

**THORMANG3**

# THORMANG3 Tutorial

Offset tuner Tool



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# **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



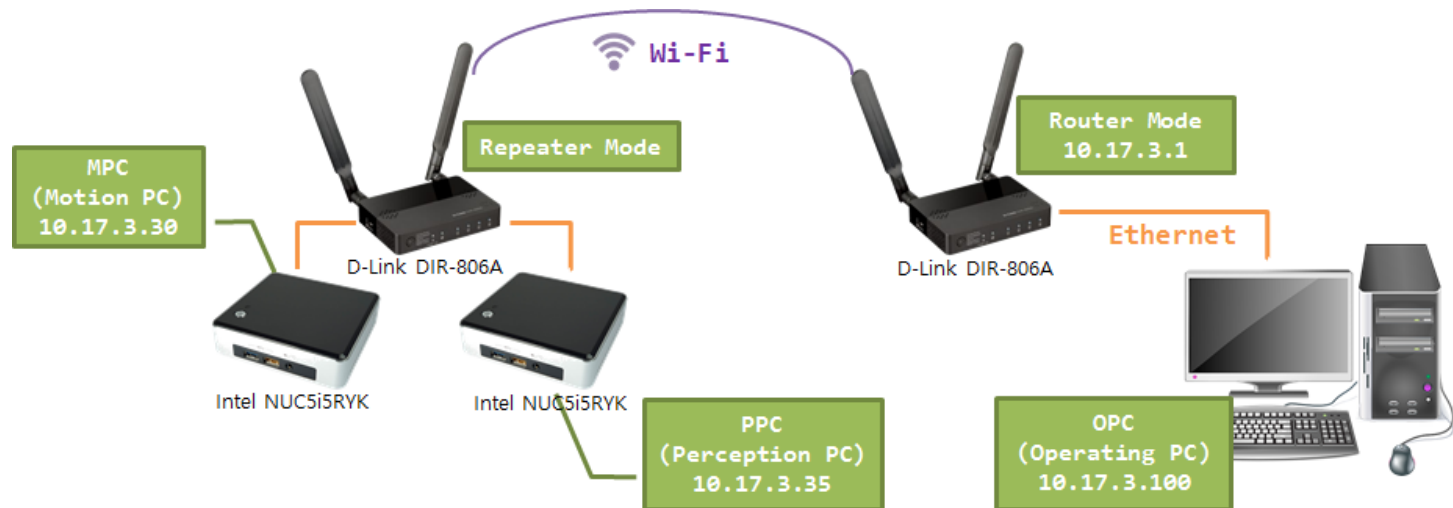
- **Connect to THORMANG3**

- 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

Offset Tuner Client

Ros Communications

Logging

Command Panel

Right Arm Left Arm Legs Body

Fixed Items : Tab List

Modifiable Items : Joint List

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

(ModVal = Goal Pos. + Offset)

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

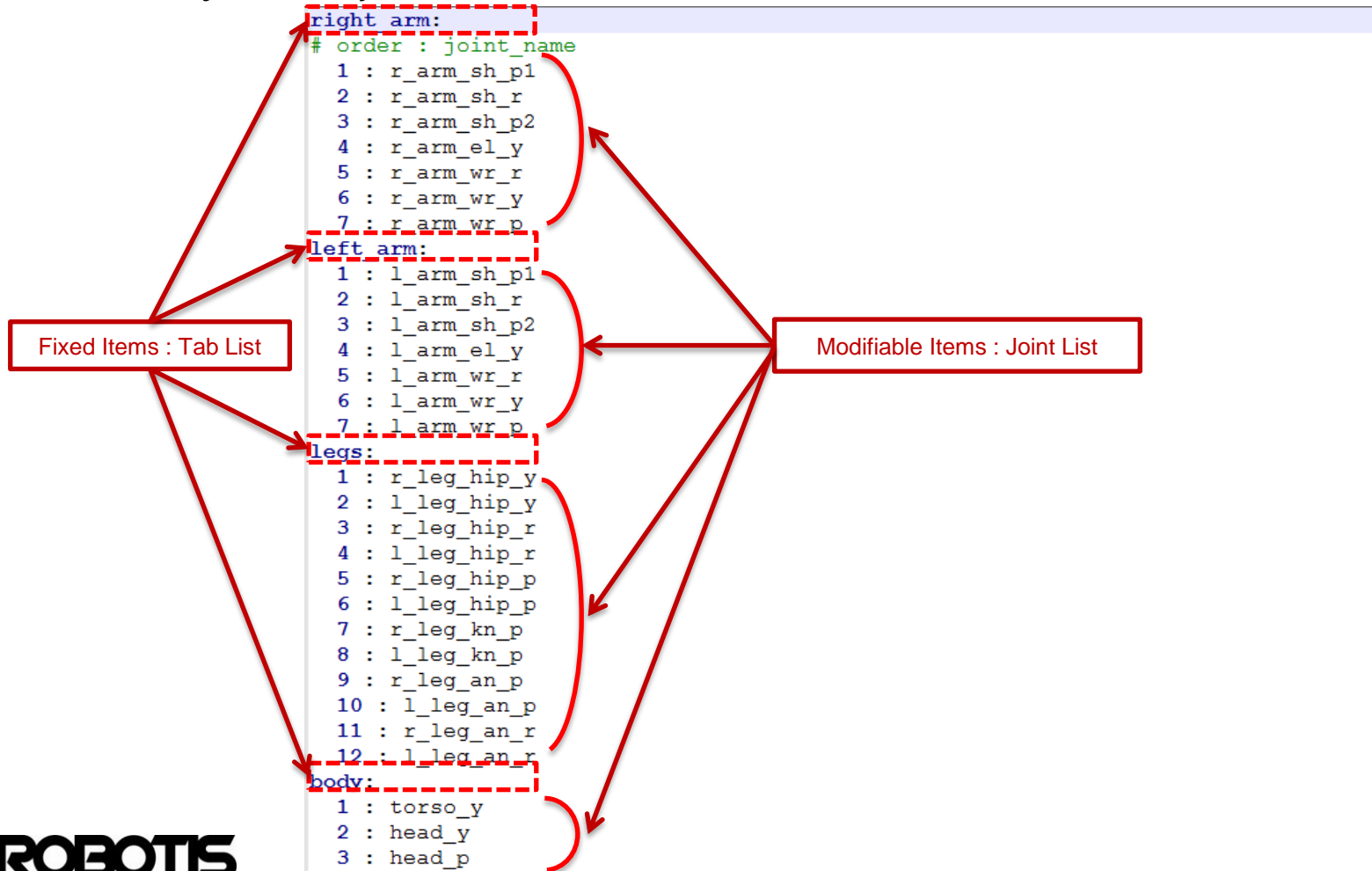
Initial Pose Refresh Save Quit



# 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

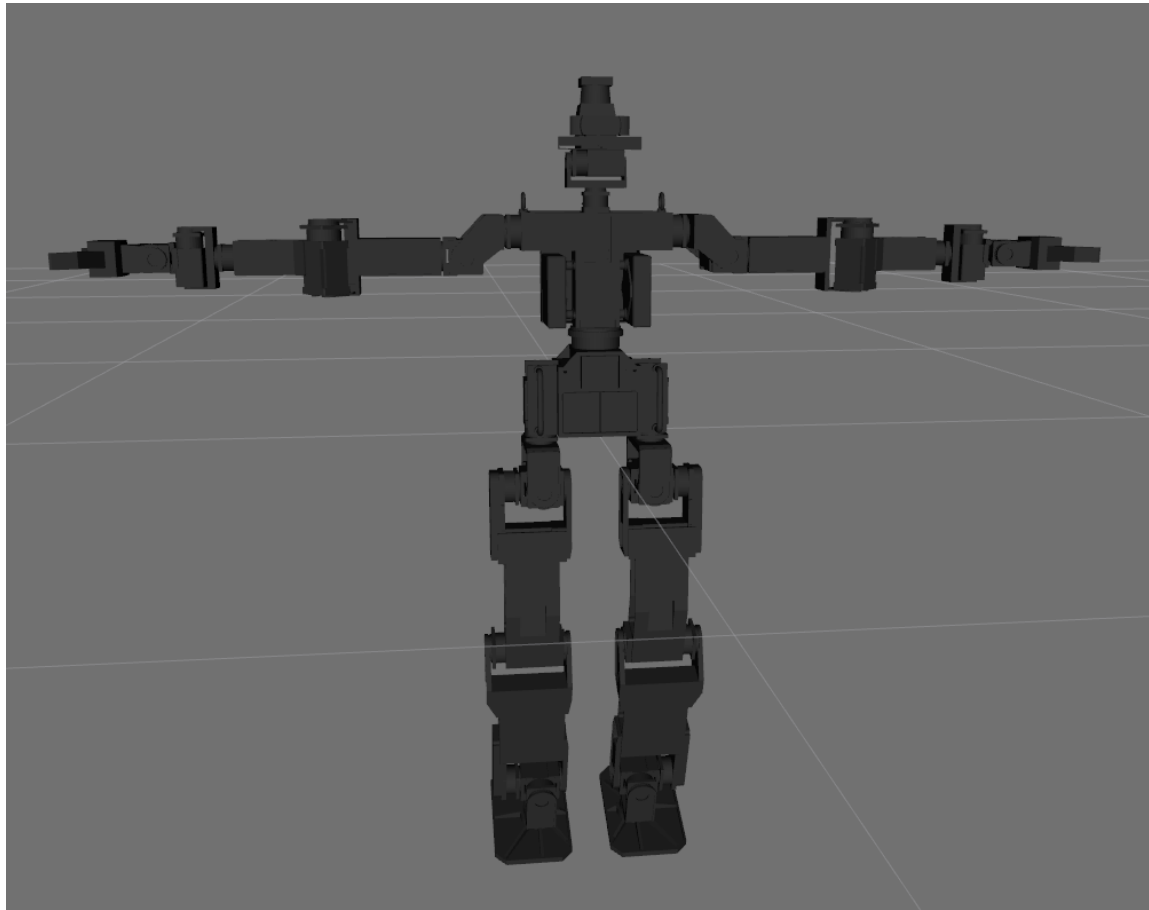
Initial Pose Refresh Save Quit



# 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

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').

	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

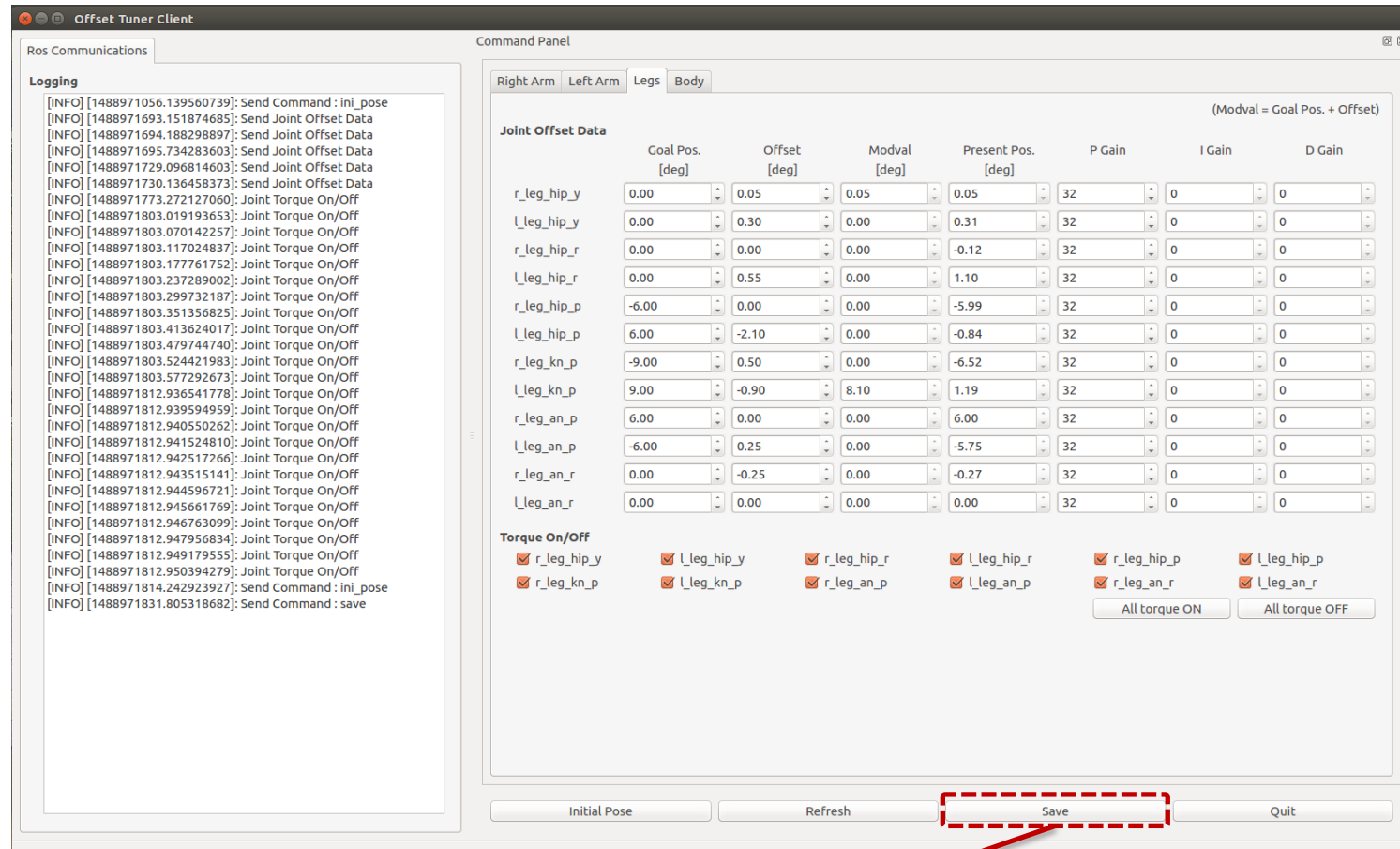




# How to use thormang3\_offset\_tuner



- Save the offset value



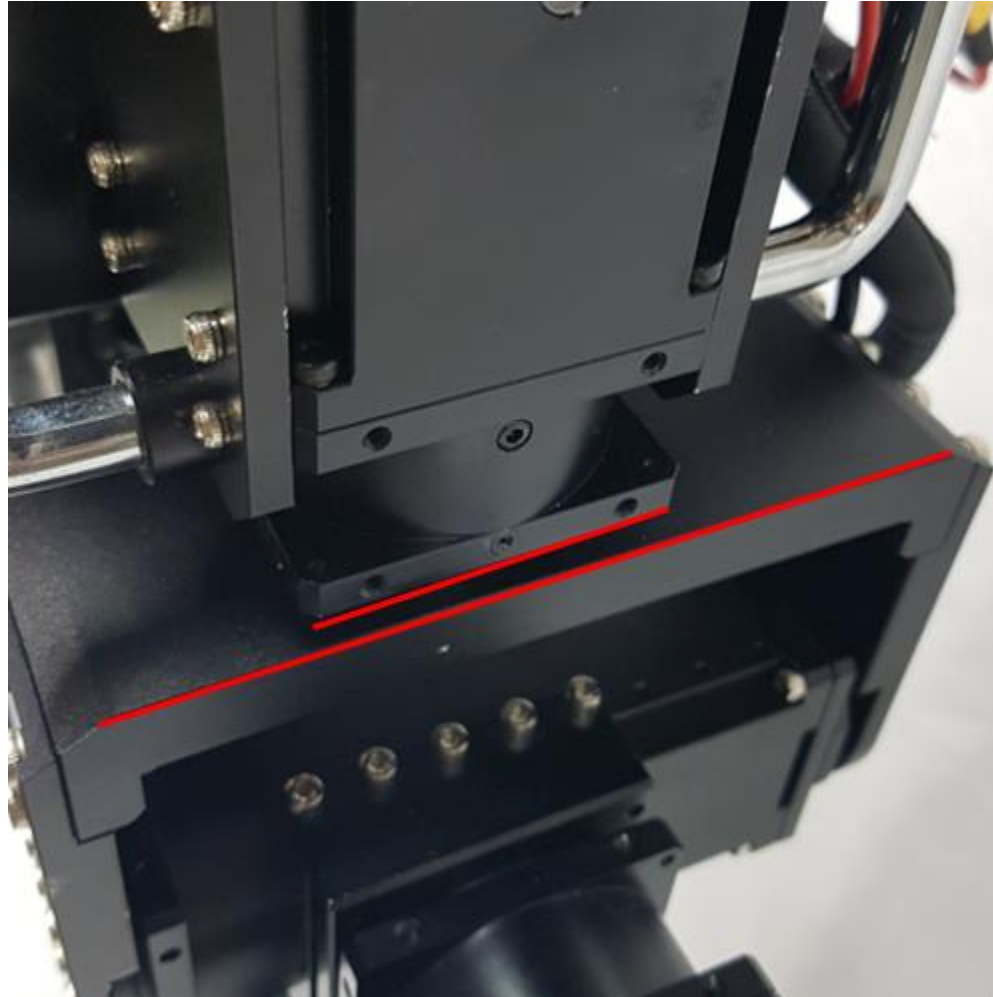
# **3. Calibration Guidelines**



# Hip yaw



- Set two lines in parallel

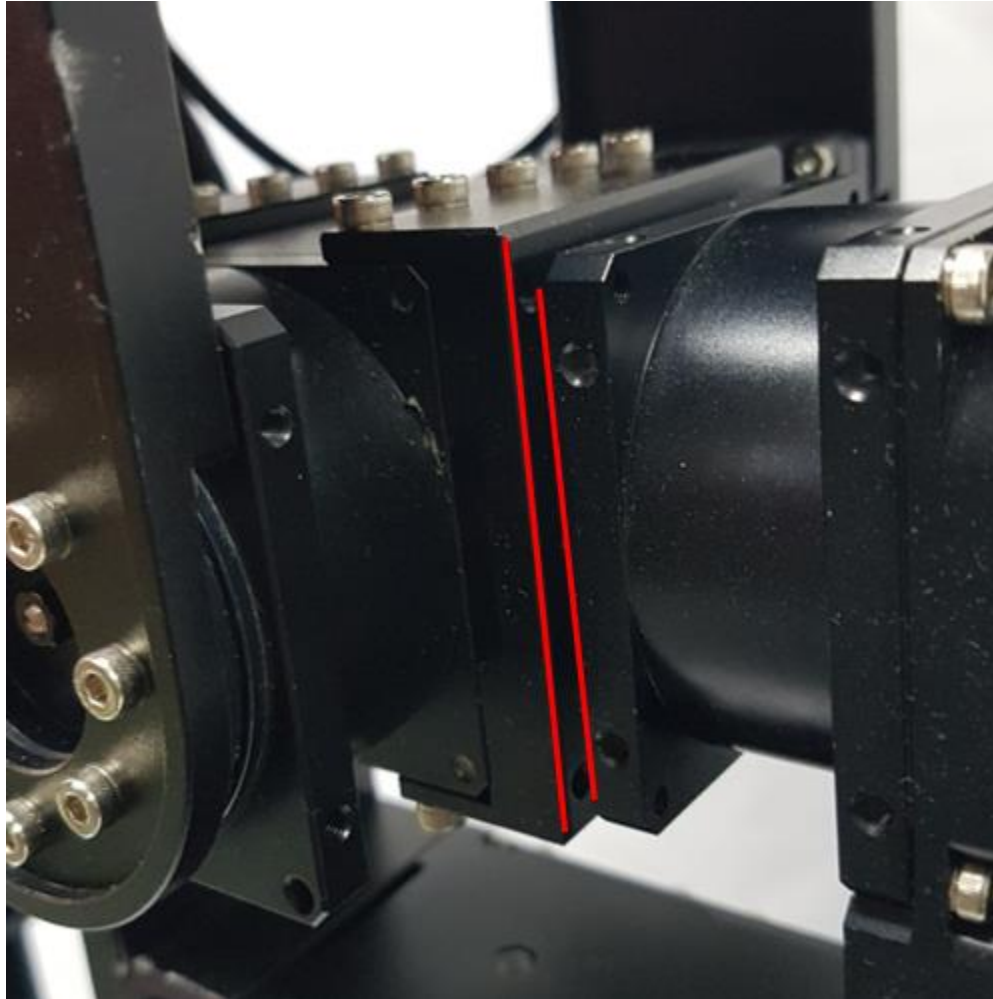




# Hip pitch



- Set two lines in parallel

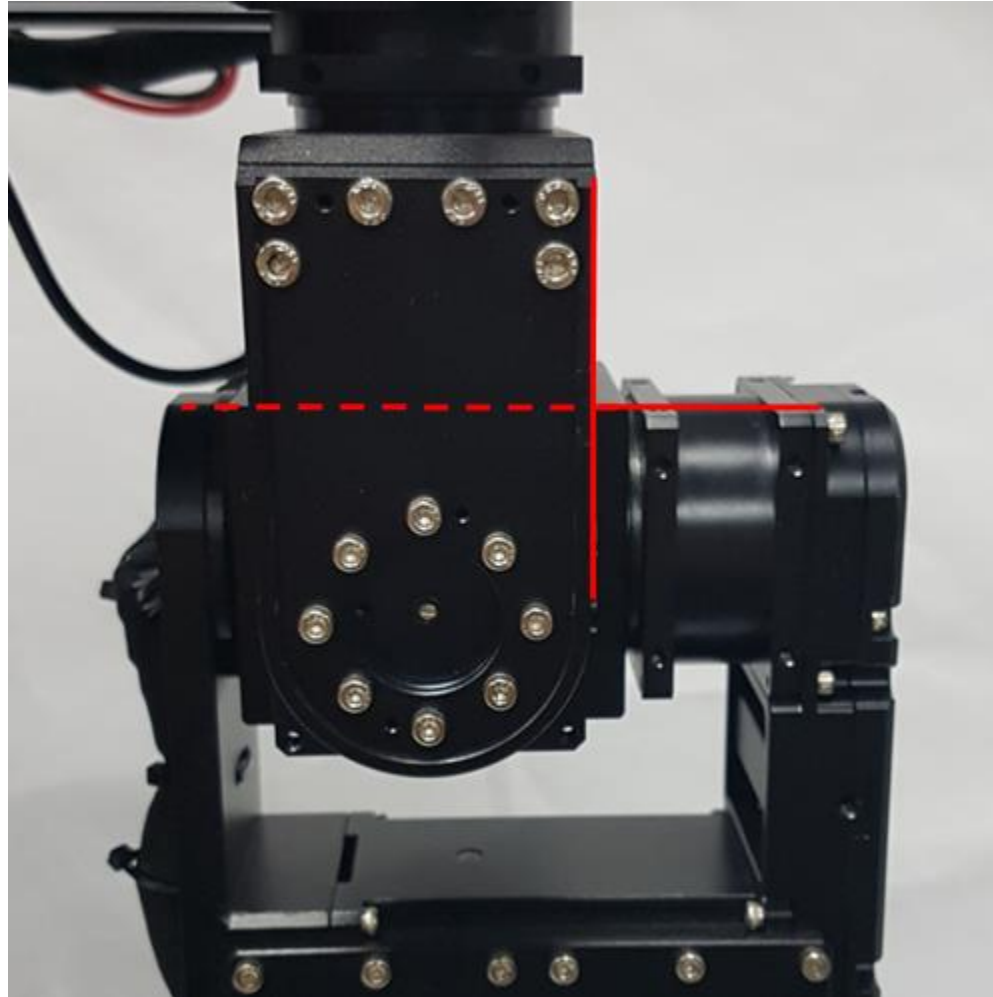




# Hip roll



- Set two lines in perpendicular





# Knee roll



- Set two lines in perpendicular

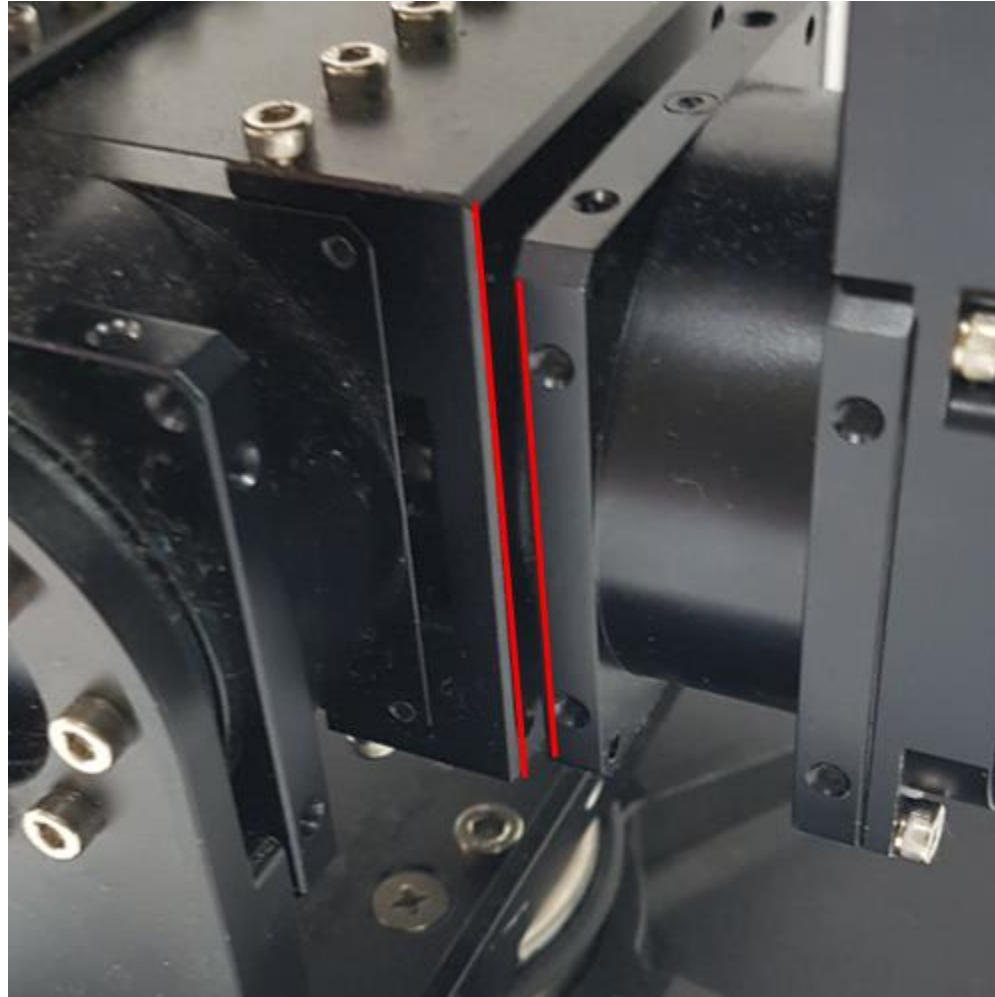




# Ankle pitch



- Set two lines in parallel



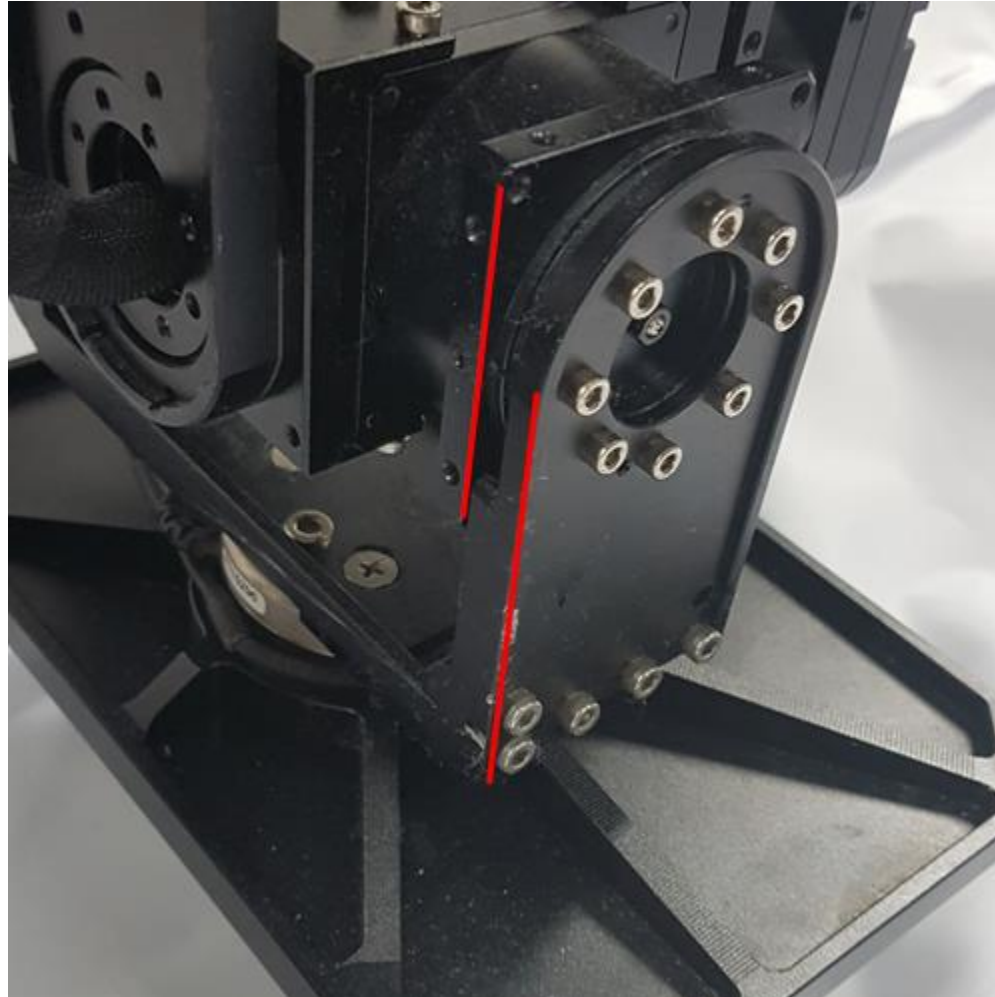




# Ankle roll



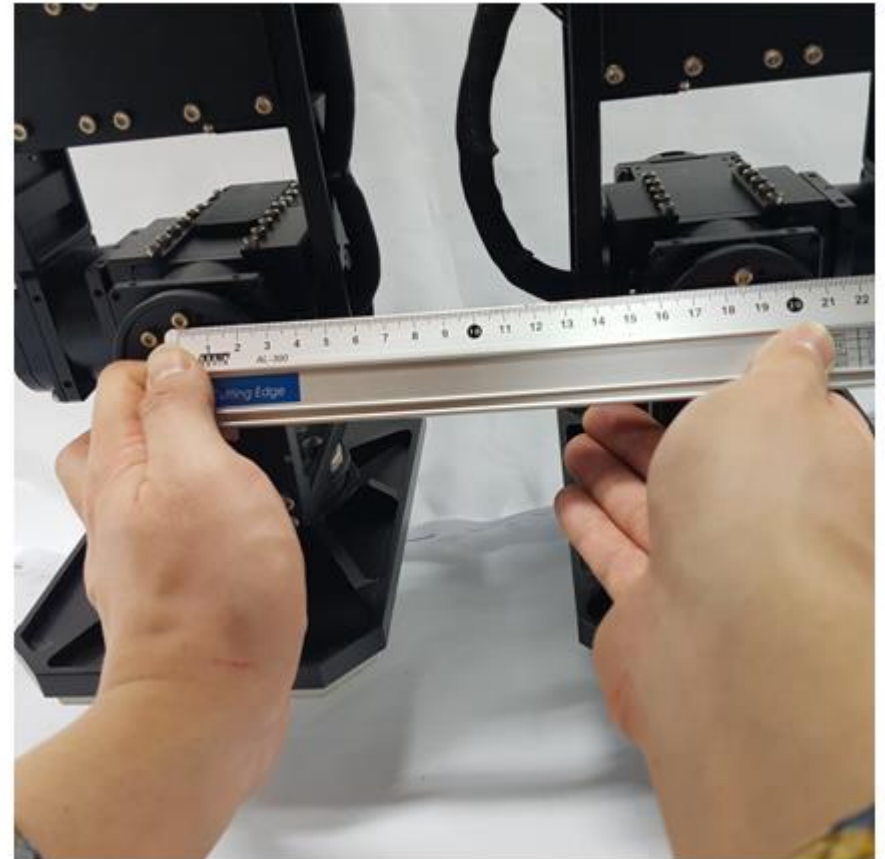
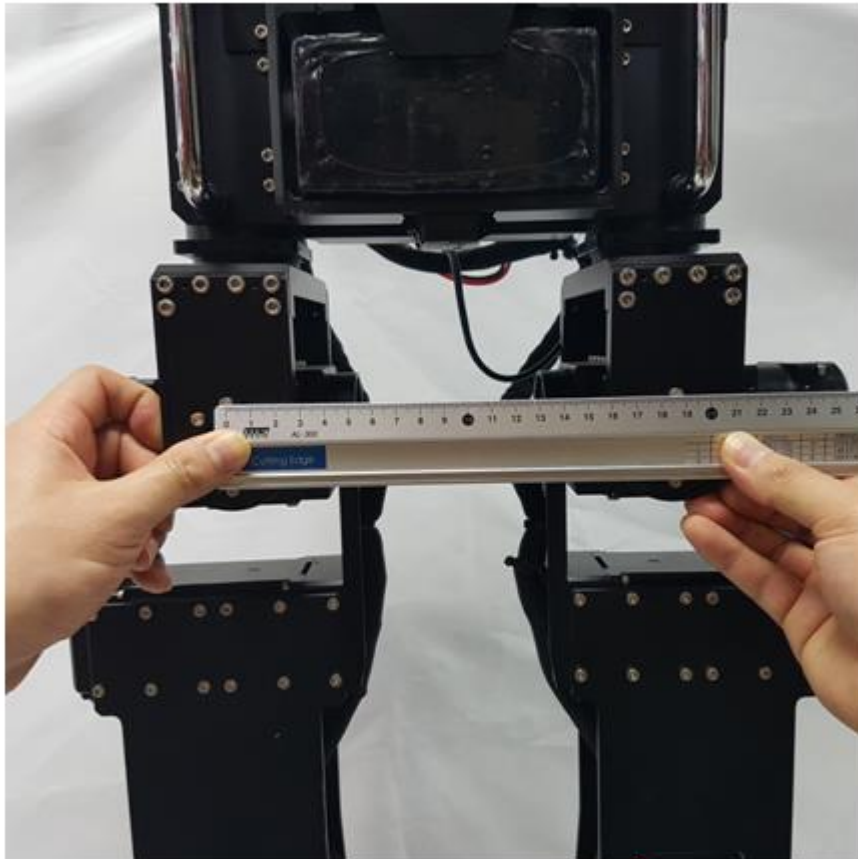
- Set two lines in parallel





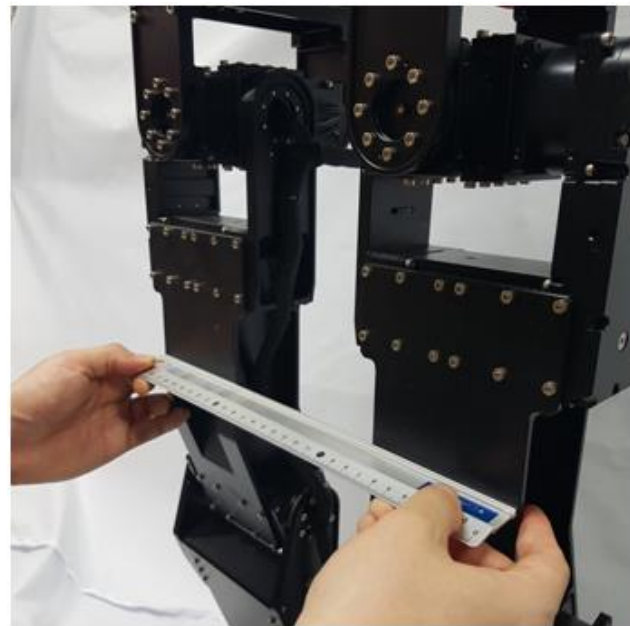


# Check the offset of leg (1)





## Check the offset of leg (2)





## Check the offset of leg (3)

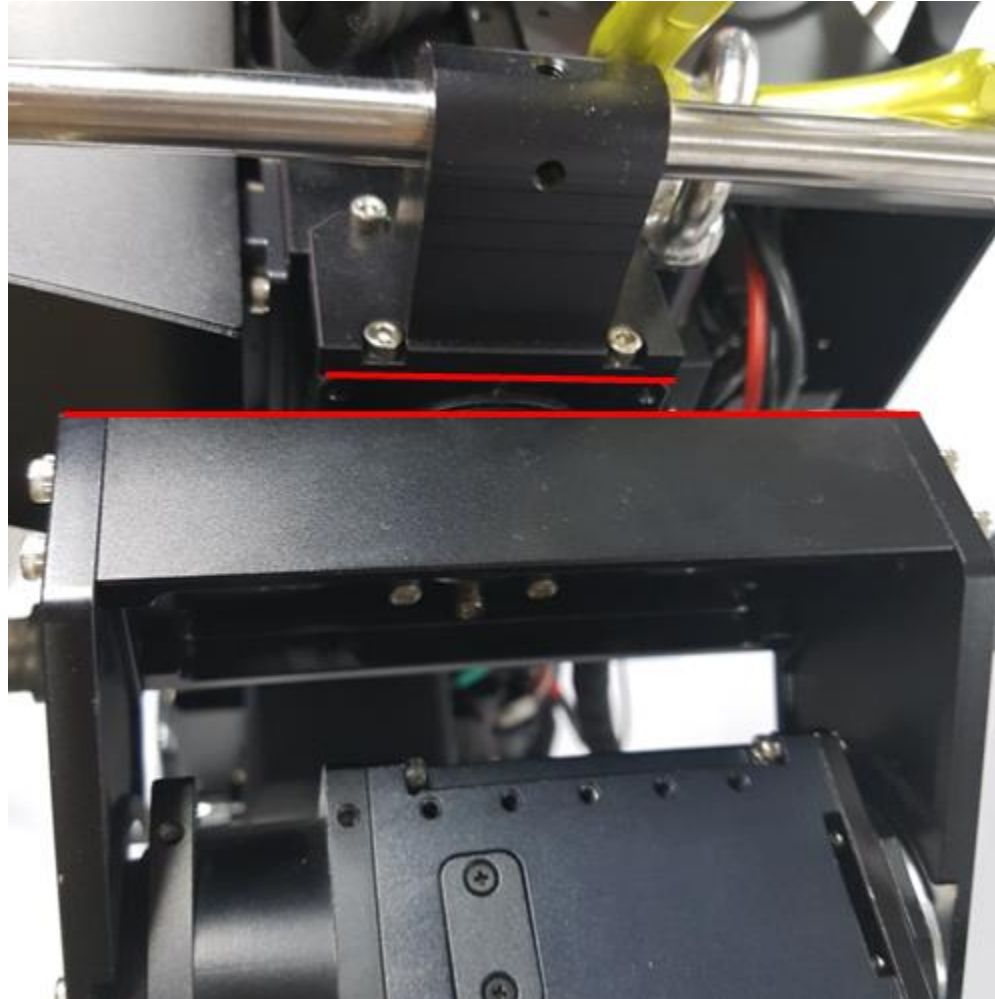




# Shoulder pitch 1



- Set two lines in parallel

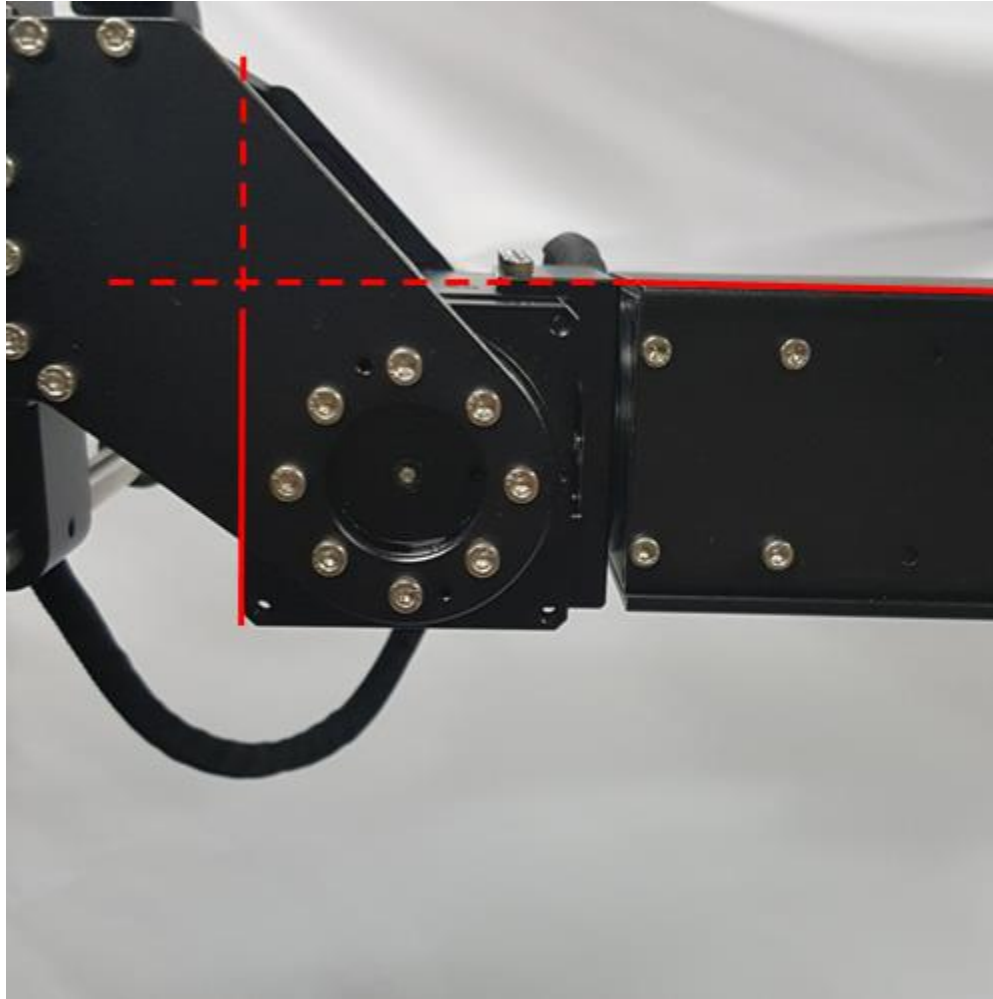




# Shoulder roll



- Set two lines in perpendicular



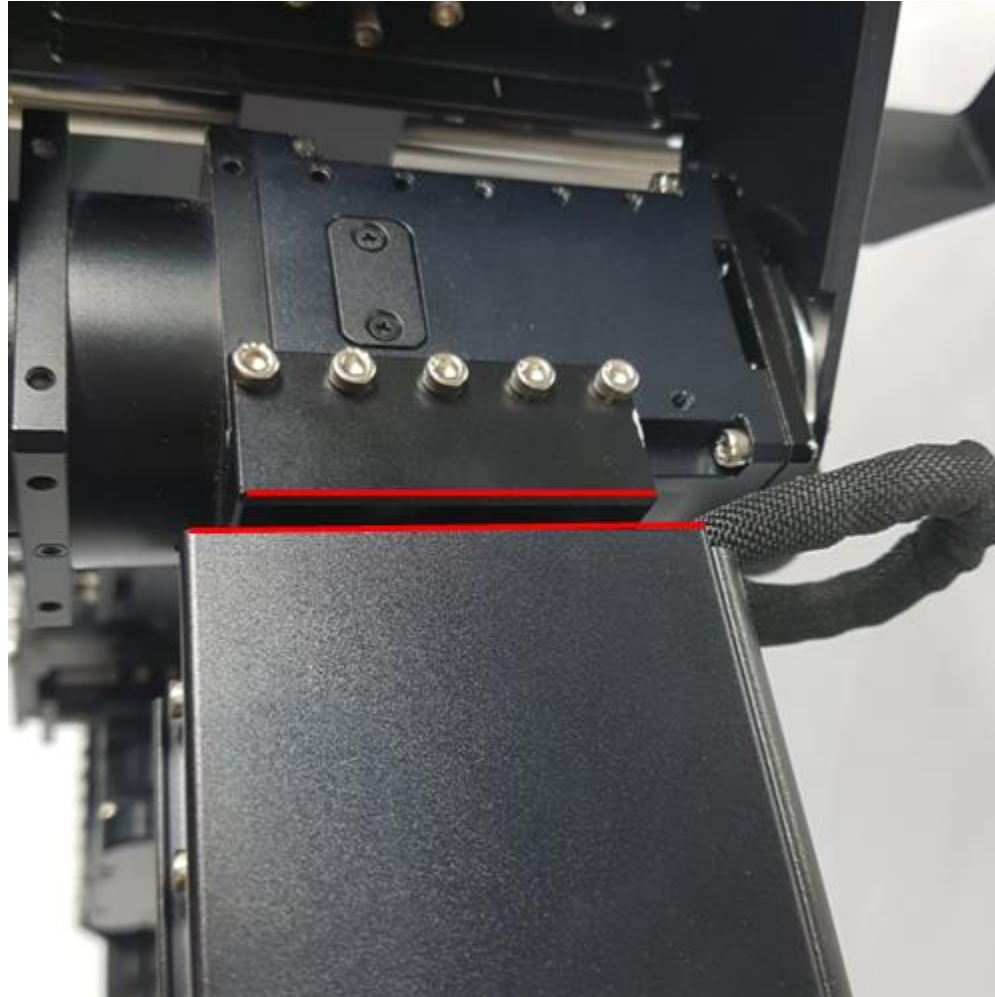




## Shoulder pitch 2



- Set two lines in parallel

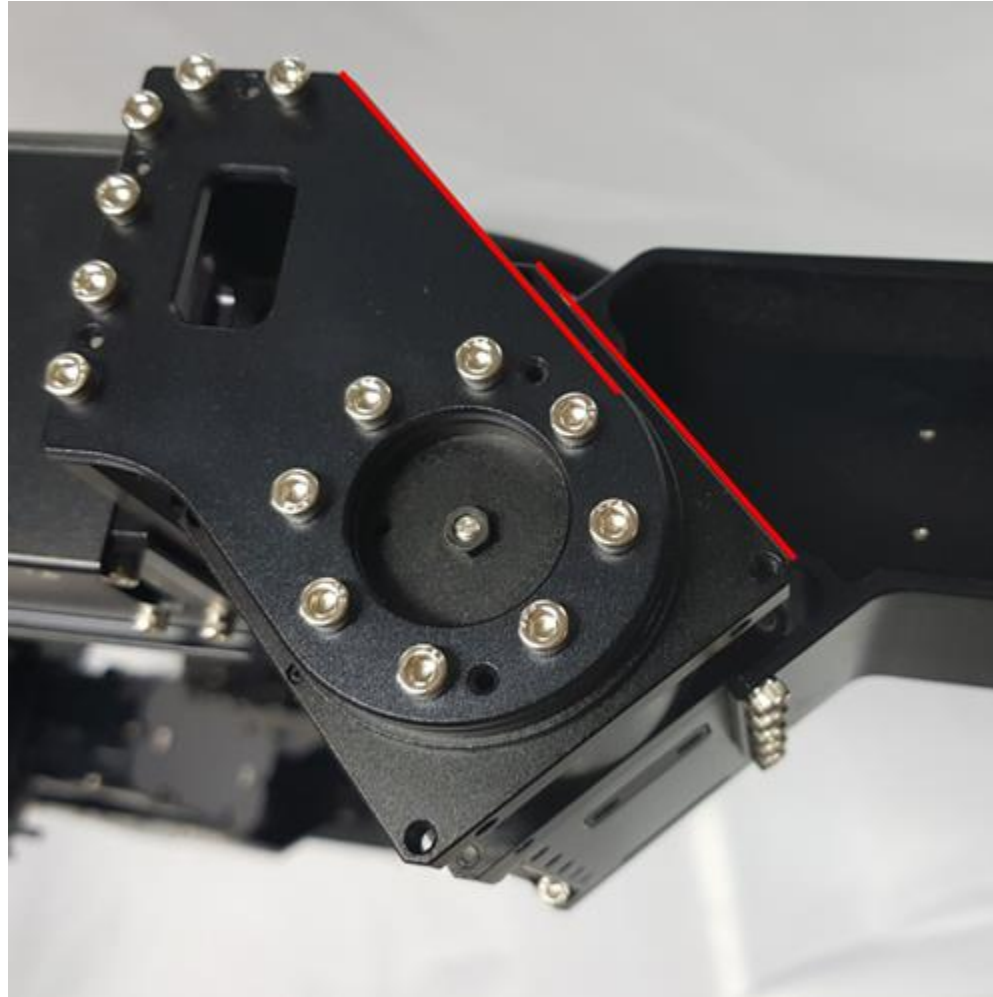




# Elbow yaw



- Set two lines in parallel

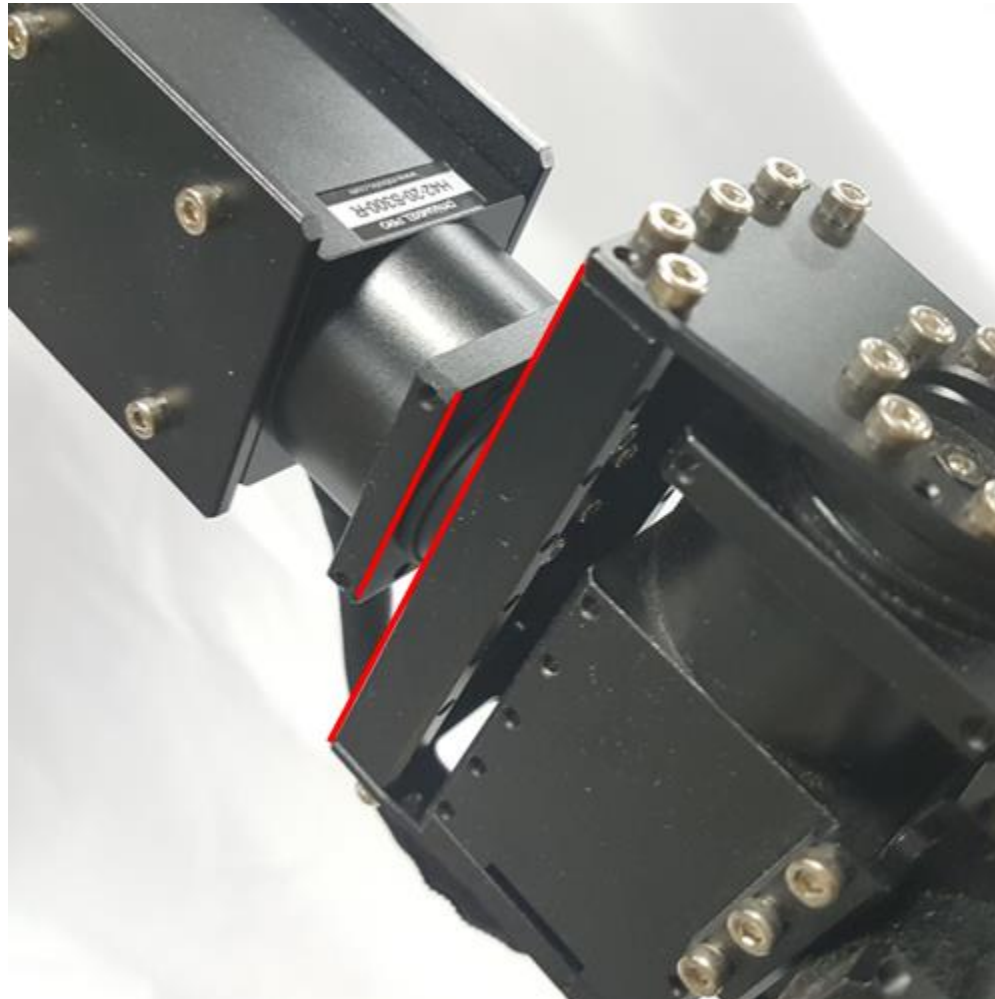




# Wrist roll



- Set two lines in parallel



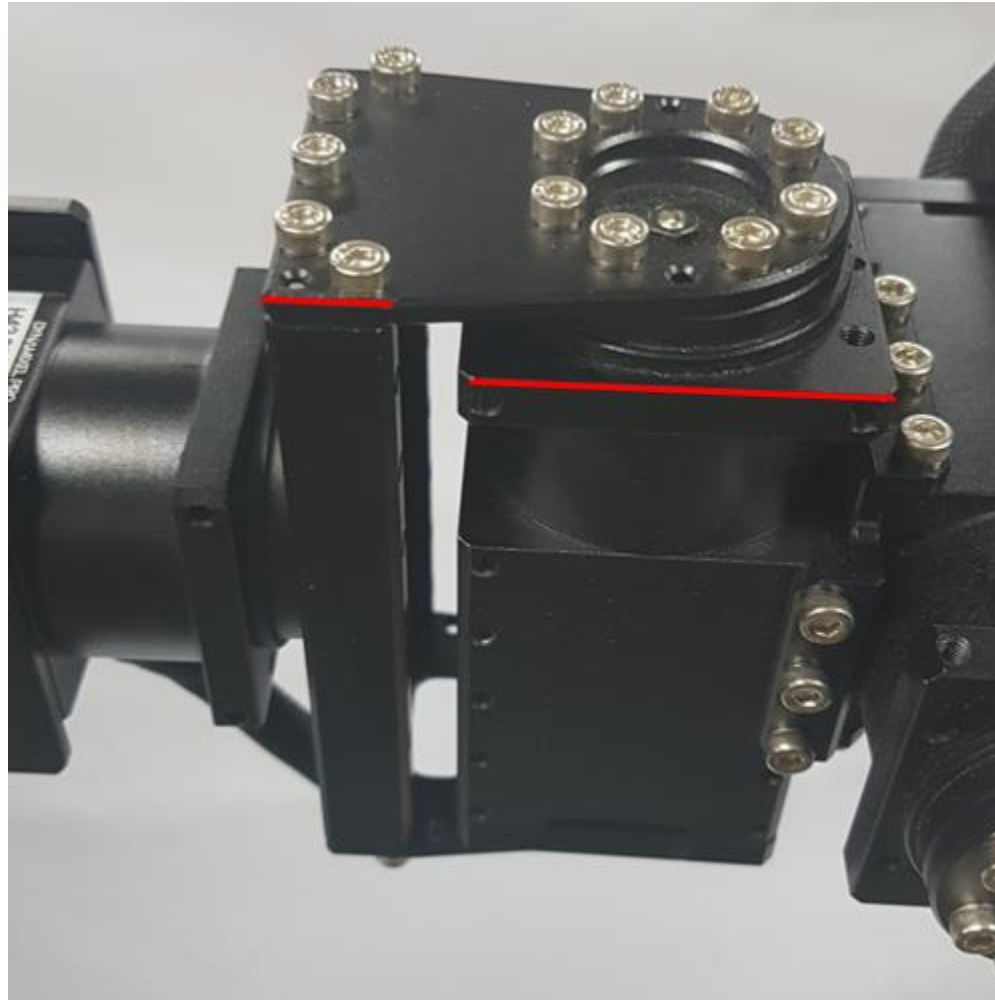




# Wrist yaw



- Set two lines in parallel





# Wrist pitch



- Set two lines in parallel

