester to the battery terminals.
If the → circuit had been short, work protection circuit within the battery, in a state where the voltage does not occur
There is a possibility you are. Please contact the battery manufacturer with respect to recovery method.

I can not calibration

- ♦ When you press the calibration button, make sure there is a click feeling.
→ button is inclined with respect to the reasons such as soldered, is in a state of left button is pressed
There is a possibility. Or redo the soldering, or please to repair by cutting the casing parts. ♦ correct version (left or right, mk1 or mk2 or)
Make sure the written program. ♦ Please make sure initial position setting of the servo motor is correct (For details, see page 134
Please give me.)
- ♦ Make sure you are connected to the substrate pin socket of the servo motor is in the correct orientation. (For more information
Please refer to the 112 page.)
- ♦ Make sure the sensor is connected correctly.
→ audio cable Do you plugged up firmly back.
If → There is no response properly connected, it can be permanently sensor or audio cable itself is damaged
Ri you.

Not to bend firm finger

- ♦ Please make sure initial position setting of the servo motor was correct. (For details, see page 134
please.)

Abnormal noise from the servo motor

- ♦ Please make sure initial position setting of the servo motor was correct. Servo motor is structurally times
If we are going to move the rolling can not direction and generates an abnormal noise. (For details, please see page 134.) ♦ Make sure that the voltage regulator of the DCDC converter was correct. If it does not the voltage adjustment servo
Servo motor takes an excessive voltage to the motor will be damaged. (For details, again refer to the 92 page.)

Suddenly no longer move the servo motor

- ♦ (the case of mk1) Make sure the poly switch is properly inserted.
If you **not** inserted, there is a possibility that the servo motor generates heat damaged. In that case, the motor Replacement, should be assembled again by inserting a poly-switch.
- ♦ also be inserted, the circuit in the servo motor in failure and insulation lack of soldering ended up short
There was a possibility. Please replace the motor that case.
- ♦ voltage adjustment of the DCDC converter Make sure was right. If it does not the voltage adjustment servo
Servo motor takes an excessive voltage to the motor will be damaged. (For details, again refer to the 92 page.)

Do not react even if you press the sensor

- ♦ Please make sure initial position setting of the servo motor was correct. (For details, see page 134
please.)
- ♦ Make sure the sensor is connected correctly.
audio cable Do you plugged up firmly back.
If **not** There is no response properly connected, it can be permanently sensor or audio cable itself is damaged
Ri you.
- ♦ Please try to adjust the position to mount the sensor.
Please as much as possible attached to a position where the muscle is easily raised **not**.

Program can not write

- ♦ Make sure you are using the USB cable with a communication function. (Through the charging dedicated USB cable
You can not trust.)
- ♦ COM port Make sure that it is properly recognized. (See page 54.) ♦ Please make sure you have selected the correct board.
(See page 56.) ♦ driver is make sure have been installed correctly.

driver is basically installed automatically, but you may not be depending on the environment. Please refer to the following site to reference
driver installation.
http://synapsekyoto/tips/FTDI_driver/page001.html

Finger runaway

- ♦ Make sure the sensor is connected correctly.
audio cable Do you plugged up firmly back.
If **not** There is no response properly connected, it can be permanently sensor or audio cable itself is damaged
Ri you.

HACKberry HANDBOOK

- Control work -

NPO Mission ARM Japan

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Web: http://www.mission-arm.jp / HACK
berry: http://Exiii-hackberry.com /

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For your questions about the contents of this document,

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<http://exiii-hackberry.com/>

As semb li ng

01 Which Hackberry Do you assembly

The HACKberry There are several configurations. First, let's decide assemble which HACKberry.

A. right hand



This is the most basic type of HACKberry. Make ask, such as to the actual righteousness limb Works compatible socket on the arm when used as a prosthetic hand. Apart from this image, you will need an external battery case for sharing the sensor and power for operating the HACKberry.

B. the right hand (with dummy socket)



The type that with a 3D printed temporary socket to HACKberry of A. External battery case is unnecessary because the internal to the battery socket to store. Sensor to operate separately from HACKberry from the present image is required.

C. left hand



The most left-hand specification of the basic type of HACKberry. When used as a prosthetic hand is made to request a matching socket such as artificial limbs Works to the actual arm. There is no difference between the right hand basically. Apart from this image, external battery case for sharing the sensor and power for operating the HACKberry is you will need to name.

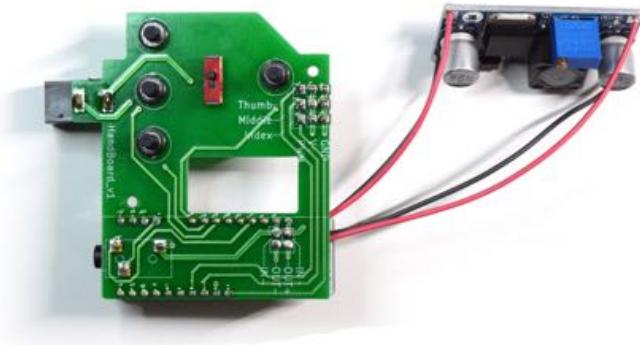
D. Left hand (with dummy socket)



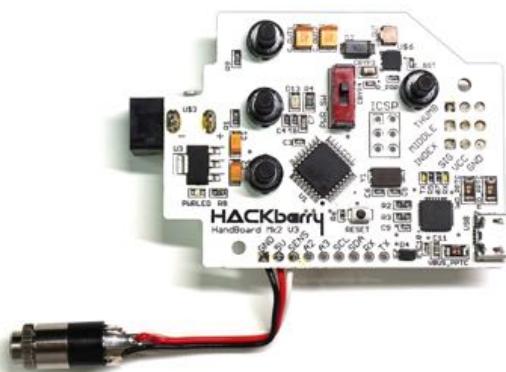
C temporary socket that has been 3D printed in HACKberry is the type with. External battery case is unnecessary because the internal to the battery socket to store. Sensor to operate separately from HACKberry from the present image is required.

In addition, the HACKberry There are two types of the board of the Mk1 and Mk2. HACKberry also works with either of the board, but a simplified implementation is more of Mk2, is the low price. Small size of the substrate itself at the same time, it highly customizable because the port for enhancements is available.

- HACKberry hand board Mk1



- HACKberry hand board Mk2



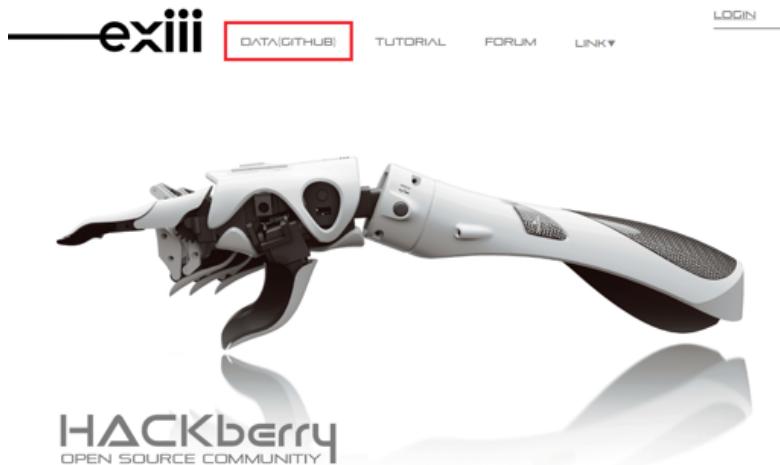
As sembli ng

02 How to get parts

[1] printing of 3D printed parts

Data of 3D printed parts can be obtained from the Internet. Please click on the DATA (GITHUB) of the page that is open and view the following link.

<https://exiii-hackberry.com/>



Site of Gi thub opens.

<https://github.com/mi ss ion-arm/HACKberry>

From there

HACKberry_3Dmodel / STL /...

And proceed to download the STL data of purpose.

mission-arm / HACKberry

Branch: master · HACKberry / HACKberry_3Dmodel / STL /

Code Issues 2 Pull requests 3 Projects 0 Insights

sktometomo add STL and STEP data for SLS print · Latest commit 922F7d4 4 days ago

upgrade hardware, circuits and software to mk2 · 5 days ago

add STL and STEP data for SLS print · 4 days ago

upgrade hardware, circuits and software to mk2 · 5 days ago

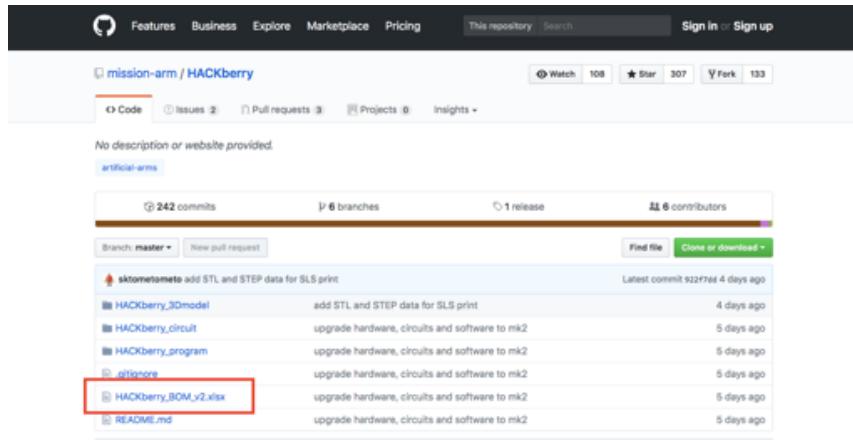
upgrade hardware, circuits and software to mk2 · 5 days ago

[2] how to purchase of machinery and electronic parts other than the 3D printed parts

Please access the GitHub page First, set forth in the preceding paragraph to the reference.

<https://github.com/mi ss ion-arm / HACKberry>

Download the "HACKberry_BOM_v2.xls" on the page. (Version of the BOM might be updated in the future.)



No description or website provided.

mission-arm / HACKberry

Code Issues Pull requests Projects Insights

242 commits 6 branches 1 release 6 contributors

Branch: master New pull request Find file Clone or download

HACKberry_3Dmodel add STL and STEP data for SLS print 4 days ago

HACKberry_circuit upgrade hardware, circuits and software to mk2 5 days ago

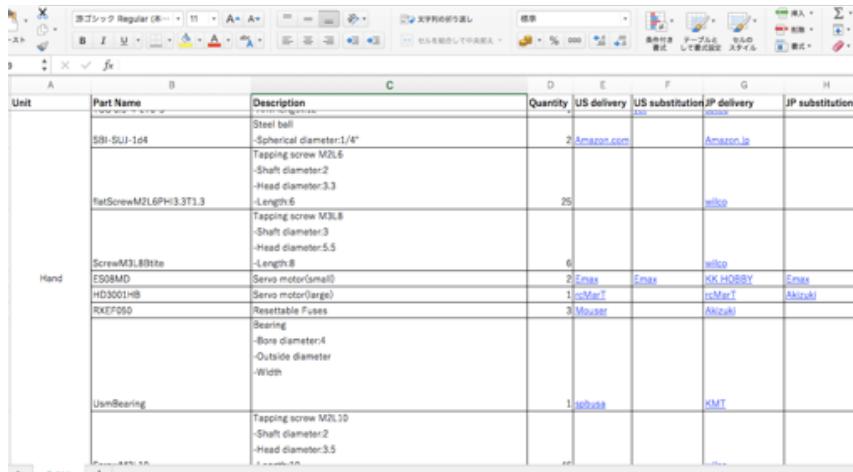
HACKberry_program upgrade hardware, circuits and software to mk2 5 days ago

options upgrade hardware, circuits and software to mk2 5 days ago

HACKberry_BOM_v2.xls upgrade hardware, circuits and software to mk2 5 days ago

README.md upgrade hardware, circuits and software to mk2 5 days ago

Open the downloaded file by using the Excel or compatible software.



Unit	Part Name	Description	Quantity	US delivery	JP delivery	JP substitution
	S8I-SU1-1d4	-Spherical diameter:1/4"	2	Amazon.com	Amazon.jp	
	Tapping screw M2L6	-Shaft diameter:2				
	FlatScrewM2L6PH3.3T3.3	-Head diameter:3.3	25	wilco		
		-Length:6				
	Tapping screw M3L8	-Shaft diameter:3				
	ScrewM3.8Btite	-Head diameter:5.5	6	wilco		
	E508MD	-Length:8				
Hand		Servo motor(small)	2	Emax	Emax	KK HOBBY
	HD3001HB	Servo motor(large)	1	rcMart	rcMart	Akizuki
	RKEF050	Resettable Fuses	3	Mouser		Akizuki
		Bearing				
		-Bore diameter:4				
		-Outside diameter:				
		-Width				
	UsmBearing				KMT	
		Tapping screw M2L10	1	Robus		
		-Shaft diameter:2				
		-Head diameter:3.5				

Because from the right side of the screen of the link of the file to open it is possible to open the purchase of the site, and part name, the necessary number as a reference, please purchase the parts.

With respect to the substrate to obtain the method used to HACKberry, please contact Mi ssi on ARM Japan. (Without the intervention of the Mi ssi on ARM Japan, or built using the circuit diagram as a reference, it is also possible for you to create using a printed circuit board manufacturing services such as Seeed Studio.) For more information, the following and access to the URL, please refer to the page that was opened by clicking on the TUTORIAL.

<http://exiii-hackberry.com/>

The screenshot shows the homepage of the exiii-hackberry.com website. At the top, there is a navigation bar with links for DATA(GITHUB), TUTORIAL (which is highlighted with a red box), FORUM, and LINKS. Below the navigation bar is a large image of a white and black robotic arm, specifically the HACKberry. Underneath the image, the word "HACKberry" is written in a bold, lowercase font, followed by "OPEN SOURCE COMMUNITY". A downward arrow points from the "HACKberry" text towards the "Contents 目次" section. The main content area has a header "Contents 目次" with a red box around the link "How to order 部品の入手方法". Below this, there are three sections: "How to use 使用方法", "How to hack 改造例", and "ABOUT HACKberry". Under "ABOUT HACKberry", there are two video thumbnails: "HACKberry" and "HACKberry user test". A second downward arrow points from the "ABOUT HACKberry" section towards the "How to order" section. The "How to order" section has a header "How to order" and contains a list of bullet points. A third downward arrow points from the "How to order" section towards the bottom of the page. At the very bottom of the page, there is a footer with a "Search" field, "Recent Changes", "Media Manager", and "Sitemap" links.

Contents 目次

- How to order 部品の入手方法
- How to use 使用方法
- How to hack 改造例

ABOUT HACKberry

HACKberry

HACKberry user test

How to order

- For how to order PCBs and 3D printing parts, please check the following pages.
 - 電子基板、3Dプリント部品の注文方法については以下のページを参照して下さい。
 - how_to_order_3dprintparts
 - how_to_order_pcbs
 - 必要なファイル一式は以下のフォルダに保存されています。 You can find all related files from the following link.
 - u https://drive.google.com/drive/u/0/folders/0B_OHNBNgKyZYmdrWmNacXjyTDQ
- For other parts, please check the following file.
 - 上記以外の部品の一覧と入手先については以下のファイルを参照して下さい。
 - u https://github.com/mision-arm/HACKberry/raw/master/HACKberry_BOM_v2.xlsx
- If you find difficulty to get parts in your country, check this sheet. You can make new column and add your country. Community member may help to find substitution parts in your country.
- あなたの国でバーナーを入手するのが難しいければ、このシートを見てみて下さい。新しい列を作りあなたの国を追加して下さい。コミュニティのメンバーが代わりの部品を探す手伝ってくれるはずです。
 - u https://docs.google.com/spreadsheets/d/116ThoPHAKnicy_gYf65WqXMeeBQ91X1E8dL2MeQv8go/edit?usp=sharing

03 Before assembling

Precautions

And assembly, please go in the order of the manual.

After-description is done with respect to basically right hand. Please think invert the image if you assemble the left hand. And a book of images by version, there may be a slight difference exists in your hand parts.

- Essential tool -

- | | | |
|-----------------------------------|---------------------------|-----------|
| 1. Soldering iron and iron holder | 2. Wire solder | 3. PC |
| 4. Micro USB cable | 5. Nipper | 6. Driver |
| 7. Pin vise | 8. Drill (φ1.6mm, φ2.2mm) | 9. Major |
| 10. Tester | 11. Vinyl tape | |



- If available convenient tools and equipment -

12. Pliers
15. Heat Shrink Tubing

13. Tweezers

14. Wire stripper

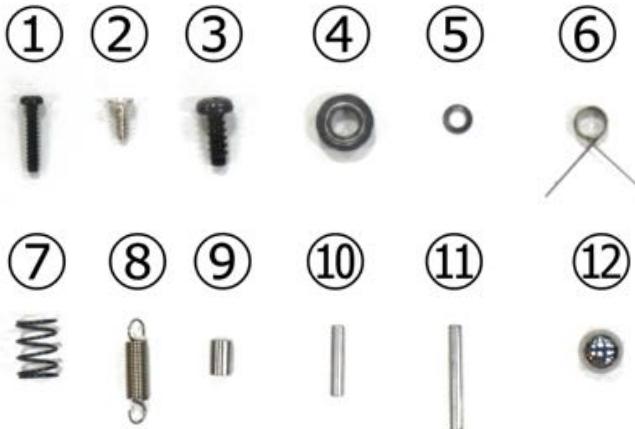


- General-purpose parts -

1. Screw (M2L10)
4. Bearing
7. Coil spring
10. Shaft (10mm)

2. Screw (M2L6)
5. Washer
8. Tension spring
11. Shaft (15mm)

3. Screw (M3L8)
6. Torsion spring
9. Spacer
12. Steel balls



- View of the part number -

This section describes the naming conventions of 3D printed parts. Hyphen (-) character by have been separated.

The first item is a large classification.

R	The right hand parts
L	The left hand parts
C	Left and right shared parts

The second item is the classification of the unit.

SO	Socket unit
T	Thumb unit
I	Index finger unit
O	Mitsuyubi (middle finger, ring finger, little finger) unit
H	Palm unit
W	Wrist unit
B	Battery case unit
SE	The sensor unit

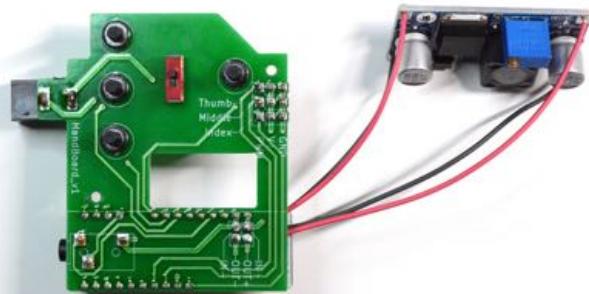
The third item is the number assigned within the unit.

As an example, if R-SO-01, will be referred to as the No. 1 component of the right hand for the socket unit.

As semb li ng

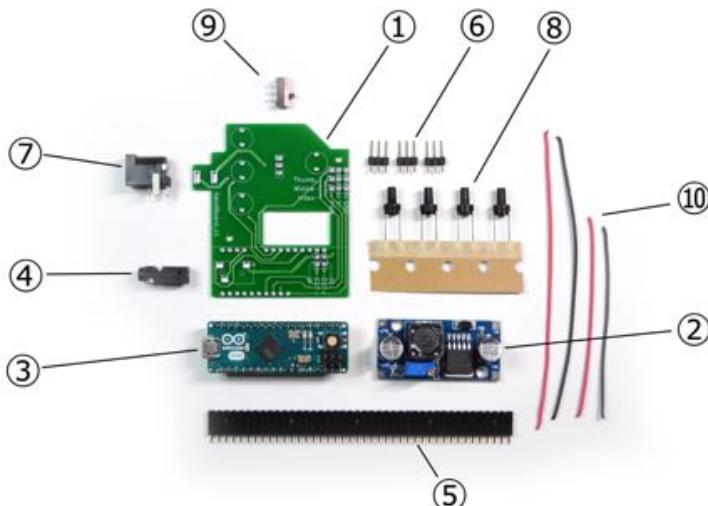
04 Soldering of the board

Soldering of HACKberry hand board Mk1



- Used parts -

- | | | |
|-----------------------------|-------------------|------------------|
| 1. HACKberry hand board Mk1 | 2. DCDC converter | 3. Arduino Micro |
| 4. Stereo jack | 5. Pin socket | 6. Pin header |
| 7. DC jack | 8. Tact switch | 9. Slide switch |
| 10. Lead | | |



* When soldering, firmly inserted all the way into the electrical element (part), floating or, please be careful not to solder while skewed.

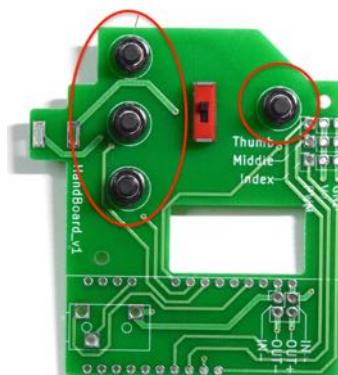
* Small electric element riding on the substrate may be damaged by static electricity. Please to remove as much as possible static electricity with an antistatic pad or the like prior to soldering.

* Circuit Touching the electrical elements with wet hands in the water will cause damage to short-circuit. Please go from wipe firmly the moisture soldering work.

[1] and the slide switch soldered to the front side of the substrate. The substrate surface on which the white characters are printed is the table surface. Moreover, there is no polarity (direction) to the slide switch.

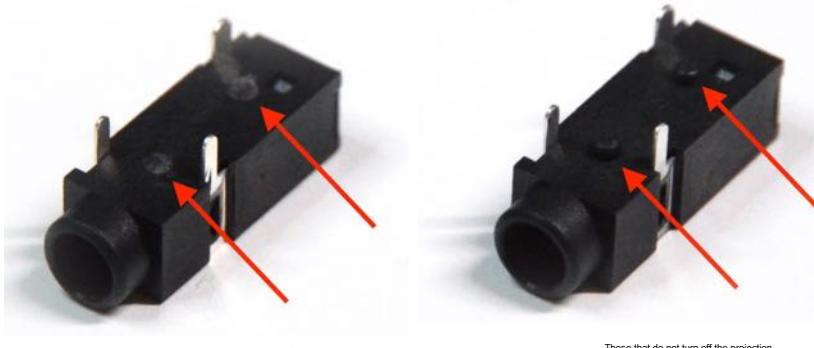


[2] and then soldered the tact switch on the front side of the substrate. Excess lead wires protruding on the back will be cut by nippers. Do not protrude from the substrate 2mm or more as a guide.



Reverse

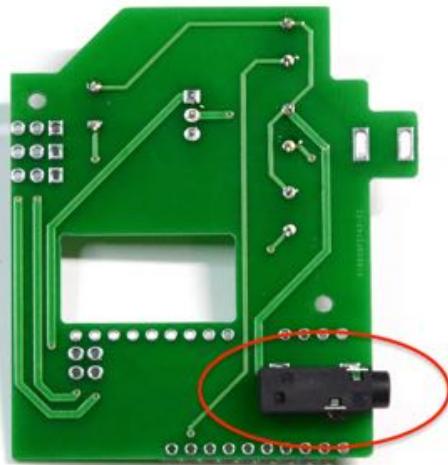
[3] and then the soldering of the back side. If the substrate for the right hand are soldered, please cut with a cutter such as a projection of the bottom surface of the stereo Ojakkus before making a circuit.



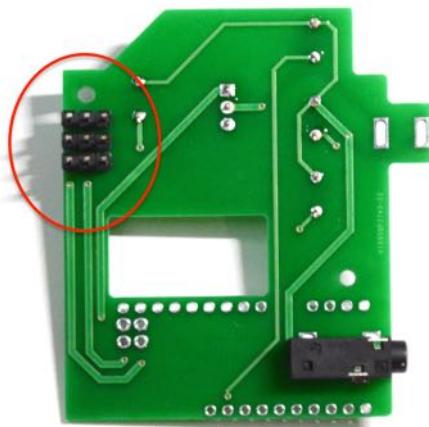
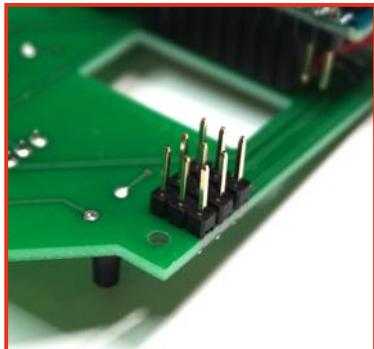
Which got off to a projection

Those that do not turn off the projection

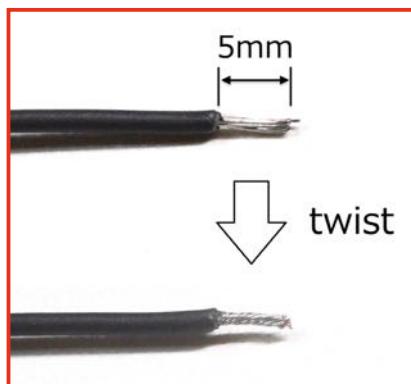
[4] and then solder the stereo jack on the position of the photograph.



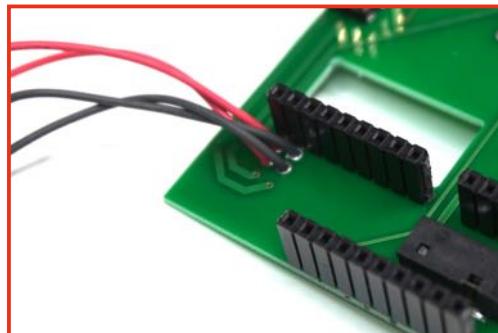
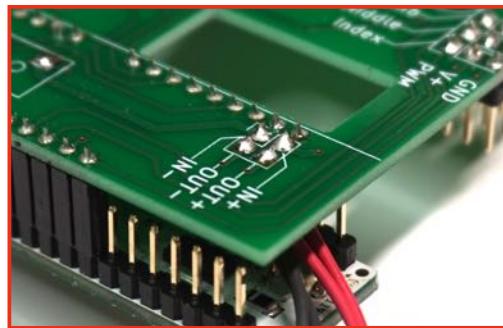
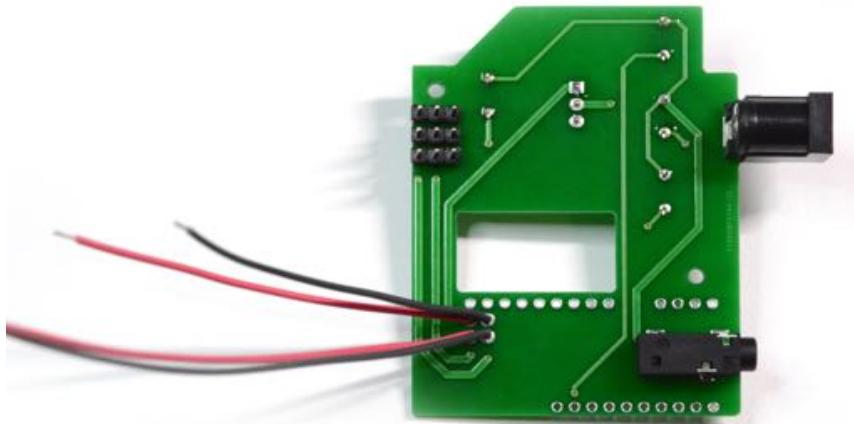
[5] pin header **The shorter of the metal part A** is inserted to the substrate and then soldered. **So that the pin is not diagonally** I'll be careful.



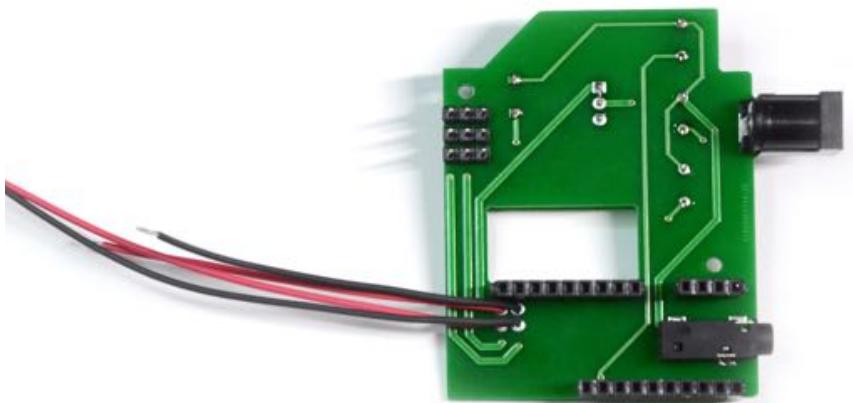
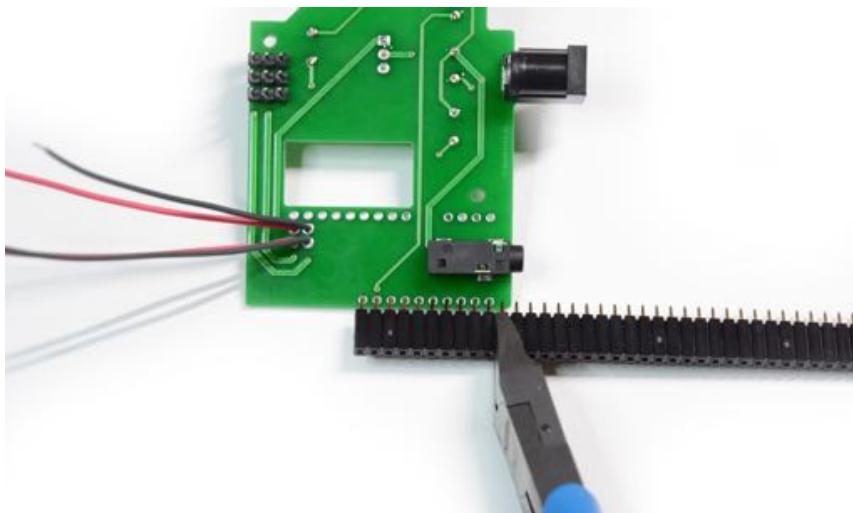
[6] Strip the coating of the previous 5mm of lead wires using a wire stripper, etc., collectively twisting the line. If there is no wire stripper scissors coated with a nipper. Strip attention while covering not to cut the core wire.



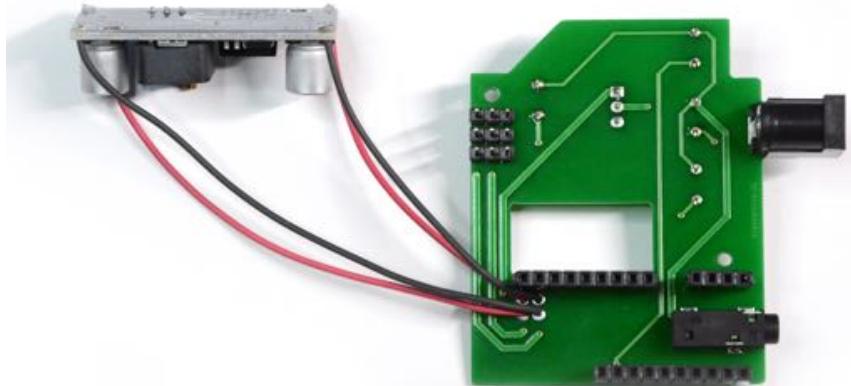
[7] longer is OUTPUT, shorter is in the INPUT, in red +, respectively, black - and then soldered to the substrate so as to lead. DC jack is also soldered.



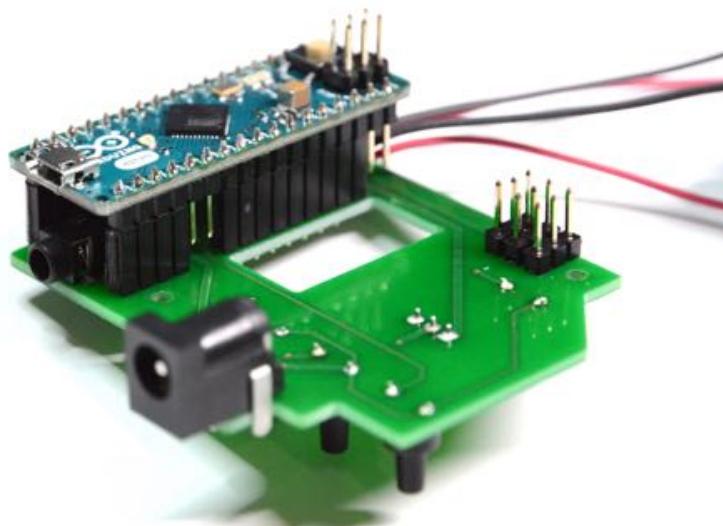
[8] Solder three places from the cut-pin socket in the nippers to match the holes in the board.



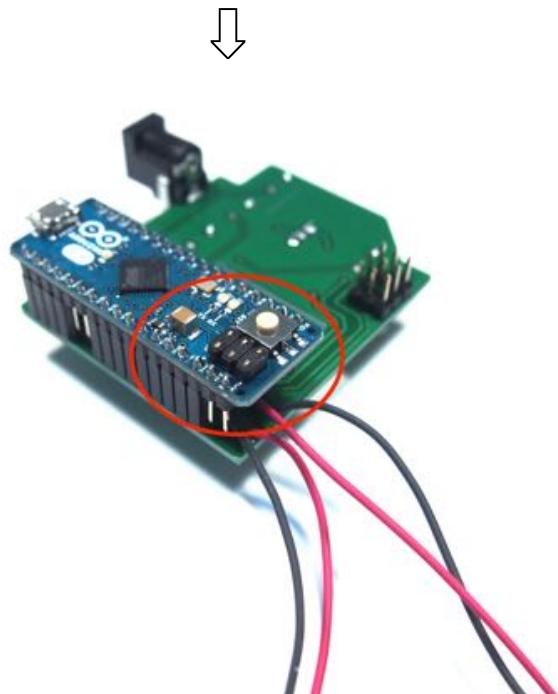
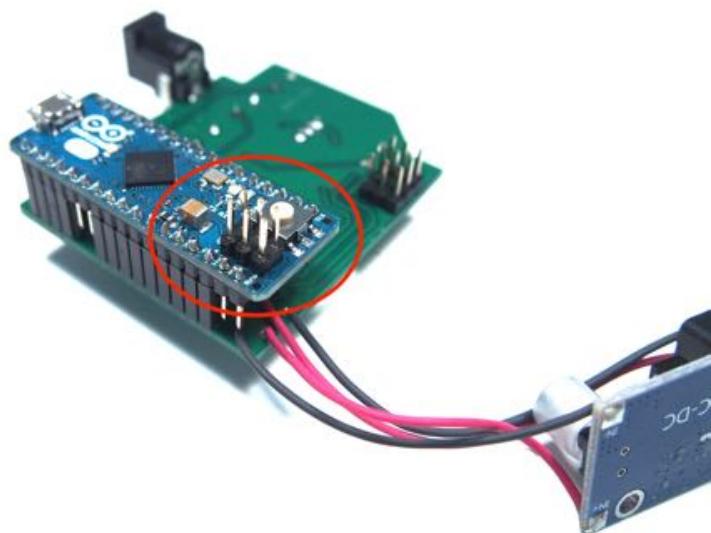
[9] DCDC converter and HACKberry hand board Mk1 of OUT +, OUT-, IN +, and then soldered so as to correspond to IN-.



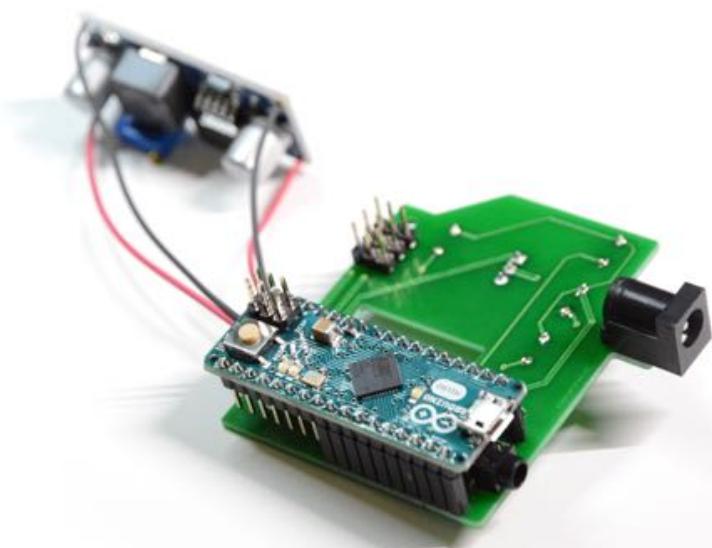
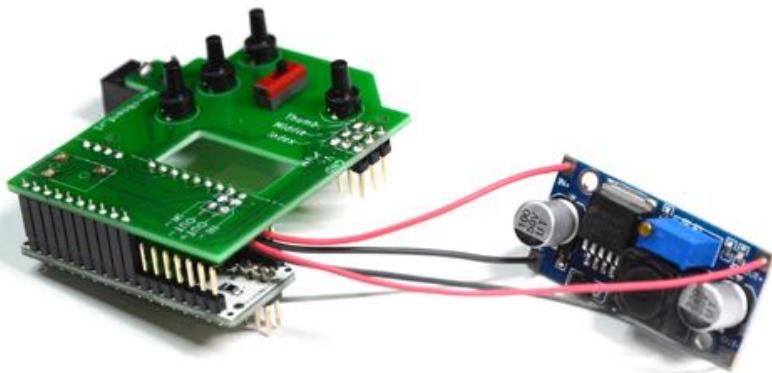
[10] Insert the Arduino Micro all the way to the pin header so as not to mistake the position of the hole.



[1] In the case of the left hand board, please cut with nippers as shown in the photograph of the pin within the red frame in FIG.



[1 2] This HACKberry hand board Mk1 is completed.



[1 3] we will then insert the poly switch to the inside of the servo motor.

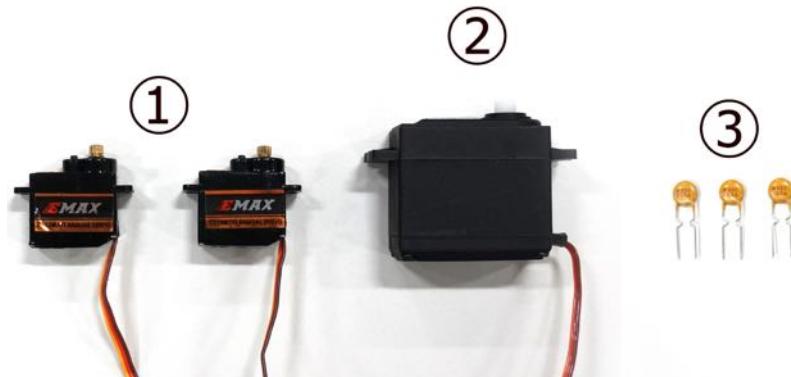
※ It is possible to move the servo motor also skip this step, you can prevent damage when an excessive degree of load is applied to the motor by attaching a poly-switch.

※ This work since the Mk2 board has already been poly-switch is mounted on the substrate itself is not required.

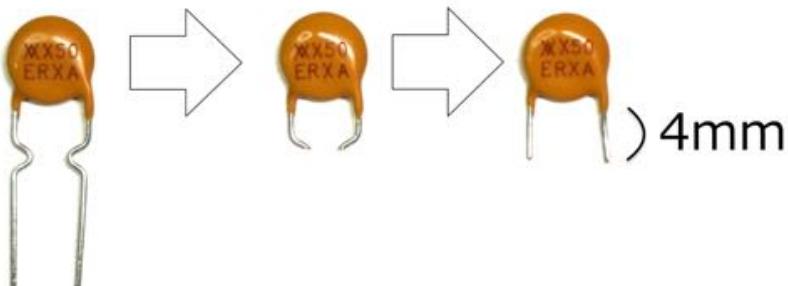
1. servo motor Small

2. servo motor size

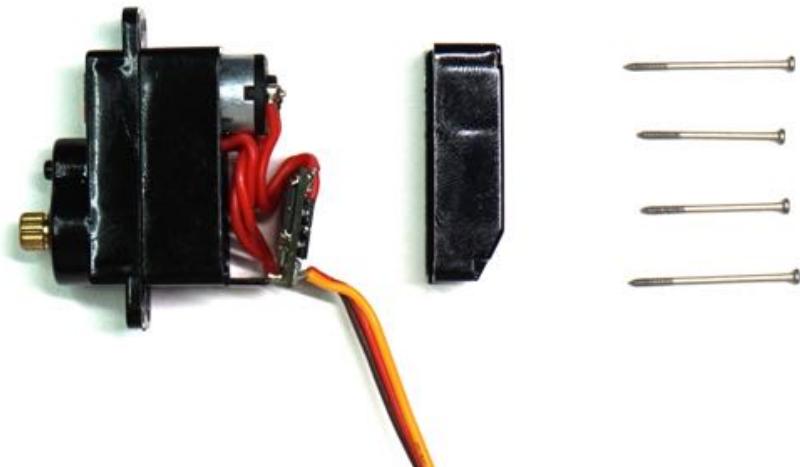
3. poly switch



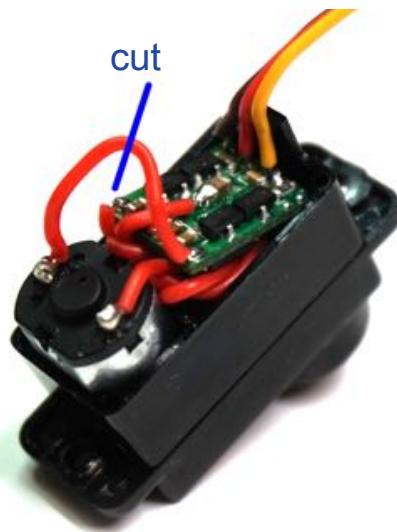
In [1 4] First, the lead line of poly switch was cut, leaving about 4mm, and straightened with needle-nose pliers. This work is done three minutes.



[1 5] Remove the cover by loosening the servo motor small screws. The manufacturer of the seal are stretched to the side, or peeled off it, please cut in the joint of the parts.



[1 6] DC motor to disconnect the portion of the photo of the blue line a single one of the two cables that have been soldered, which is in.

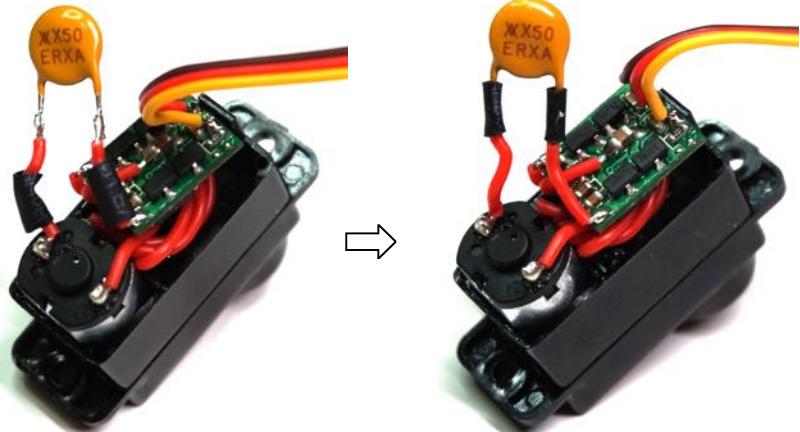


[1 7] strip the cut coating of the cable by using a wire stripper as 4mm, the core wire and leave twist.

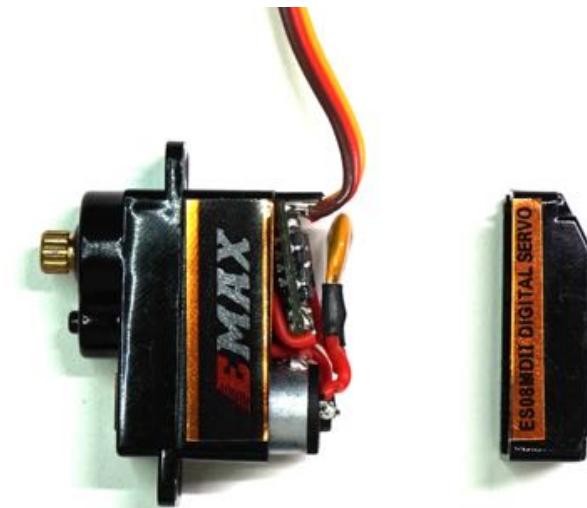


[1 8] to cut the cable and soldered the poly switch cover with plastic tape. **Please cover the entire firm metal part because it is dangerous to expose the metal part.**

※ If using a heat-shrinkable tube if there is a heat-shrinkable tube is more secure. ※ There is no polarity to the poly switch.



[1 9] folded the cable as shown in the figure, close the cover, and tighten the screws. **In this case, please be careful not to pinch the cable.**



[2 0] and remove the cover by loosening the servo motor size of the screw. Rubber packing for waterproof will come out, but it is not required at the time of closing the last cover.

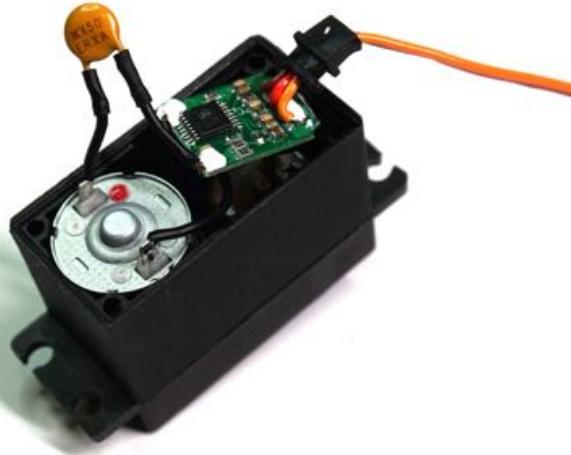


[2 1] a single one of the two cables are soldered to the cutting as shown in the photograph in DC motor is in, peeled by using a wire stripper as 4mm coating, collectively twisted core wire you.



[2 2] to cut the cable and soldered the poly switch cover with plastic tape. **Please cover the entire firm metal part because it is dangerous to expose the metal part.**

※ If using a heat-shrinkable tube if there is a heat-shrinkable tube is more secure. ※ There is no polarity to the poly switch.



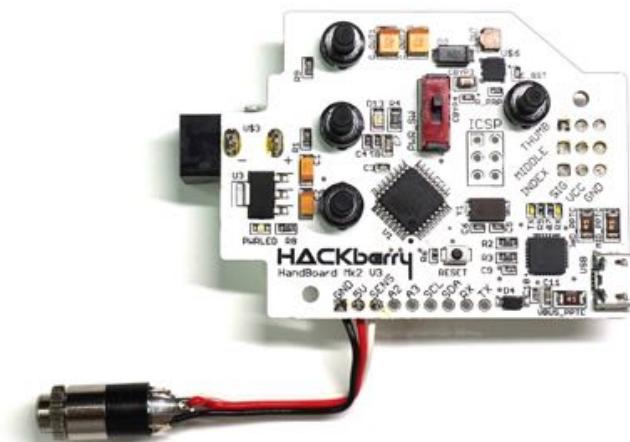
[2 3] Close the cover, and tighten the screws. This insertion of the poly-switch is complete.



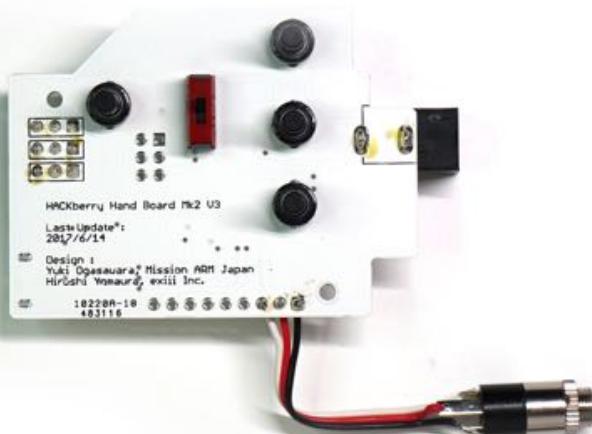
Mk2 soldering of the board

HACKberry hand board Mk2 is the control board of the left and right shared, **Both sides will be reversed in or to use for both left and right.** Please be careful not to make a mistake because there is a description of the soldering method for the left hand after the soldering method for the right hand.

Mk2 board complete image (the right specifications)



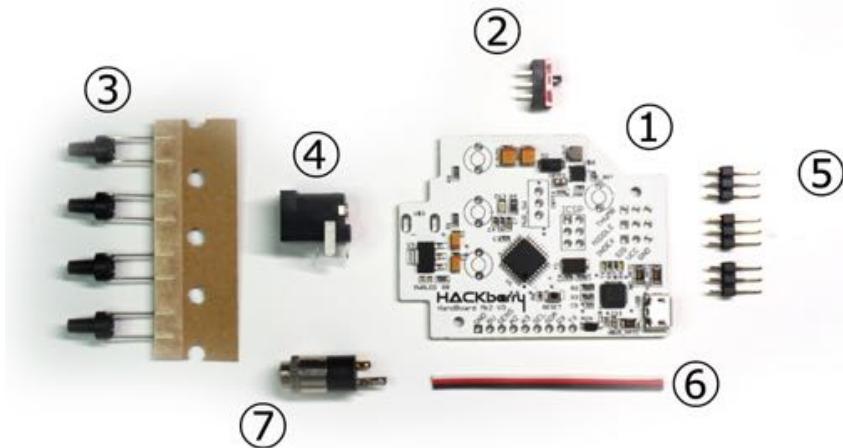
Mk2 board complete image (left hand specification)



* may differ photos and appearance of the above slightly depending on the version of the board.

- Used parts-

- | | | |
|-----------------------------|-----------------|----------------|
| 1. HACKberry hand board Mk2 | 2. Slide switch | 3. Tact switch |
| 4. DC jack | 5. Pin header | 6. Flat cable |
| 7. Stereo jack | | |



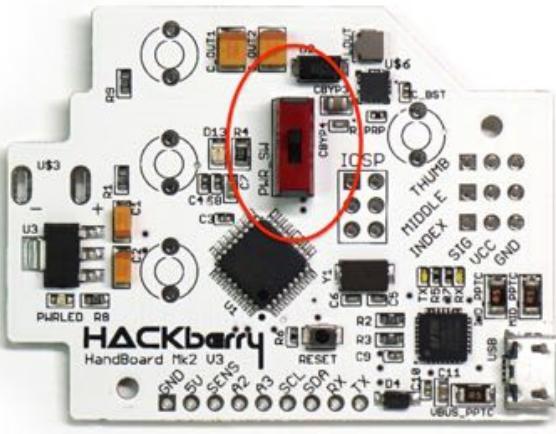
* When soldering, firmly inserted all the way into the electrical element (part), floating or, please be careful not to soldering while skewed.

* Small electric element riding on the substrate may be damaged by static electricity. Please to remove as much as possible static electricity with an antistatic pad or the like prior to soldering.

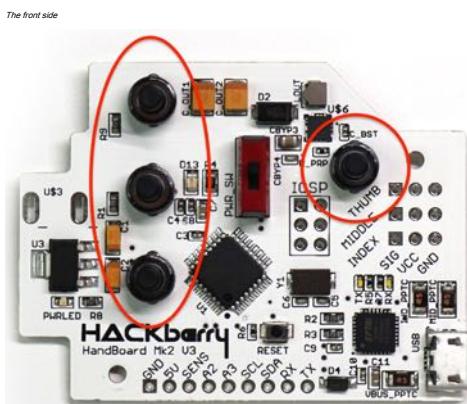
* Circuit Touching the electrical elements with wet hands in the water will cause damage to short-circuit. Please go from wipe firmly the moisture soldering work.

Soldering in the case of using the right hand

[1] The slide switch on the board **The front side** Solder to. **The substrate surface on which the logo of HACKberry is printed is the front.** In addition there is no polarity to the slide switch.



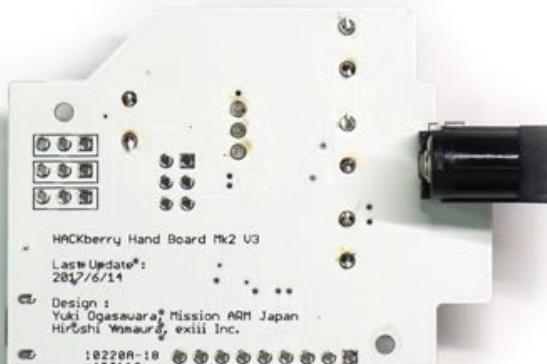
[2] and then soldered the tact switch on the front side of the substrate. Excess lead wires protruding on the back side will be cut at the root. As a guide to cut within 2mm from the surface of the substrate.



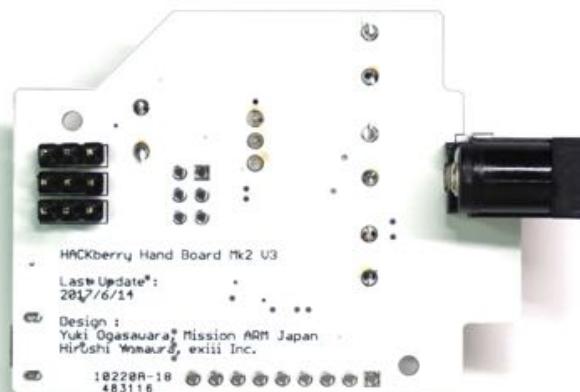
The back side



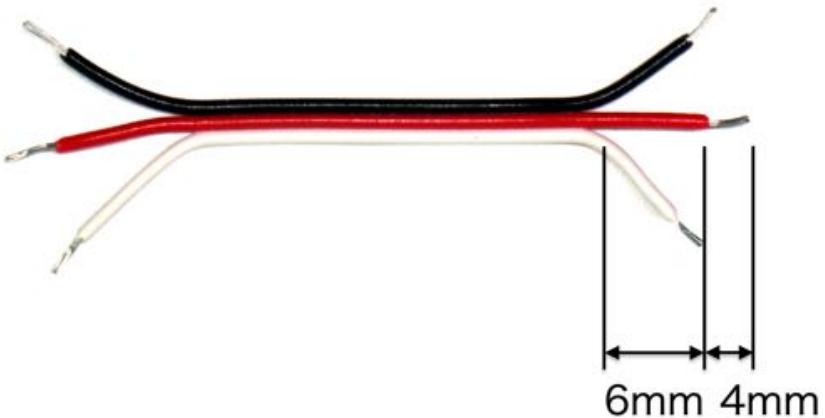
[3] and then soldered as shown in the illustration DC jack.



[4] pin header **The shorter of the metal part** A is inserted to the substrate and then soldered. **Easy slope diagonally** Please be careful so.



[5] devote each about 10mm both ends of the flat cable. Strip using, for example, further each 4mm about wire strike Ripper film. Core wire is collectively twisted by hand.



[6] and then soldering the flat cable to the stereo jack of the terminal. At this time, **White in the upper right corner of the terminal, red to end child of under, and the black cable to the upper left corner of the terminal** Solder so as not to mistake.

