

THORMANG3

THORMANG3 Tutorial

Offset tuner Tool



Table of Contents



1. Introduction

1. Why calibration is needed?

2. Getting Started

1. How to run thormang3_offset_tuner
2. How to use thormang3_offset_tuner

3. Calibration guidelines

1. Introduction



1. Why calibration is needed?



- **Why**
 - Model error
 - Assembly error
- **Calibration**
 - Level-1 (mastering)
 - Level-2 (kinematic calibration)
 - Level-3 (non-kinematic calibration)

2. Getting Started



How to run thormang3_offset_tuner



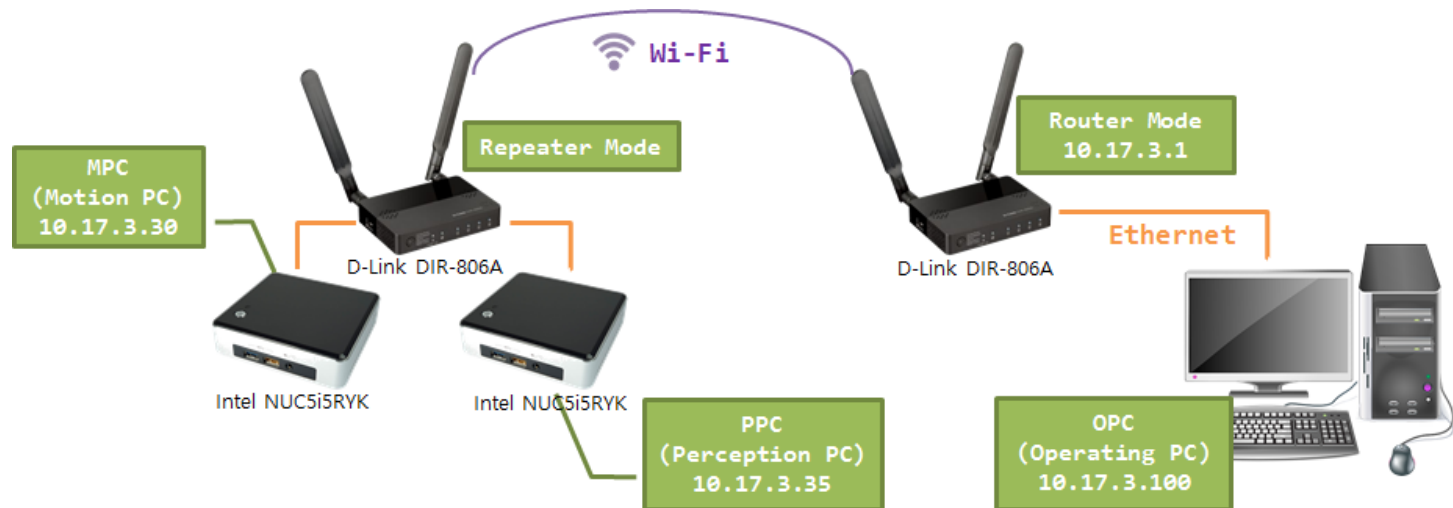
- **Connect to THORMANG3**

- Connect to the MPC
open terminal and type as following(*pw:111111*)

```
$ ssh robotis@10.17.3.30
```

- Connect to the PPC
open terminal and type as following(*pw:111111*)

```
$ ssh robotis@10.17.3.35
```





How to run thormang3_offset_tuner



- **Execute the program on the PPC**
 - **roscore** (ROS_MASTER_URI)
 1. Connect to the PPC
 2. Launch roscore

```
$ roscore
```



How to run thormang3_offset_tuner



- **Execute the program on the MPC**

- **thormang3_tuner_server**

1. Connect to the PPC
2. Launch thormang3_tuner_server

```
$ roslaunch thormang3_offset_tuner_server thormang3_offset_tuner_server.launch
```

- *thormang3_offset_tuner_server.launch*

```
<launch>
  <param name="offset_file_path" value="$(find thormang3_manager)/config/offset.yaml"/>
  <param name="robot_file_path" value="$(find thormang3_manager)/config/THORMANG3.robot"/>
  <param name="init_file_path" value="$(find thormang3_manager)/config/dxl_init.yaml"/>

  <node name="thormang3_offset_tuner_server_node" pkg="thormang3_offset_tuner_server"
type="thormang3_offset_tuner_server_node" output="screen">
    </node>
</launch>
```

- offset.yaml : offset config file
- THORMANG3.robot : robot information
- dxl_init.yaml : initial setting for dynamixel



How to run thormang3_offset_tuner



- Execute the program on the MPC
 - **thormang3_tuner_server**
 - offset.yaml

```
offset:
  head_p: 0
  head_y: 0
  l_arm_el_y: 0
  l_arm_grip: 0
  l_arm_sh_p1: 0
  l_arm_sh_p2: 0
  l_arm_sh_r: 0
  .
  .
  .
init_pose_for_offset_tuner:
  head_p: 0
  head_y: 0
  l_arm_el_y: -1.570796326794845
  l_arm_grip: 0
  l_arm_sh_p1: 0
  l_arm_sh_p2: 0
  l_arm_sh_r: 0
  .
  .
  .
```

- offset : offset value for the joint, unit : radian
- init_pose_for_offset_tuner : angles of the initial posture for offset tuning, unit : radian



How to run thormang3_offset_tuner



- Execute the program on the OPC
 - thormang3_offset_tuner_client
 1. run thormang3_tuner_client

```
$ rosrn thormang3_offset_tuner_client thormang3_offset_tuner_client
```

- thormang3_offset_tuner_client/config/joint_data.yaml : config file for UI

The screenshot shows the 'Offset Tuner Client' window. It has a 'Command Panel' at the top with tabs for 'Right Arm', 'Left Arm', 'Legs', and 'Body'. A red dashed box highlights these tabs, with an arrow pointing to a label 'Fixed Items : Tab List'. Below the tabs is a 'Joint Offset Data' table with columns: Goal Pos. [deg], Offset [deg], ModVal [deg], Present Pos. [deg], P Gain, I Gain, and D Gain. A red arrow points from a label 'Modifiable Items : Joint List' to the 'Joint Offset Data' table. Below the table is a 'Torque On/Off' section with checkboxes for various joints. At the bottom are buttons for 'Initial Pose', 'Refresh', 'Save', and 'Quit'. A note '(ModVal = Goal Pos. + Offset)' is visible on the right side of the table.

Joint Offset Data	Goal Pos. [deg]	Offset [deg]	ModVal [deg]	Present Pos. [deg]	P Gain	I Gain	D Gain
r_arm_sh_p1	0.00	0.00	0.00	0.00	32	0	0
r_arm_sh_r	0.00	0.00	0.00	0.00	32	0	0
r_arm_sh_p2	0.00	0.00	0.00	0.00	32	0	0
r_arm_el_y	0.00	0.00	0.00	0.00	32	0	0
r_arm_wr_r	0.00	0.00	0.00	0.00	32	0	0
r_arm_wr_y	0.00	0.00	0.00	0.00	32	0	0
r_arm_wr_p	0.00	0.00	0.00	0.00	32	0	0

Torque On/Off

☒ r_arm_sh_p1 ☒ r_arm_sh_r ☒ r_arm_sh_p2 ☒ r_arm_el_y ☒ r_arm_wr_r ☒ r_arm_wr_y

☒ r_arm_wr_p

All torque ON All torque OFF

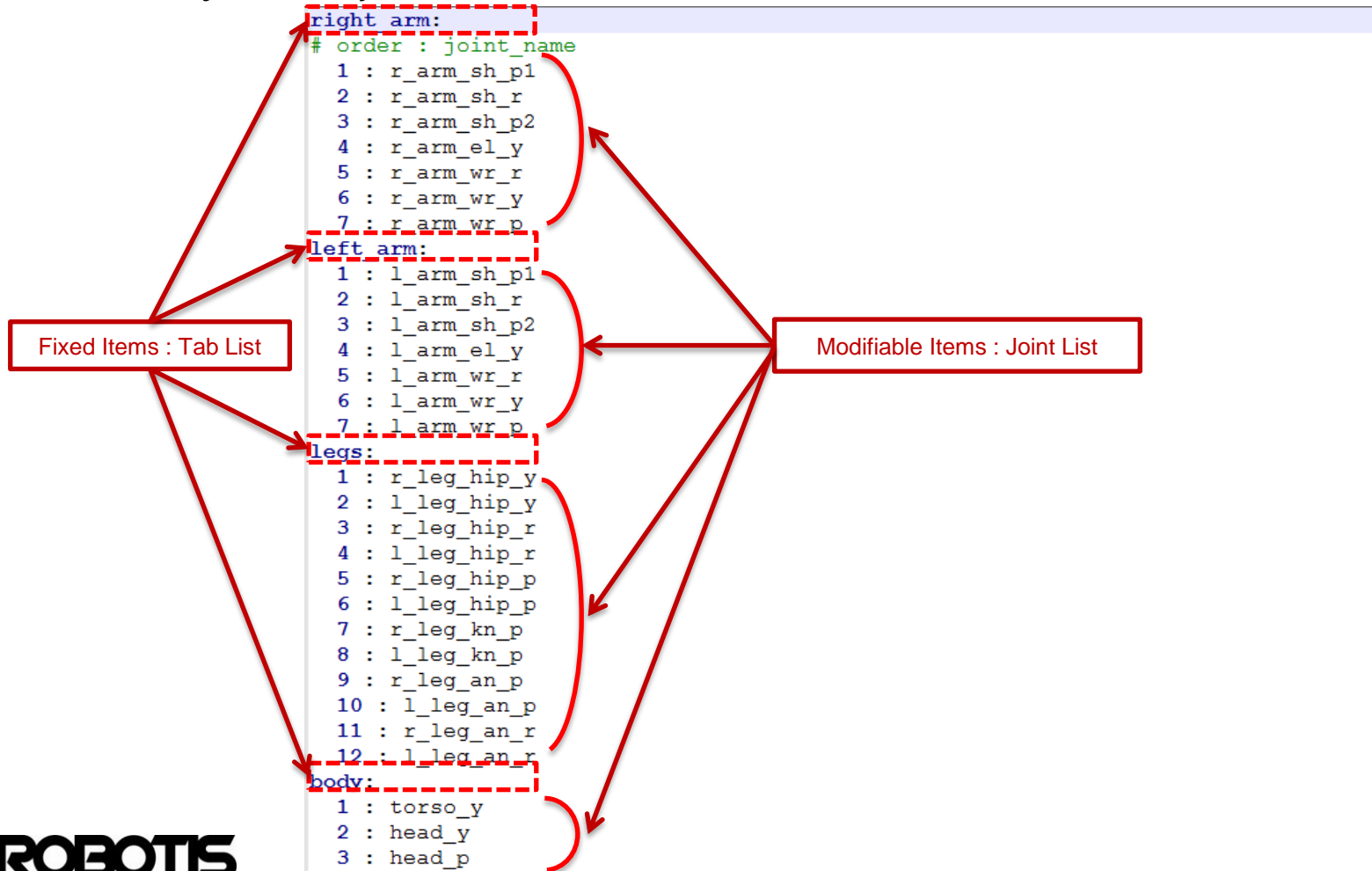
Initial Pose Refresh Save Quit



How to run thormang3_offset_tuner



- Execute the program on the OPC
 - thormang3_offset_tuner_client
- 2. joint_data.yaml





How to use thormang3_offset_tuner



1. Click 'Initial Pose' button
2. Select Tab for tuning

Offset Tuner Client

Ros Communications

Logging

Command Panel

Right Arm Left Arm **Legs** Body

(Modval = Goal Pos. + Offset)

Joint Offset Data	Goal Pos. [deg]	Offset [deg]	ModVal [deg]	Present Pos. [deg]	P Gain	I Gain	D Gain
r_arm_sh_p1	0.00	0.00	0.00	0.00	32	0	0
r_arm_sh_r	0.00	0.00	0.00	0.00	32	0	0
r_arm_sh_p2	0.00	0.00	0.00	0.00	32	0	0
r_arm_el_y	0.00	0.00	0.00	0.00	32	0	0
r_arm_wr_r	0.00	0.00	0.00	0.00	32	0	0
r_arm_wr_y	0.00	0.00	0.00	0.00	32	0	0
r_arm_wr_p	0.00	0.00	0.00	0.00	32	0	0

Torque On/Off

☒ r_arm_sh_p1 ☒ r_arm_sh_r ☒ r_arm_sh_p2 ☒ r_arm_el_y ☒ r_arm_wr_r ☒ r_arm_wr_y

☒ r_arm_wr_p

All torque ON All torque OFF

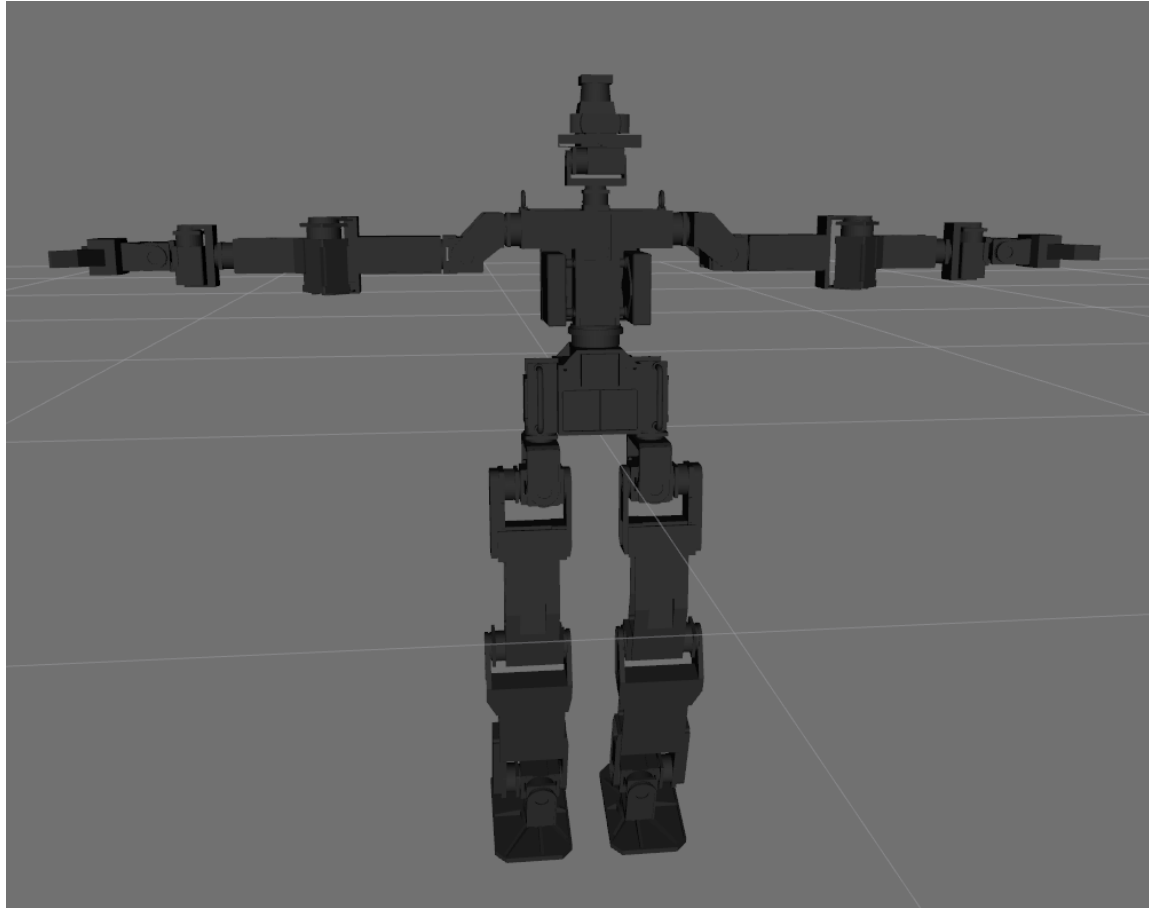
Initial Pose Refresh Save Quit



How to use thormang3_offset_tuner



- Initial Pose for tuning





How to use thormang3_offset_tuner



- Torque on/off – individual joint

Offset Tuner Client

Ros Communications

Logging

```
[INFO] [1488971056.139560739]: Send Command : ini_pose  
[INFO] [1488971693.151874685]: Send Joint Offset Data  
[INFO] [1488971694.188298897]: Send Joint Offset Data  
[INFO] [1488971695.734283603]: Send Joint Offset Data  
[INFO] [1488971729.096814603]: Send Joint Offset Data  
[INFO] [1488971730.136458373]: Send Joint Offset Data  
[INFO] [1488971773.272127060]: Joint Torque On/Off
```

Command Panel

Right Arm Left Arm Legs Body

Joint Offset Data

	Goal Pos. [deg]	Offset [deg]	Modval [deg]	Present Pos. [deg]	P Gain	I Gain	D Gain
r_leg_hip_y	0.00	0.05	0.05	0.05	32	0	0
l_leg_hip_y	0.00	0.30	0.00	0.31	32	0	0
r_leg_hip_r	0.00	0.00	0.00	-0.02	32	0	0
l_leg_hip_r	0.00	0.55	0.00	0.56	32	0	0
r_leg_hip_p	-6.00	0.00	0.00	-5.99	32	0	0
l_leg_hip_p	6.00	-2.10	0.00	3.90	32	0	0
r_leg_kn_p	-9.00	0.50	0.00	-8.50	32	0	0
l_leg_kn_p	9.00	-0.90	8.10	8.10	32	0	0
r_leg_an_p	6.00	0.00	0.00	5.99	32	0	0
l_leg_an_p	-6.00	0.25	0.00	-5.75	32	0	0
r_leg_an_r	0.00	-0.25	0.00	-0.26	32	0	0
l_leg_an_r	0.00	0.00	0.00	0.00	32	0	0

Torque On/Off

<input checked="" type="checkbox"/> r_leg_hip_y	<input checked="" type="checkbox"/> l_leg_hip_y	<input type="checkbox"/> r_leg_hip_r	<input checked="" type="checkbox"/> l_leg_hip_r	<input checked="" type="checkbox"/> r_leg_hip_p	<input checked="" type="checkbox"/> l_leg_hip_p
<input checked="" type="checkbox"/> r_leg_kn_p	<input checked="" type="checkbox"/> l_leg_kn_p	<input checked="" type="checkbox"/> r_leg_an_p	<input checked="" type="checkbox"/> l_leg_an_p	<input checked="" type="checkbox"/> r_leg_an_r	<input checked="" type="checkbox"/> l_leg_an_r

All torque ON All torque OFF

Initial Pose Refresh Save Quit

2. Torque off

1. Check / Uncheck



How to use thormang3_offset_tuner



- Torque on/off – all joints

The screenshot shows the 'Offset Tuner Client' window. On the left is a 'Logging' panel with a list of system messages. The main area is the 'Command Panel' with tabs for 'Right Arm', 'Left Arm', 'Legs', and 'Body'. The 'Legs' tab is active, showing a table of joint offset data. A red dashed box highlights the 'Joint Offset Data' table. Below the table are checkboxes for 'Torque On/Off' for each joint. At the bottom right, two buttons are labeled 'All torque ON' and 'All torque OFF'. Red arrows and boxes provide instructions: '2. Torque off' points to the 'All torque OFF' button, '1. Click' points to the 'All torque OFF' button, and '3. Click' points to the 'All torque ON' button.

Offset Tuner Client

Ros Communications

Logging

```
[INFO] [1488971056.139560739]: Send Command : ini_pose
[INFO] [1488971693.151874685]: Send Joint Offset Data
[INFO] [1488971694.188298897]: Send Joint Offset Data
[INFO] [1488971695.734283603]: Send Joint Offset Data
[INFO] [1488971729.096814603]: Send Joint Offset Data
[INFO] [1488971730.136458373]: Send Joint Offset Data
[INFO] [1488971773.272127060]: Joint Torque On/Off
[INFO] [1488971803.019193653]: Joint Torque On/Off
[INFO] [1488971803.070142257]: Joint Torque On/Off
[INFO] [1488971803.117024837]: Joint Torque On/Off
[INFO] [1488971803.177761752]: Joint Torque On/Off
[INFO] [1488971803.237289002]: Joint Torque On/Off
[INFO] [1488971803.299732187]: Joint Torque On/Off
[INFO] [1488971803.351356825]: Joint Torque On/Off
[INFO] [1488971803.413624017]: Joint Torque On/Off
[INFO] [1488971803.479744740]: Joint Torque On/Off
[INFO] [1488971803.524421983]: Joint Torque On/Off
[INFO] [1488971803.577292673]: Joint Torque On/Off
```

Command Panel

Right Arm Left Arm Legs Body

Joint Offset Data

(Modval = Goal Pos. + Offset)

	Goal Pos. [deg]	Offset [deg]	Modval [deg]	Present Pos. [deg]	P Gain	I Gain	D Gain
r_leg_hip_y	0.00	0.05	0.05	0.05	32	0	0
l_leg_hip_y	0.00	0.30	0.00	0.31	32	0	0
r_leg_hip_r	0.00	0.00	0.00	-0.11	32	0	0
l_leg_hip_r	0.00	0.55	0.00	0.64	32	0	0
r_leg_hip_p	-6.00	0.00	0.00	-5.99	32	0	0
l_leg_hip_p	6.00	-2.10	0.00	1.97	32	0	0
r_leg_kn_p	-9.00	0.50	0.00	-8.38	32	0	0
l_leg_kn_p	9.00	-0.90	8.10	6.67	32	0	0
r_leg_an_p	6.00	0.00	0.00	6.00	32	0	0
l_leg_an_p	-6.00	0.25	0.00	-5.75	32	0	0
r_leg_an_r	0.00	-0.25	0.00	-0.27	32	0	0
l_leg_an_r	0.00	0.00	0.00	0.00	32	0	0

Torque On/Off

☐ r_leg_hip_y ☐ l_leg_hip_y ☐ r_leg_hip_r ☐ l_leg_hip_r ☐ r_leg_hip_p ☐ l_leg_hip_p

☐ r_leg_kn_p ☐ l_leg_kn_p ☐ r_leg_an_p ☐ l_leg_an_p ☐ r_leg_an_r ☐ l_leg_an_r

All torque ON All torque OFF

Initial Pose Refresh Save Quit

2. Torque off

3. Click

1. Click



How to use thormang3_offset_tuner



- calibrate the joint

1. Check current angle of joint : click 'Refresh' button
2. Tuning offset value : change value of spin box

The screenshot shows the 'Offset Tuner Client' window. It has a 'Ros Communications' tab on the left with a logging area. The main area is the 'Command Panel' with tabs for 'Right Arm', 'Left Arm', 'Legs', and 'Body'. The 'Legs' tab is selected, showing a table of joint offset data. Annotations with red boxes and arrows point to the 'Offset [deg]' column (labeled '2. Change value'), the 'Present Pos. [deg]' column (labeled '1. Check value'), and the 'Refresh' button at the bottom (labeled '1. Click').

Joint Offset Data	Goal Pos. [deg]	Offset [deg]	Modval [deg]	Present Pos. [deg]	P Gain	I Gain	D Gain
r_leg_hip_y	0.00	0.00	0.00	0.01	32	0	0
l_leg_hip_y	0.00	0.30	0.00	0.31	32	0	0
r_leg_hip_r	0.00	0.00	0.00	0.00	32	0	0
l_leg_hip_r	0.00	0.55	0.00	0.56	32	0	0
r_leg_hip_p	-6.00	0.00	0.00	-5.99	32	0	0
l_leg_hip_p	6.00	-2.10	0.00	3.90	32	0	0
r_leg_kn_p	-9.00	0.50	0.00	-8.50	32	0	0
l_leg_kn_p	9.00	-0.90	0.00	8.10	32	0	0
r_leg_an_p	6.00	0.00	0.00	5.99	32	0	0
l_leg_an_p	-6.00	0.25	0.00	-5.75	32	0	0
r_leg_an_r	0.00	-0.25	0.00	-0.26	32	0	0
l_leg_an_r	0.00	0.00	0.00	0.00	32	0	0

Torque On/Off

<input checked="" type="checkbox"/> r_leg_hip_y	<input checked="" type="checkbox"/> l_leg_hip_y	<input checked="" type="checkbox"/> r_leg_hip_r	<input checked="" type="checkbox"/> l_leg_hip_r	<input checked="" type="checkbox"/> r_leg_hip_p	<input checked="" type="checkbox"/> l_leg_hip_p
<input checked="" type="checkbox"/> r_leg_kn_p	<input checked="" type="checkbox"/> l_leg_kn_p	<input checked="" type="checkbox"/> r_leg_an_p	<input checked="" type="checkbox"/> l_leg_an_p	<input checked="" type="checkbox"/> r_leg_an_r	<input checked="" type="checkbox"/> l_leg_an_r

All torque ON All torque OFF

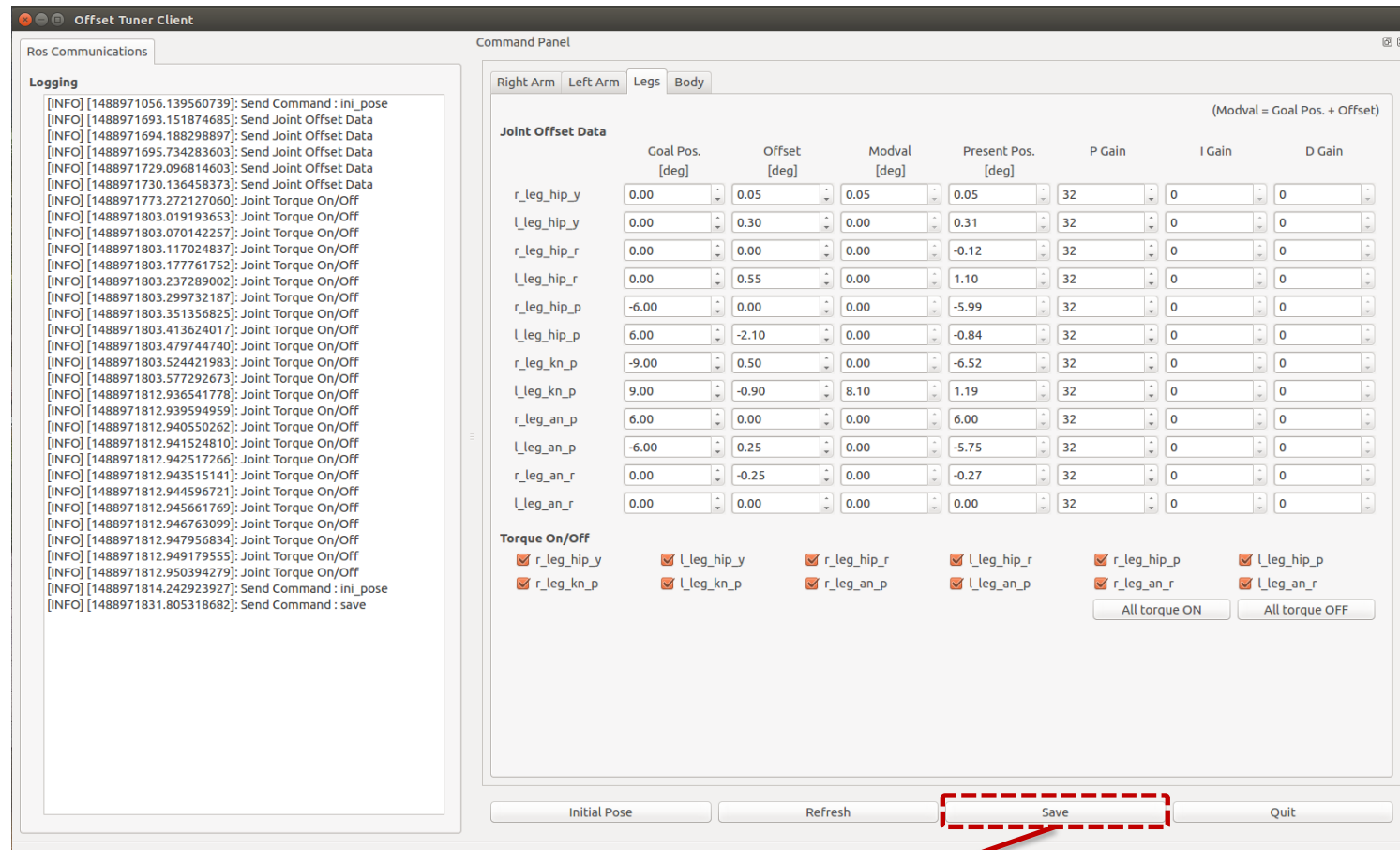
Initial Pose Refresh Save Quit



How to use thormang3_offset_tuner



- Save the offset value



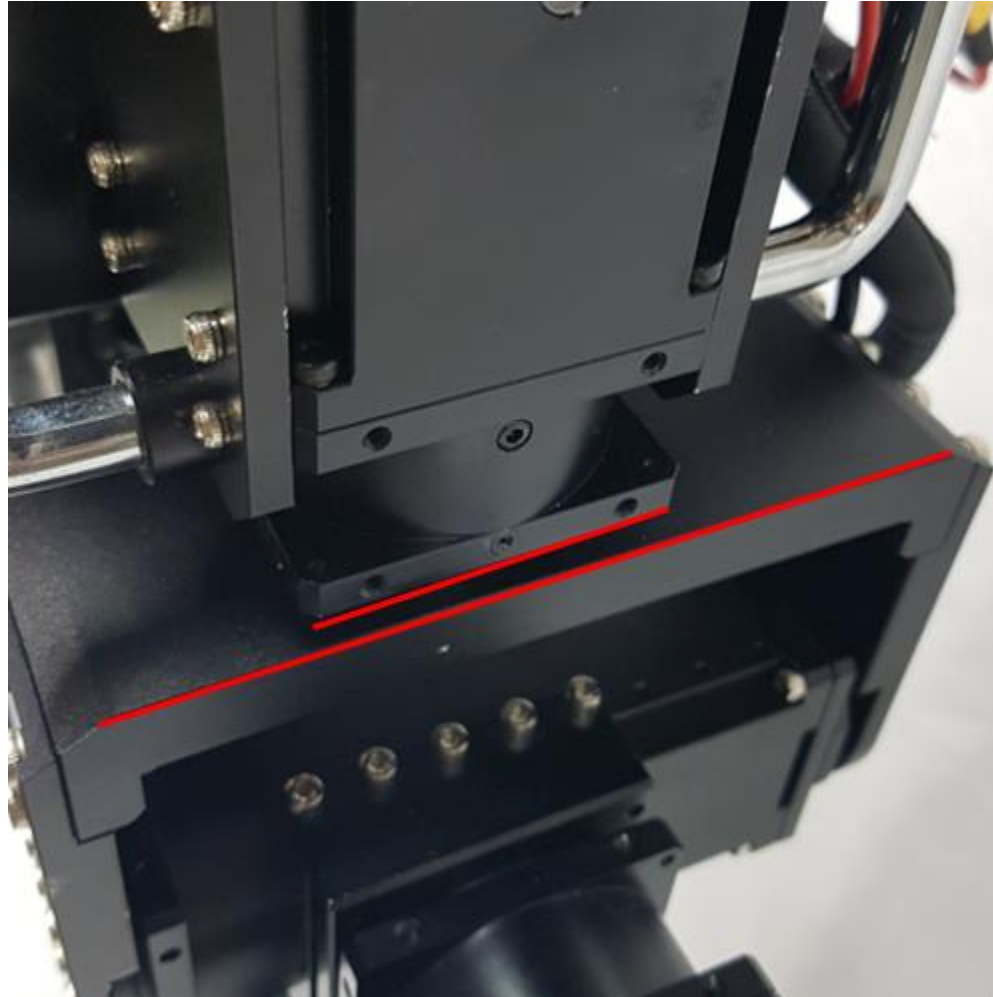
3. Calibration Guidelines



Hip yaw



- Set two lines in parallel

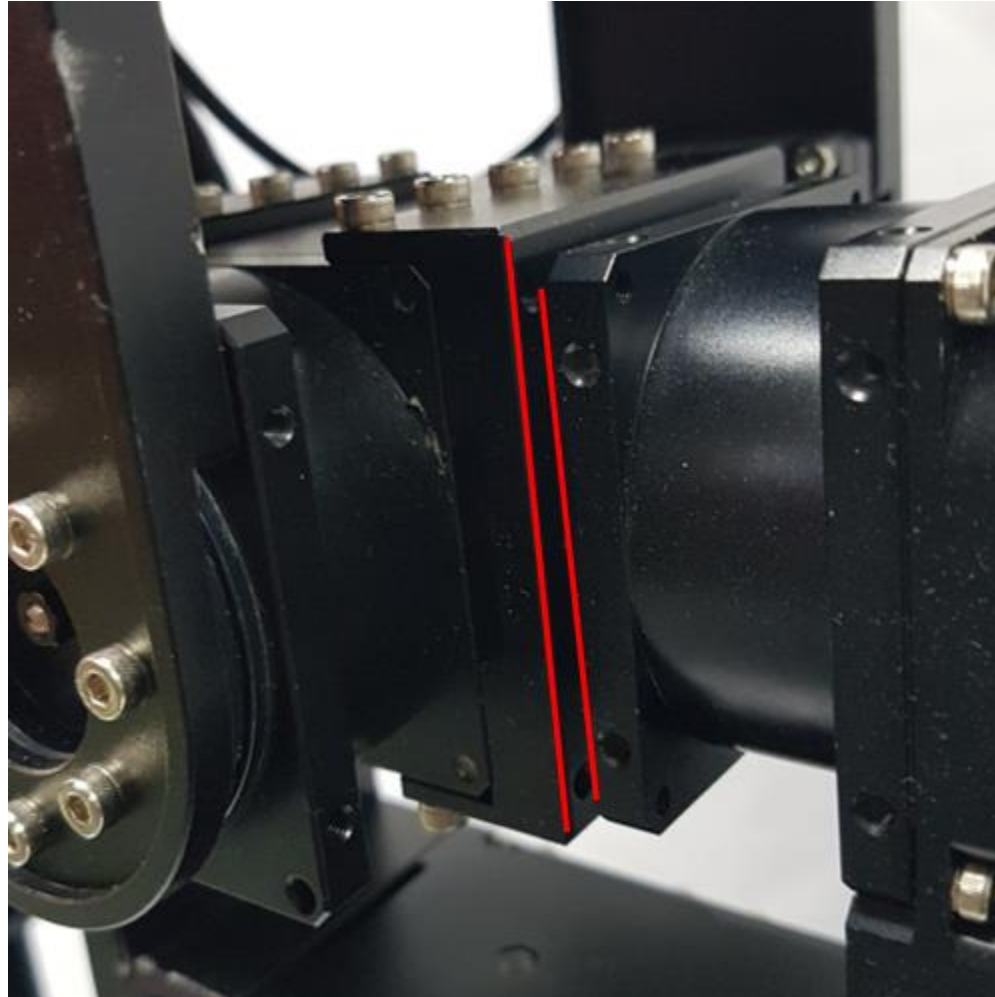




Hip pitch



- Set two lines in parallel

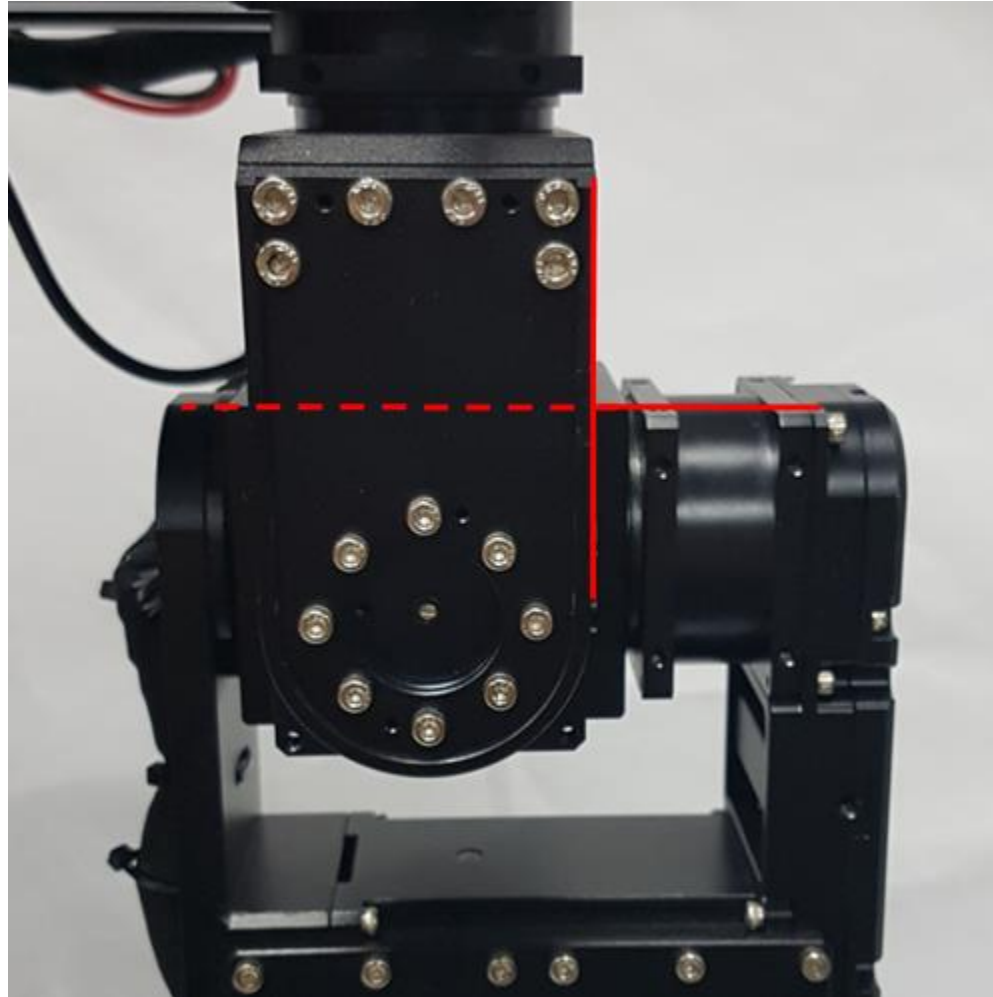




Hip roll



- Set two lines in perpendicular





Knee roll



- Set two lines in perpendicular

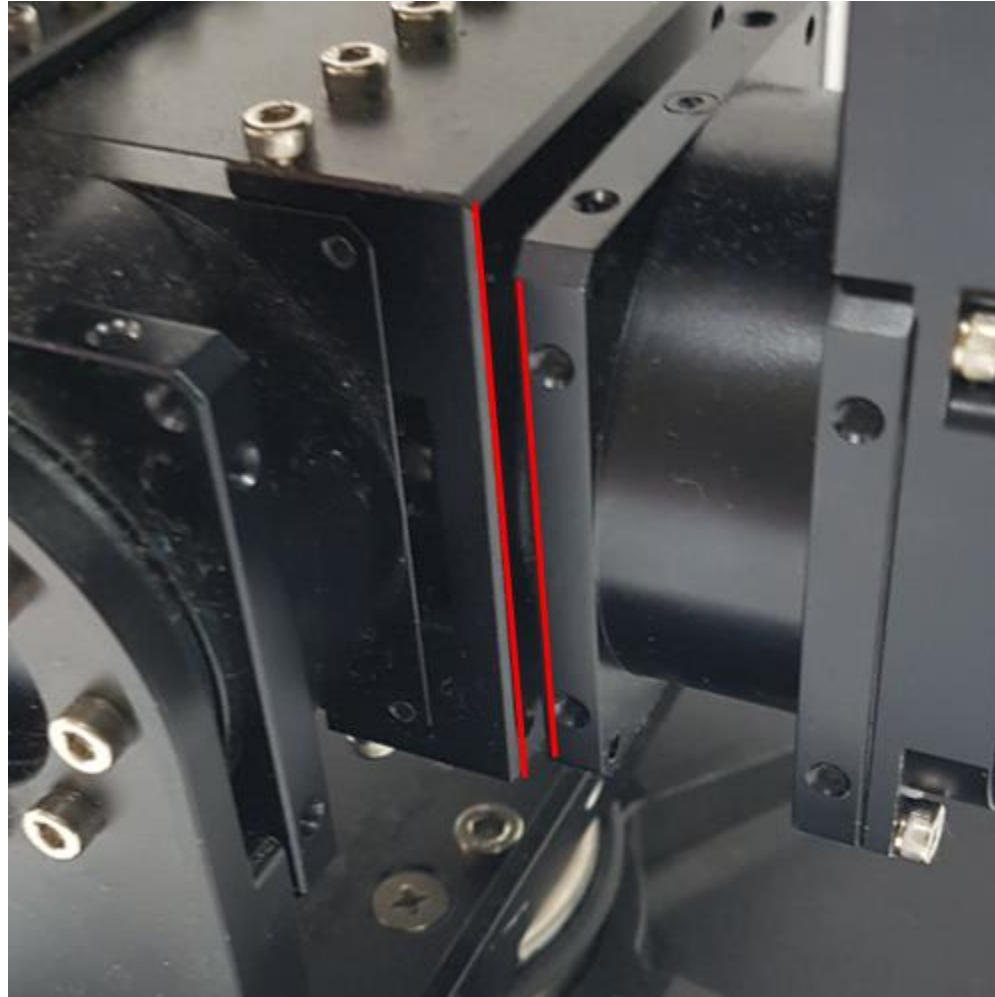




Ankle pitch



- Set two lines in parallel

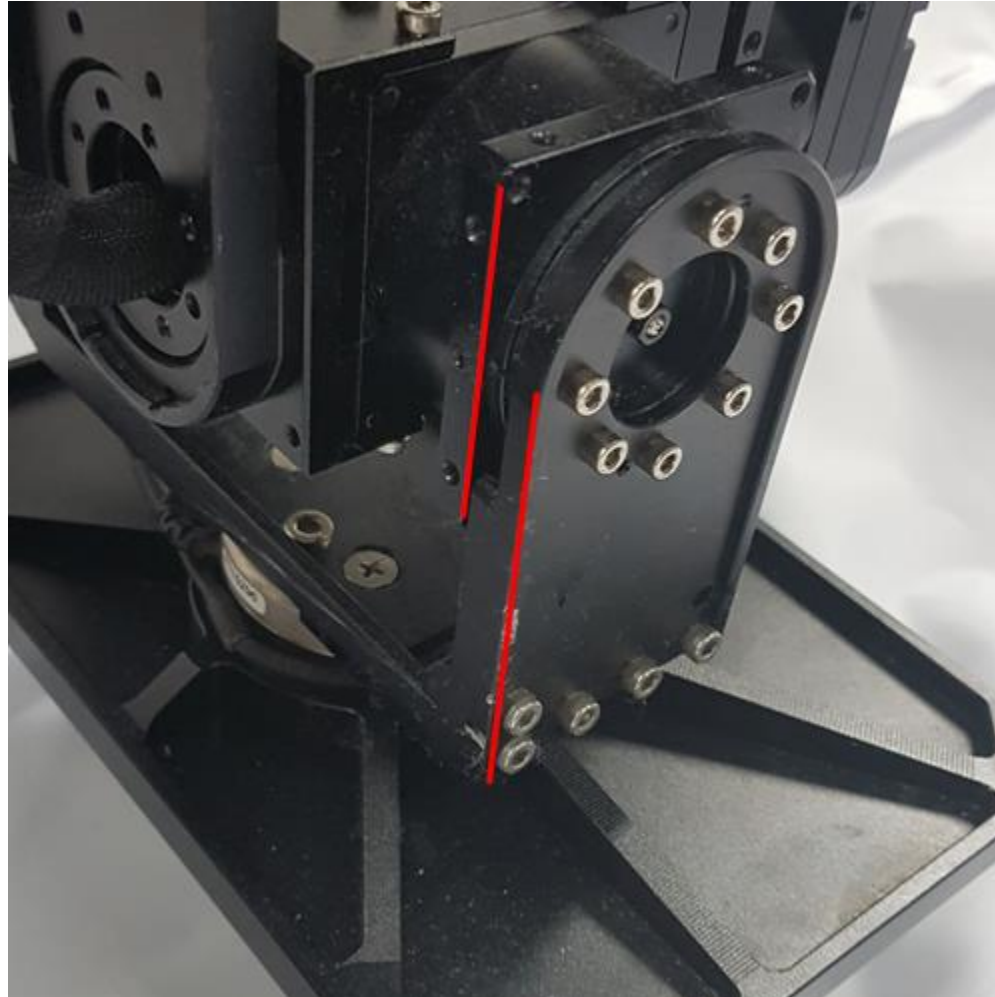




Ankle roll

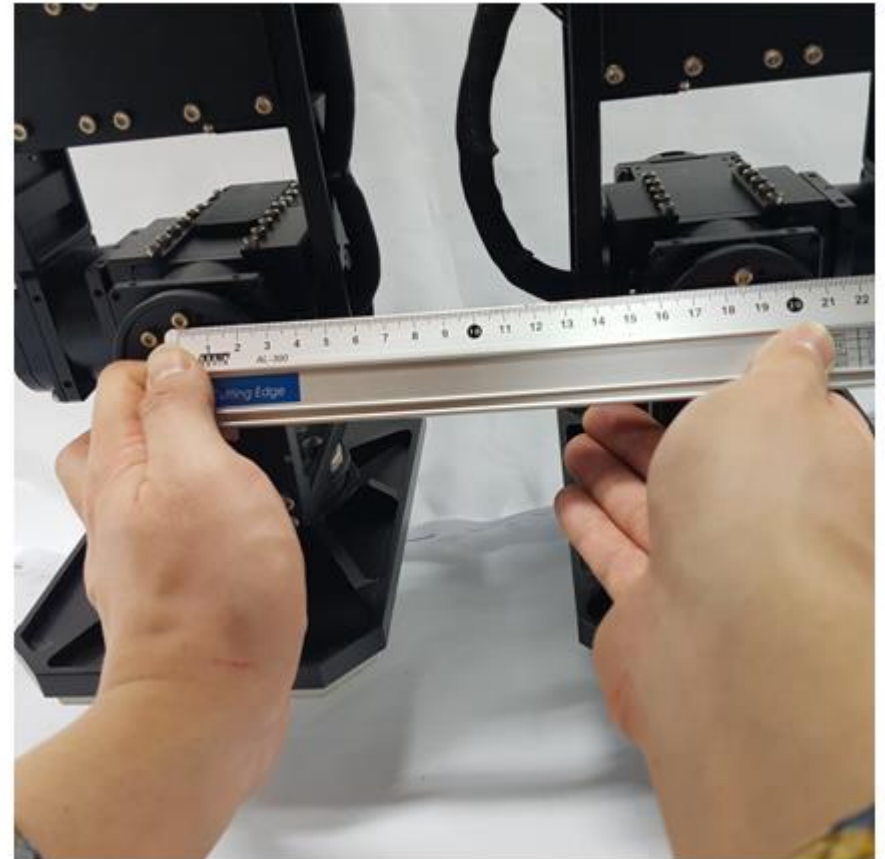
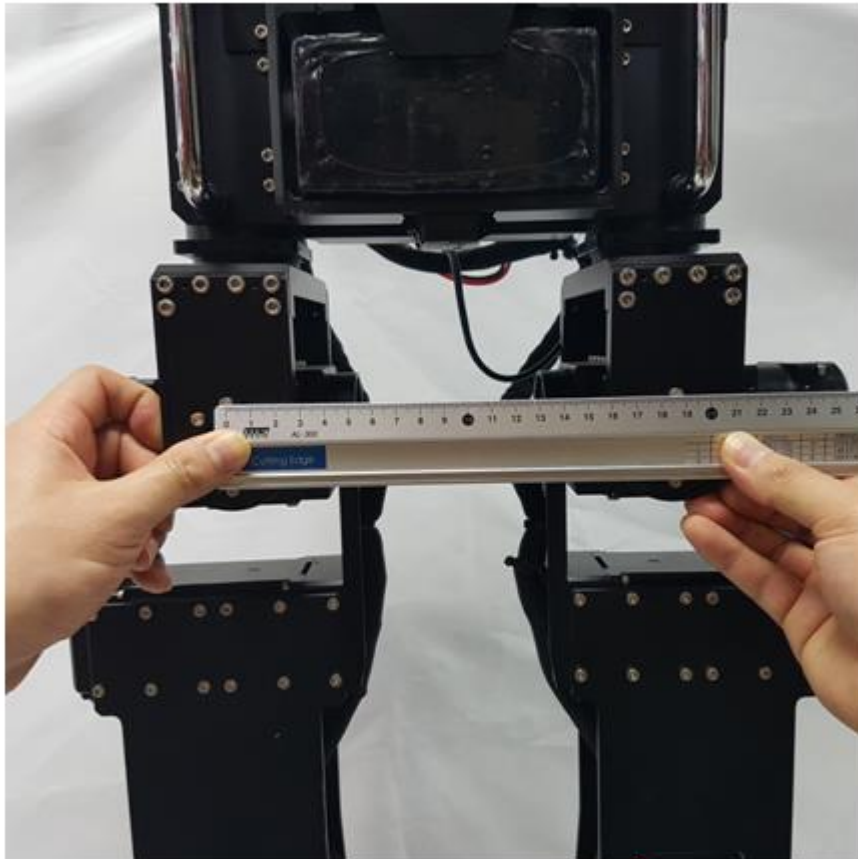


- Set two lines in parallel





Check the offset of leg (1)





Check the offset of leg (2)





Check the offset of leg (3)

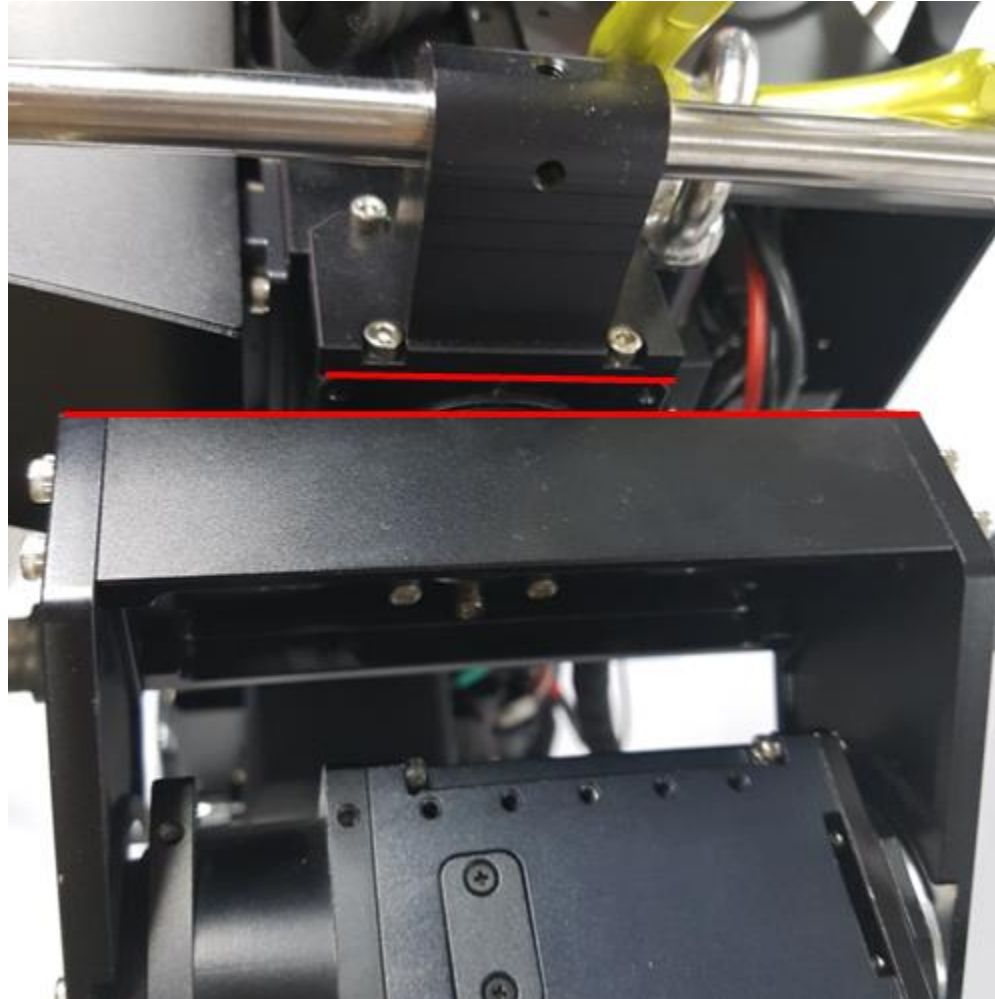




Shoulder pitch 1



- Set two lines in parallel

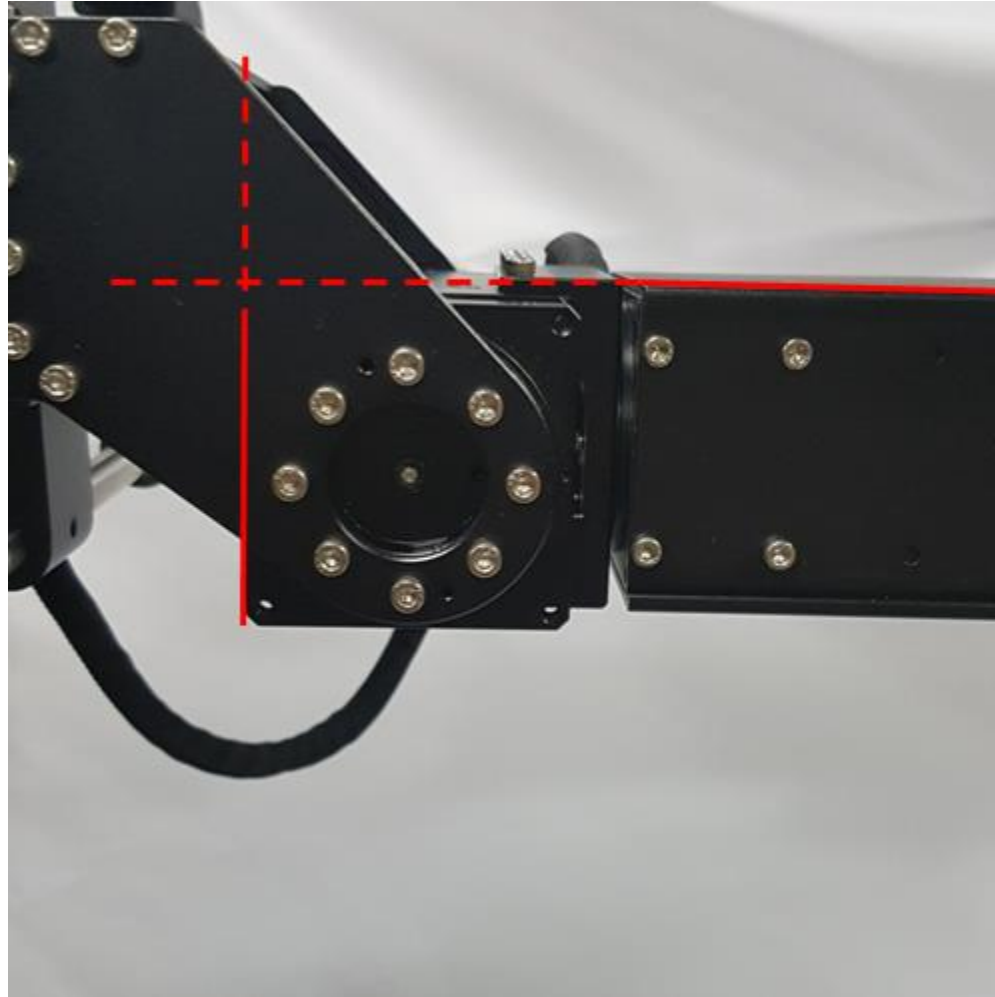




Shoulder roll



- Set two lines in perpendicular

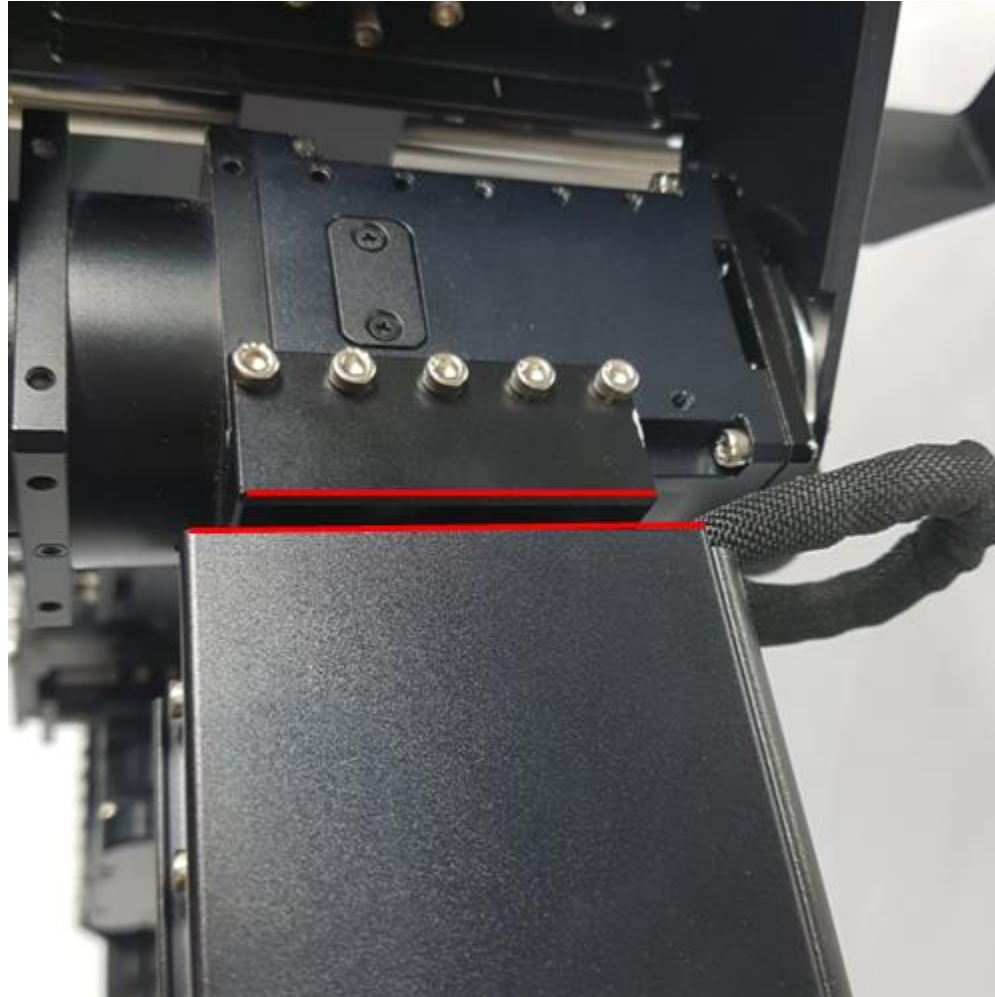




Shoulder pitch 2



- Set two lines in parallel

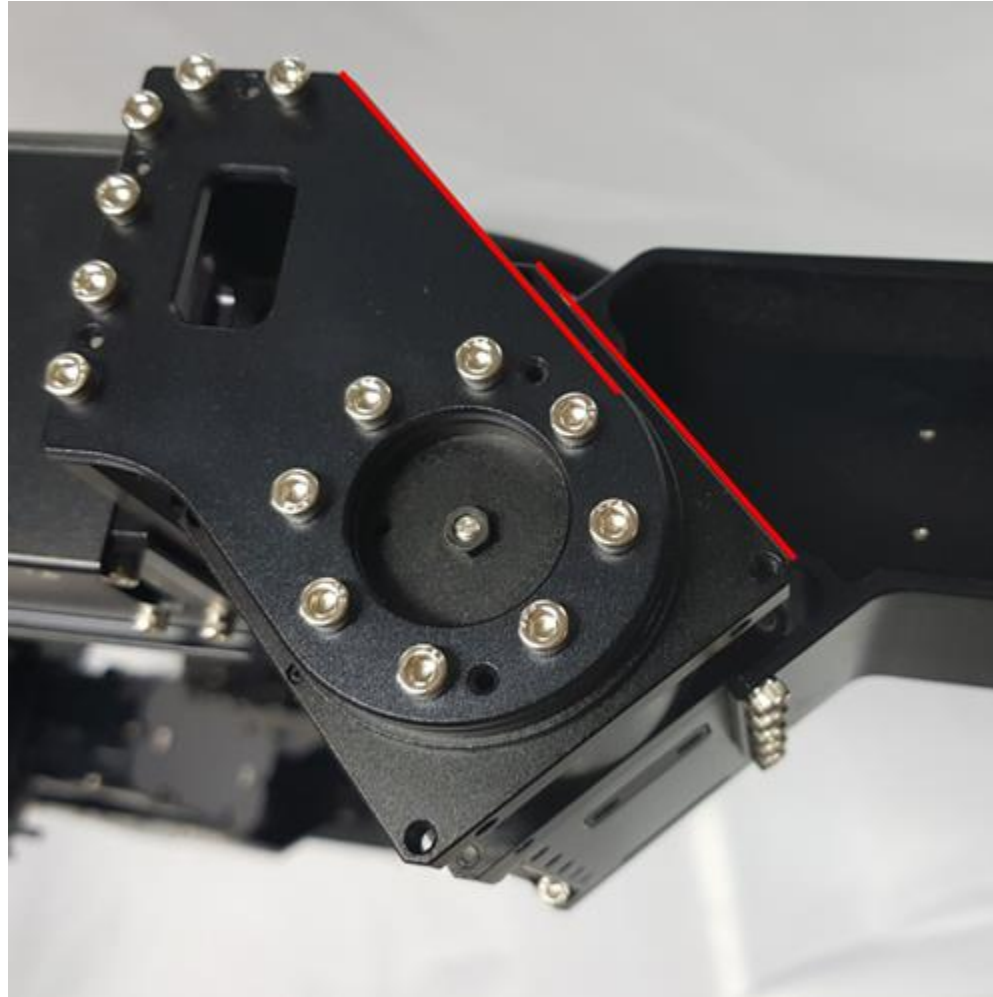




Elbow yaw



- Set two lines in parallel

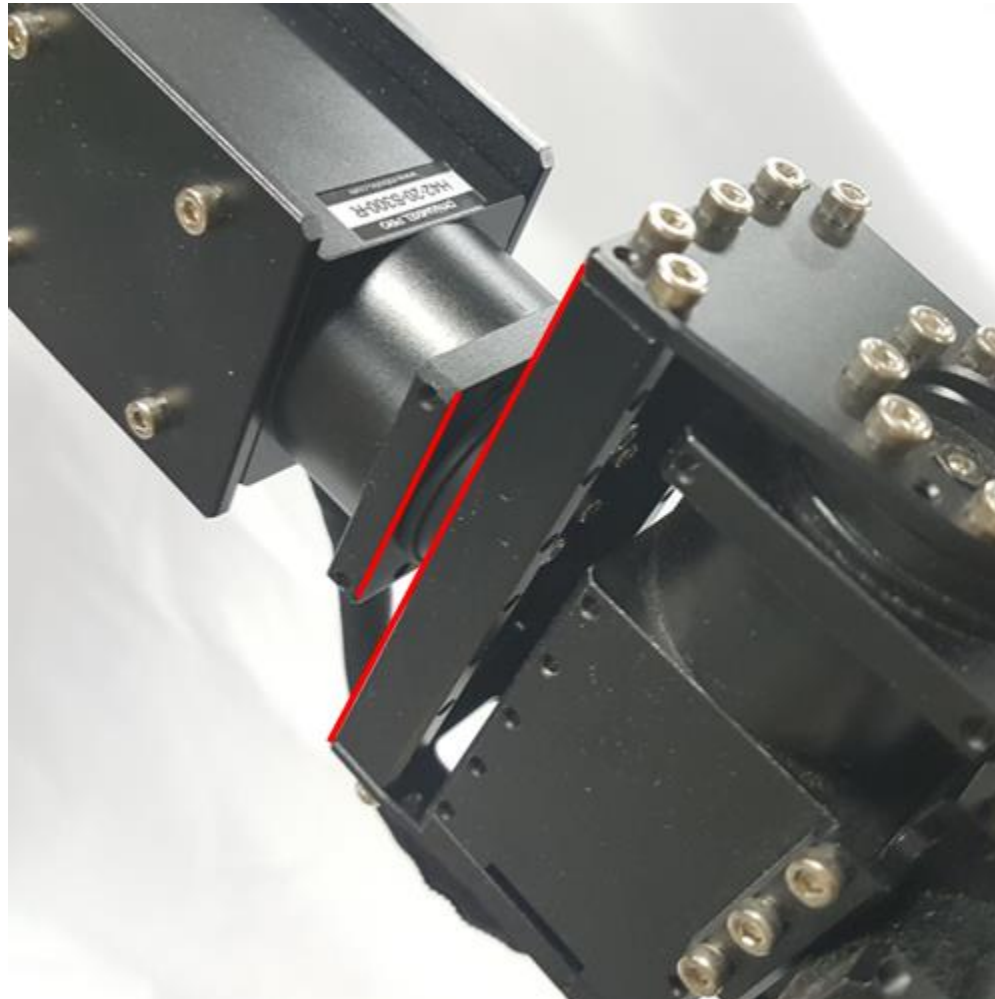




Wrist roll



- Set two lines in parallel

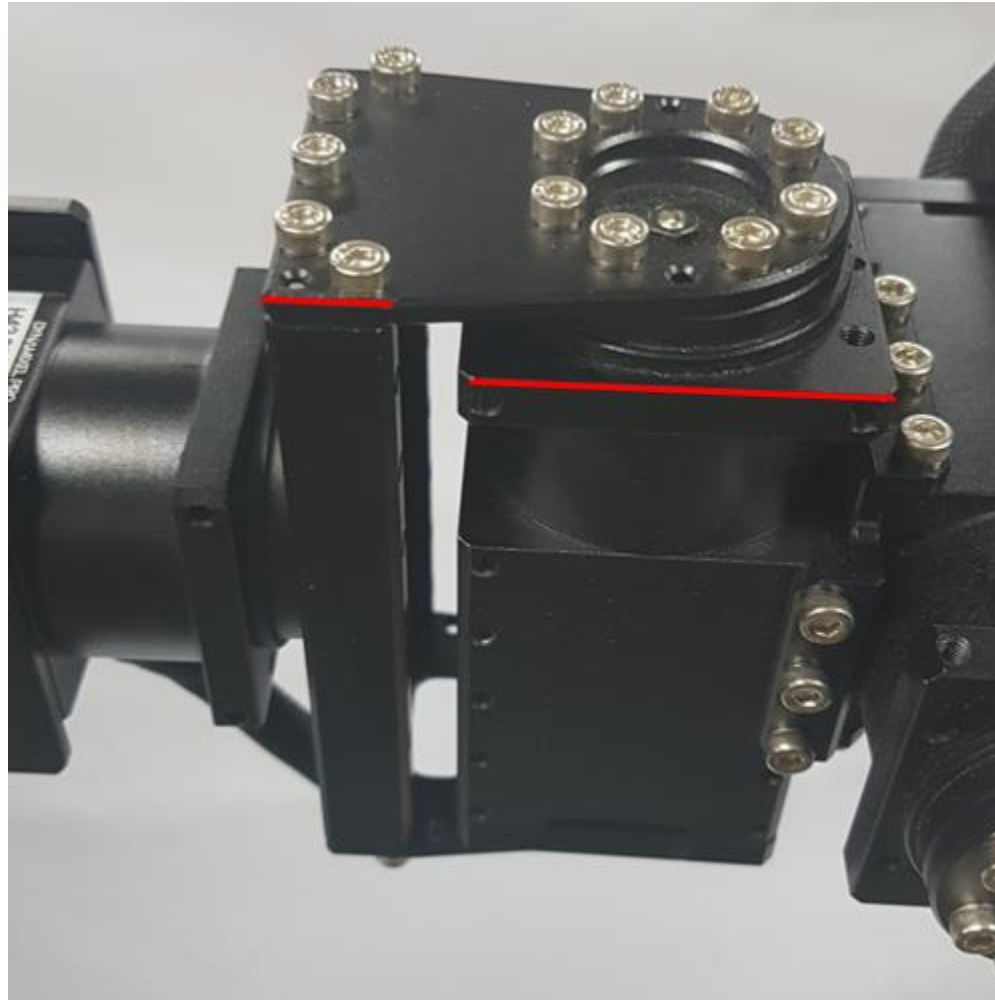




Wrist yaw



- Set two lines in parallel





Wrist pitch



- Set two lines in parallel

