

HEBI
ROBOTICS



6-DoF Arm Kit

Assembly Instructions

General Warnings and Cautions

Danger (May cause serious injury or death)

- Keep water, flammables, solvents and other liquids clear from actuator.
- Never place fingers, arms, toes and other body parts near actuator during operation.
- Cut power if actuator emits strange odors or smoke.
- Keep actuator out of reach of children.

Warning (May cause injury or damage to actuator)

- Before operating, read all applicable instructions and notices found here:
<http://docs.hebi.us/#quickstart-guide-x-series-actuator>
- Comply with the operating temperature (-10°C to 50°C)
- Turn off power source before connecting or disconnecting actuator power.
- Do not expose the actuator to permanent and strong magnetic fields.
- The actuator must not be exposed to dusty or wet environments.
- If actuator is under load, abruptly removing the power connection can cause permanent damage.
- Do not force screws into the bottom of the actuator.
 - **X5**: 5mm tap depth
 - **X8**: 7mm tap depth
- Use provided hardware with accessories and hand tighten as needed.
- Do not attempt to disassemble actuator, this will void the warranty and can cause permanent damage.

For more information please visit: ***docs.hebi.us***

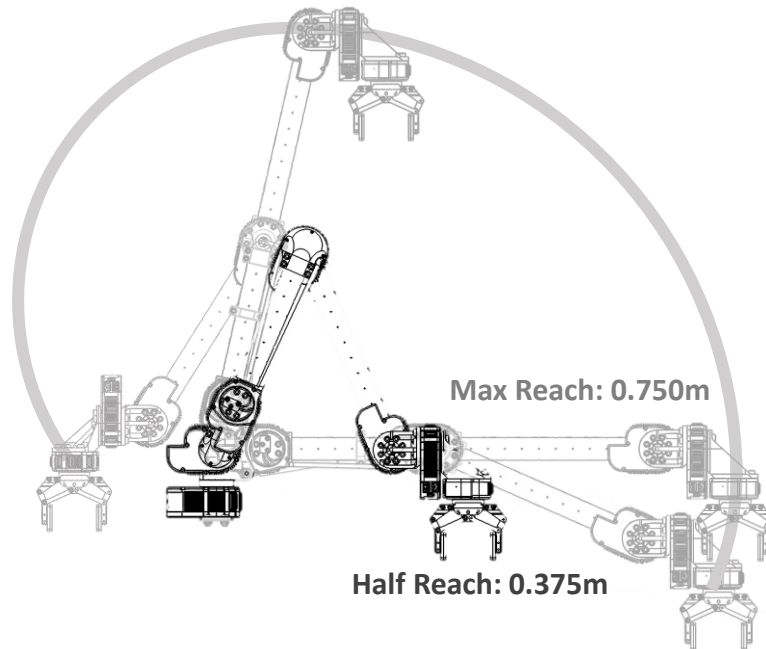
Technical Specifications

Specifications	Value
Weight (w/ Gripper Assembly)	4.75 kg
Max Reach	750 mm
Payload @ Max Reach	0.60 kg
Half Reach	375 m
Payload @ Half Reach	3.5 kg

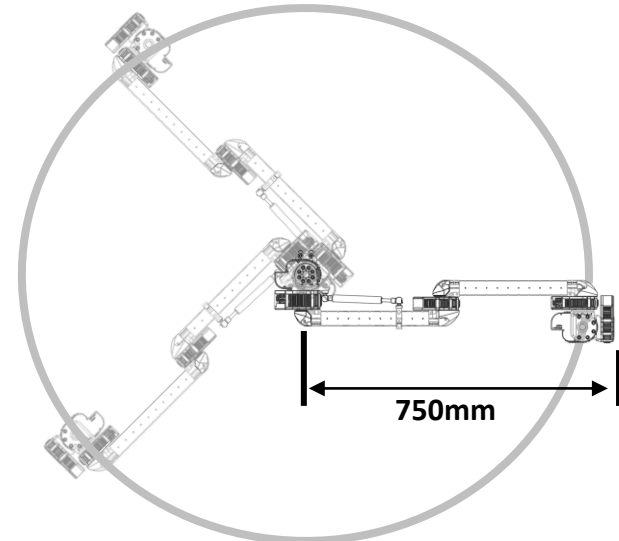
Calculated using Default Configuration without Gas Spring.
Using a different configuration of X-Series Actuators will provide different payload capacities.

Movement	Working Range	Speed
Axis 1 – Base [Default: X8-9]	Continuous (limited by wiring)	180°/s
Axis 2 – Shoulder [Default: X8-16]	0° to +70° (limited by gas spring)	90°/s
Axis 3 – Elbow [Default: X8-9]	-155° to +155° (avoid end effector collisions)	180°/s
Axis 4 – Wrist 1 [Default: X5-1]	Continuous (avoid end effector collisions)	540°/s
Axis 5 – Wrist 2 [Default: X5-1]	Continuous (limited by wiring)	540°/s
Axis 6 – Wrist 3 [Default: X5-1]	Continuous (limited by wiring)	540°/s

Side View



Top View

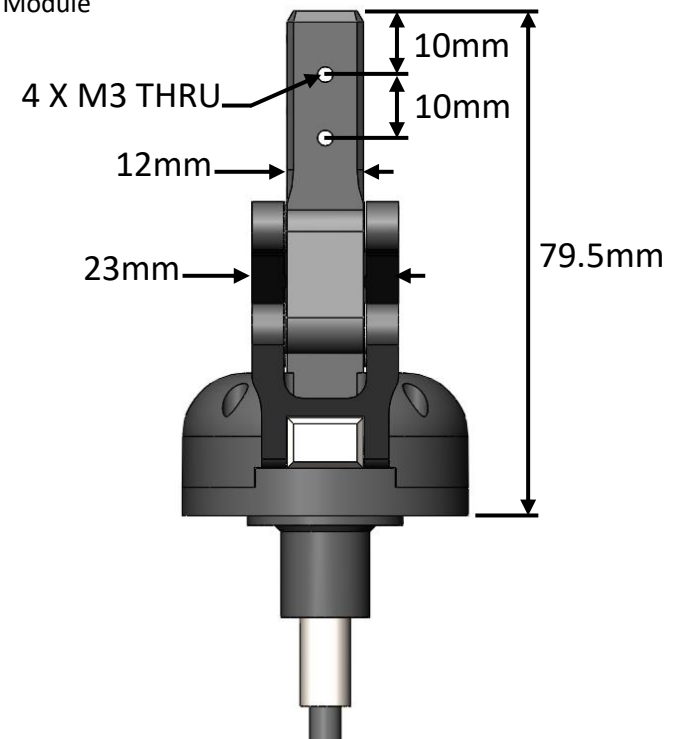
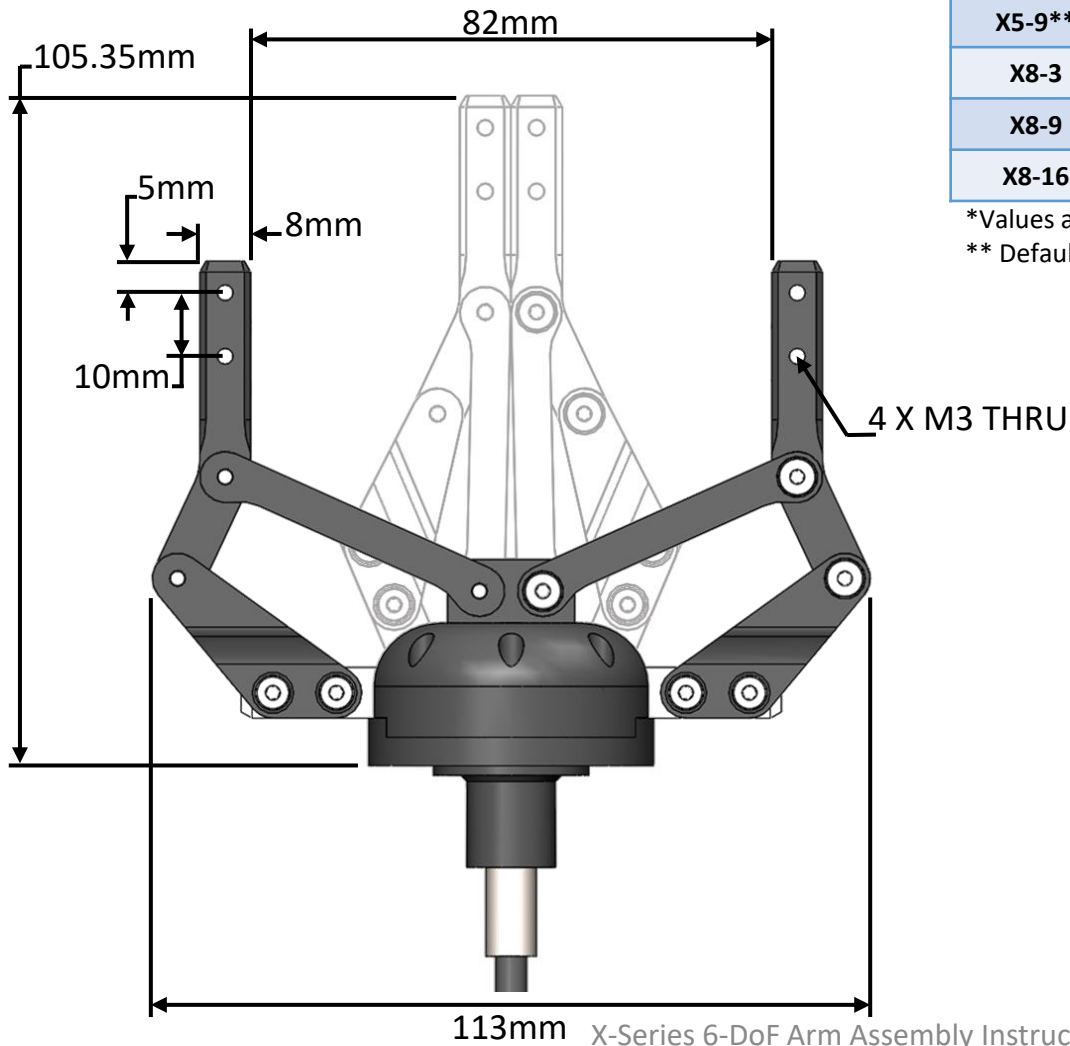


Technical Specifications

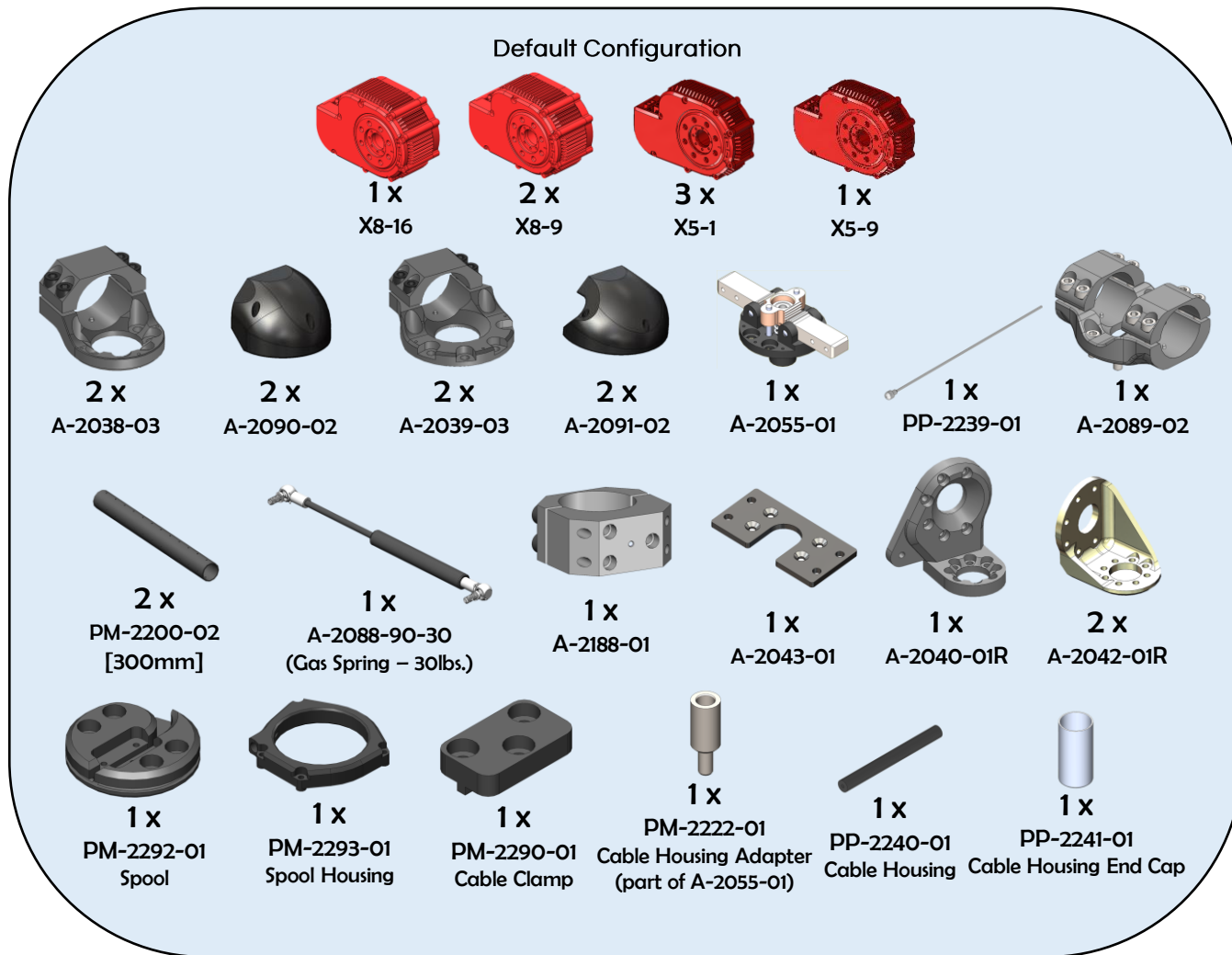
<u>Spool Module</u>	<u>Max Finger Torque</u>	<u>Max Finger Force at 50mm</u>
X5-1	0.1 Nm	2 N
X5-4	0.5 Nm	10 N
X5-9**	1.1 Nm	23 N
X8-3	0.4 Nm	8 N
X8-9	1.1 Nm	23 N
X8-16	2.0 Nm	40 N

*Values assume a symmetric two-finger grasp

** Default Module



Bill of Materials - Mechanical*



fasteners included, not shown

Bill of Materials - Electrical



3 x
A-2128-01
Power Distribution Board



1 x
A-2048-02
Power Jumper



4 x
A-2046-12
Power Cable, 12" Length



4 x
A-2046-18
Power Cable, 18" Length



2 x
A-2046-24
Power Cable, 24" Length

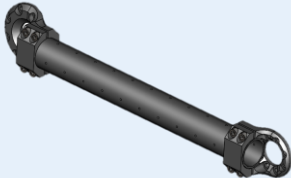
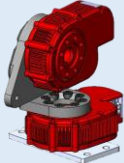
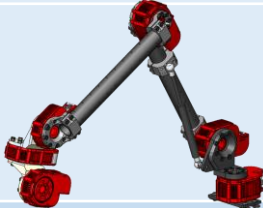
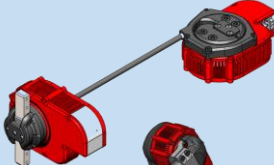
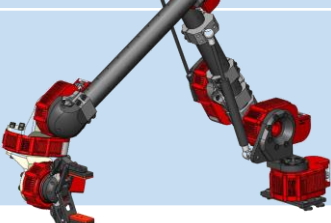


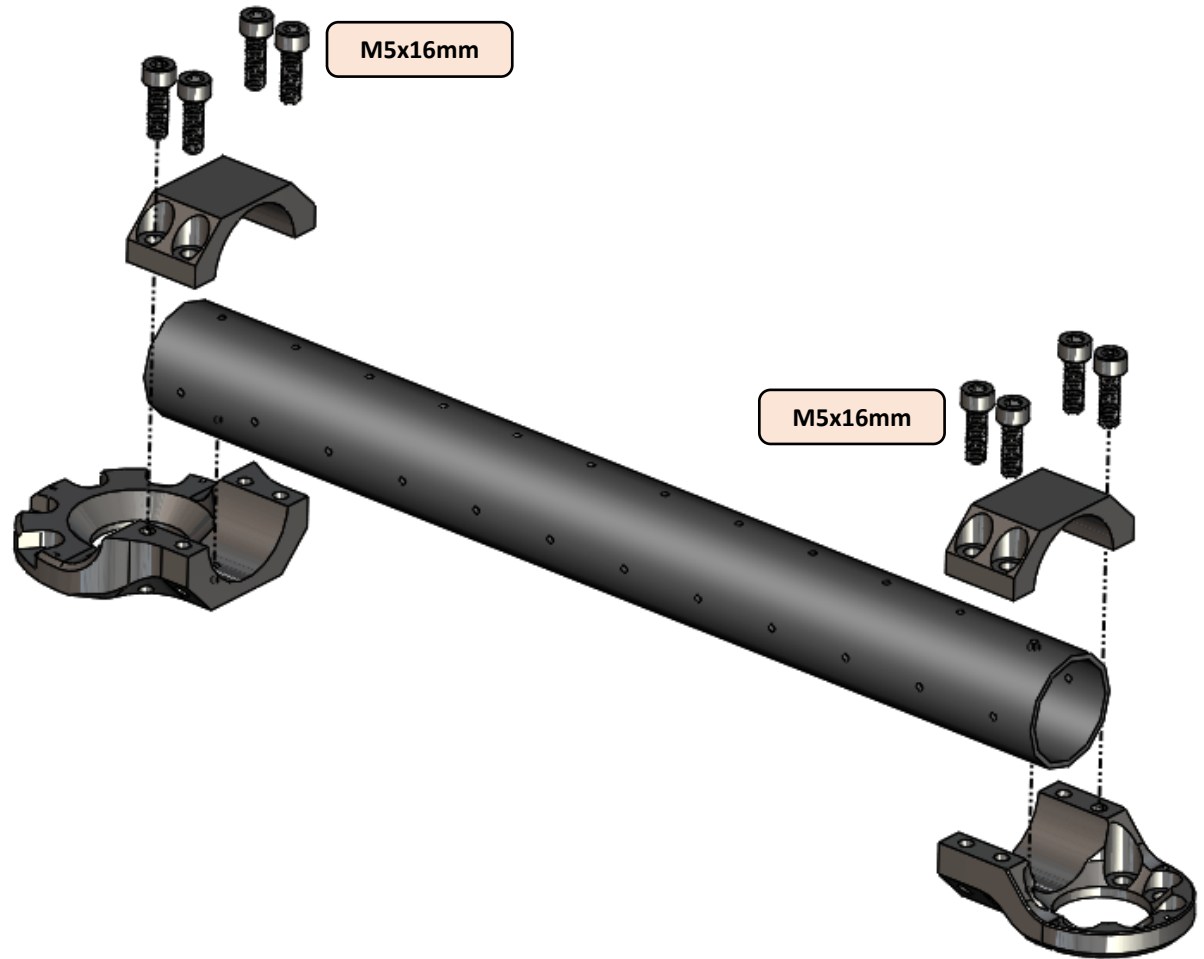
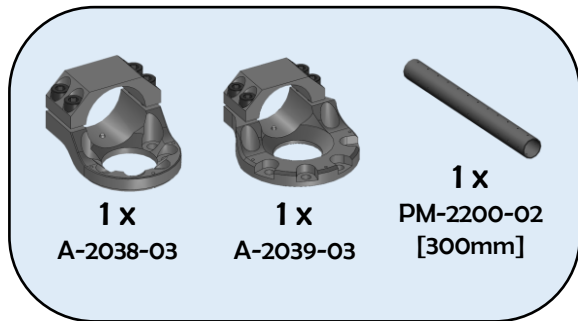
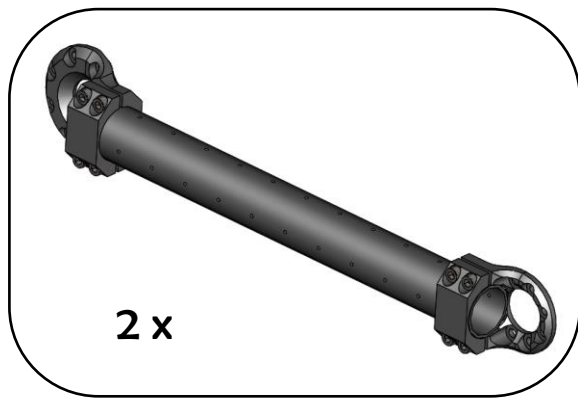
4 x
PP-2059-01
Ethernet Cable, 12" Length

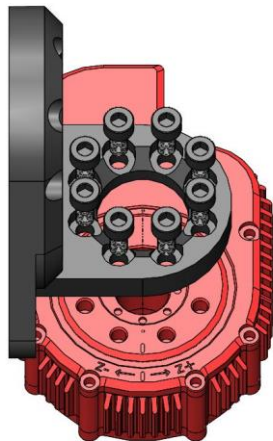
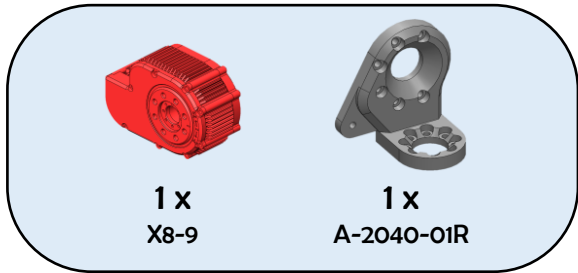
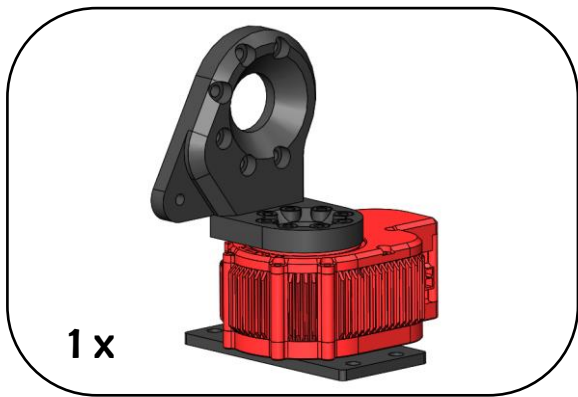


3 x
PP-2061-01
Ethernet Cable, 36" Length

Table of Contents

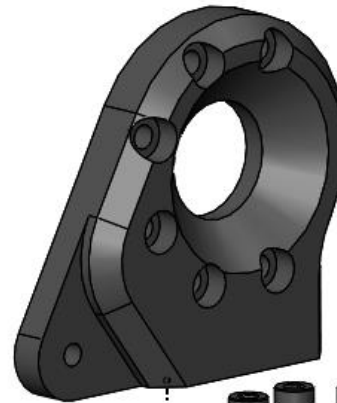
<u>Assembly</u>	<u>Image</u>	<u>Pages</u>
Tubes		[8]
Base		[9-10]
Arm		[11-15]
Gripper		[16-21]
Final		[22-30]



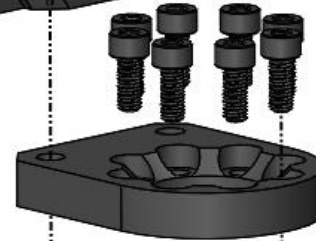


**Align with actuator
output hub tick mark**

(face parallel with tick mark and
mounting hole pointed on same side)



Flat face towards outside

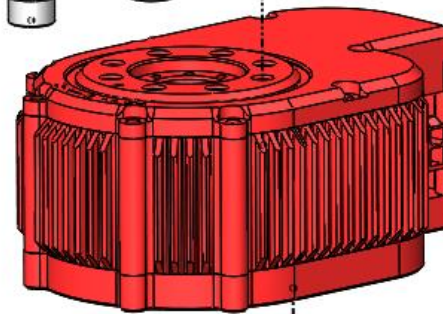


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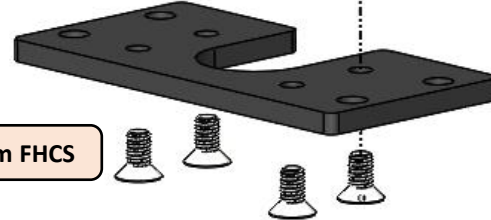
Step 2 of 2

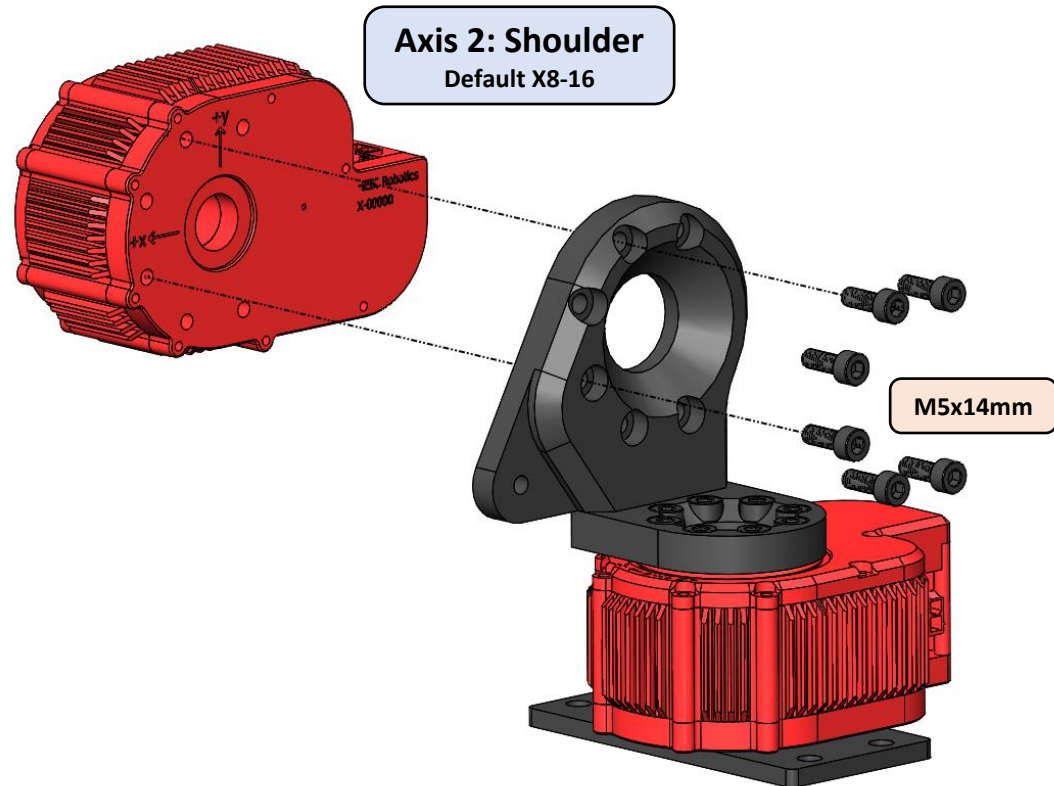
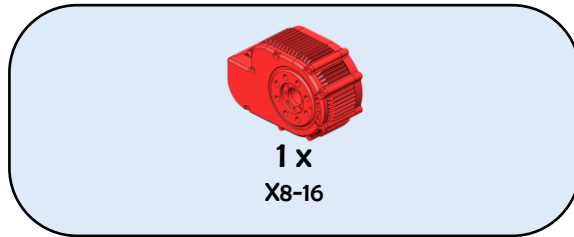
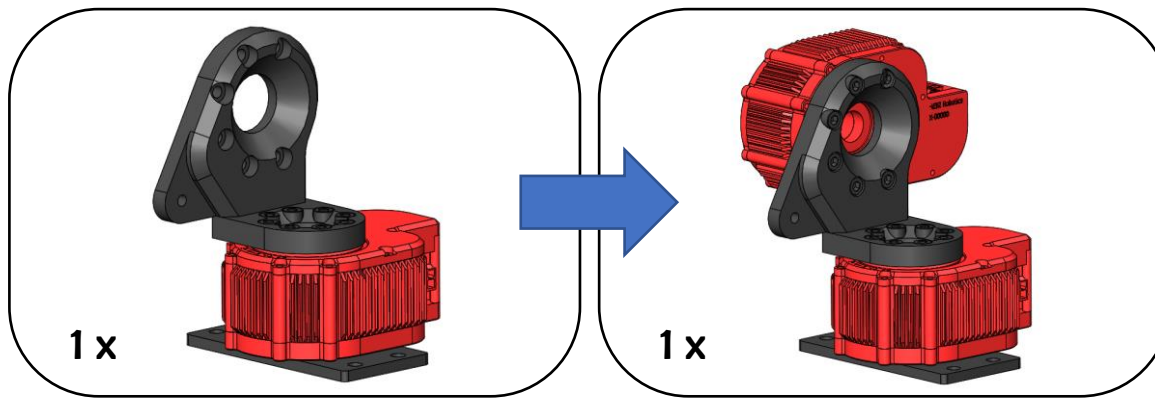
M6x12mm
Step 1 of 2

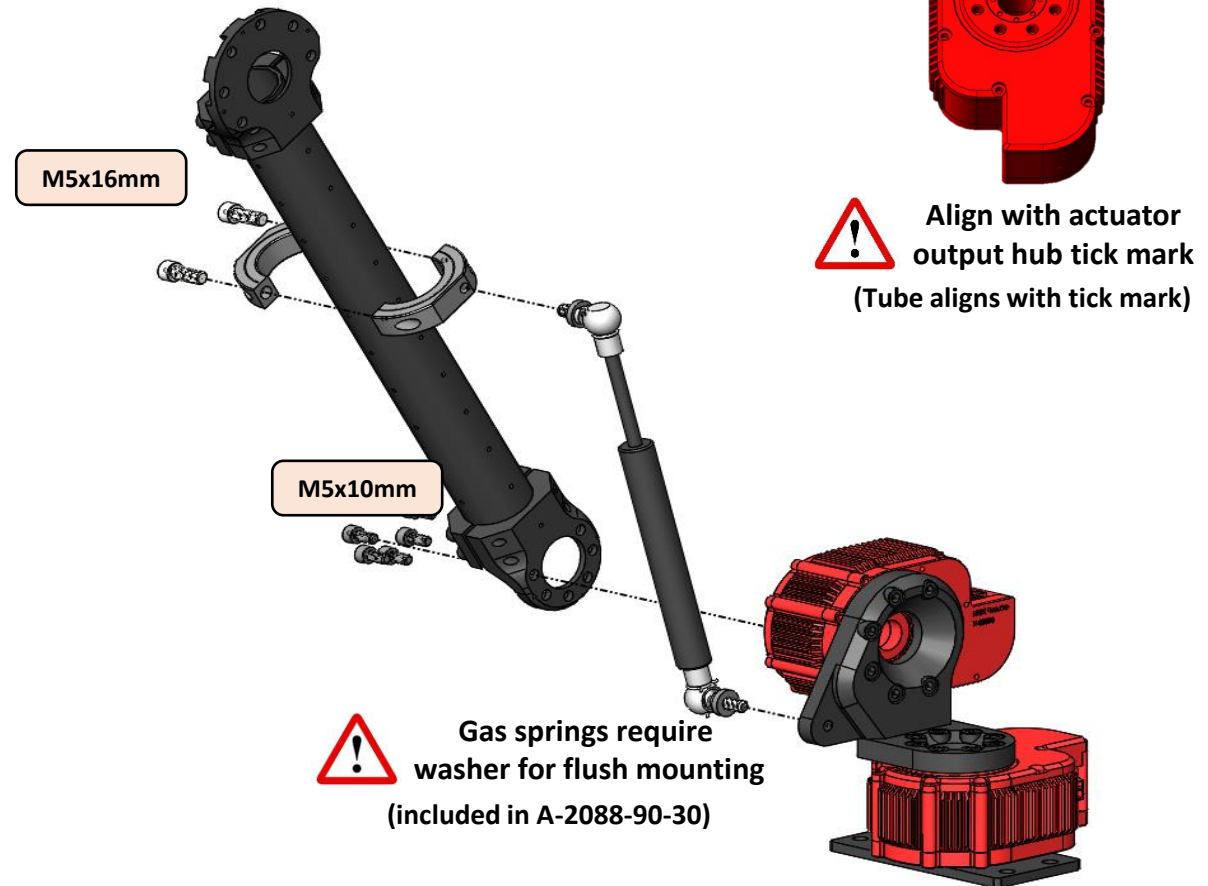
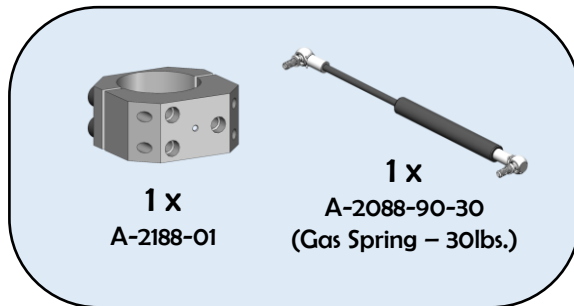
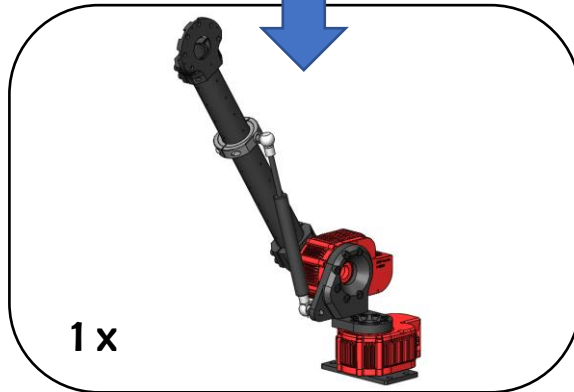
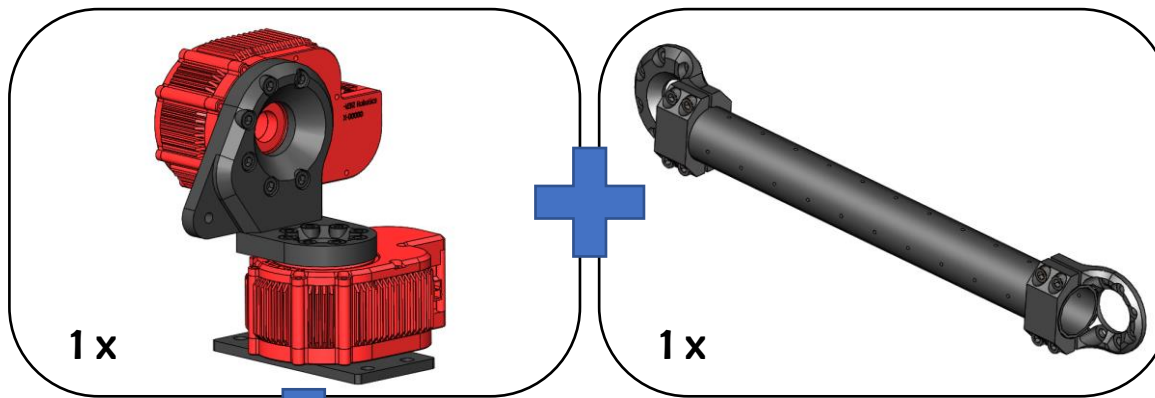
Axis 1: Base
Default X8-9

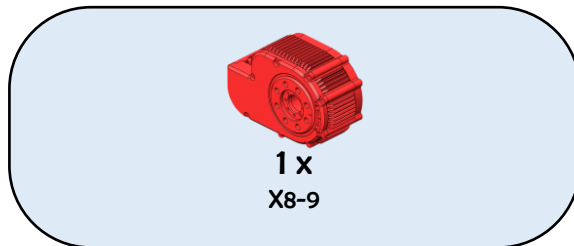
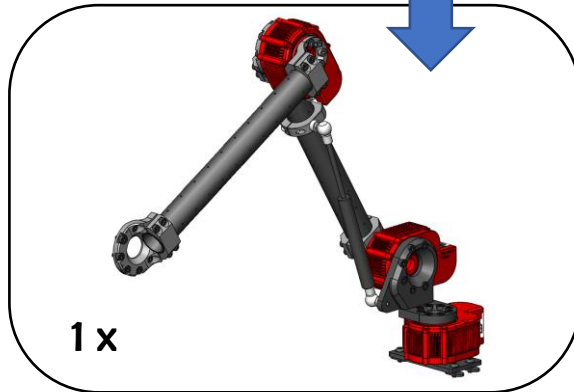
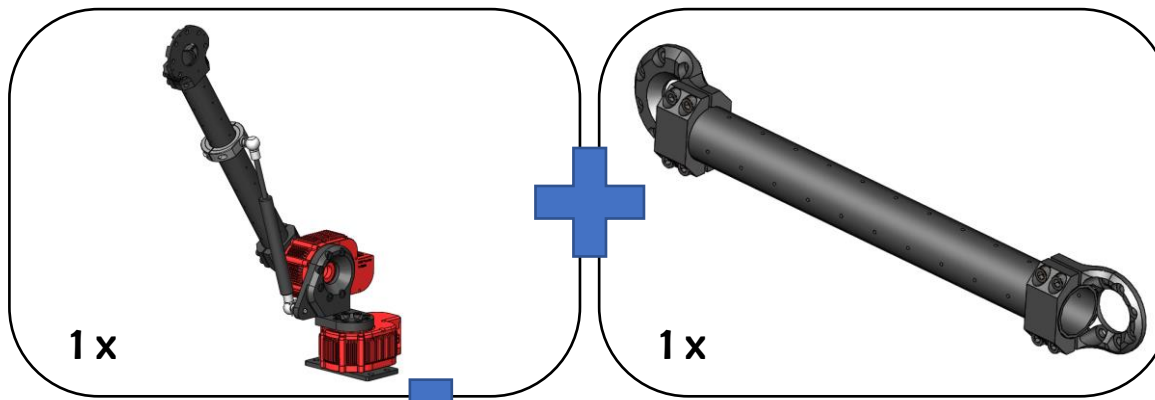


M5x10mm FHCS







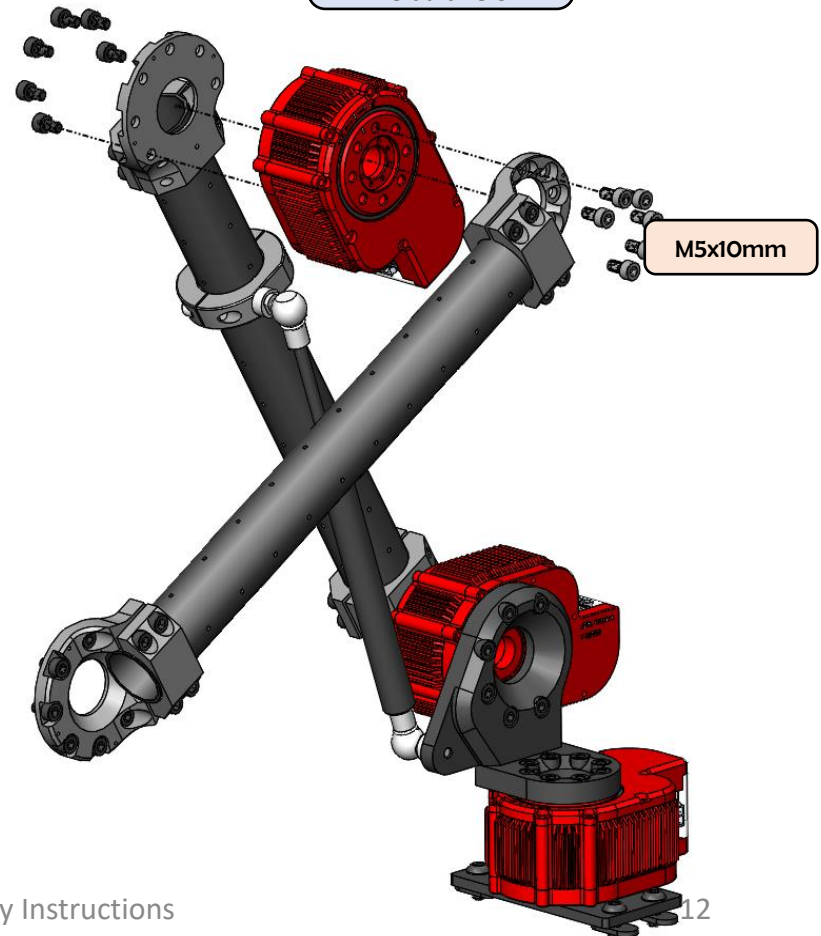


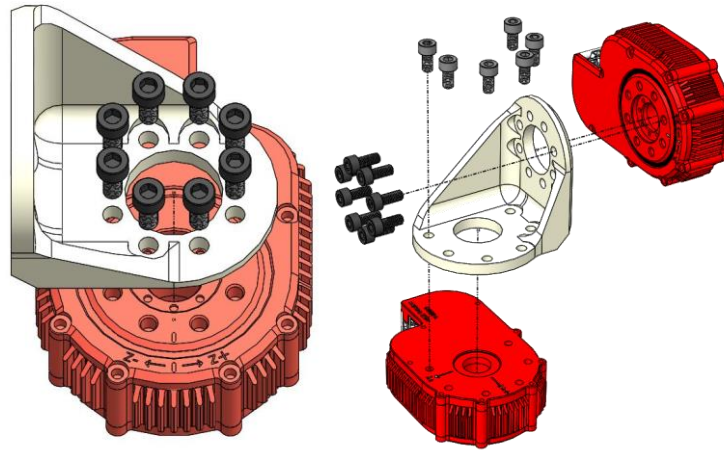
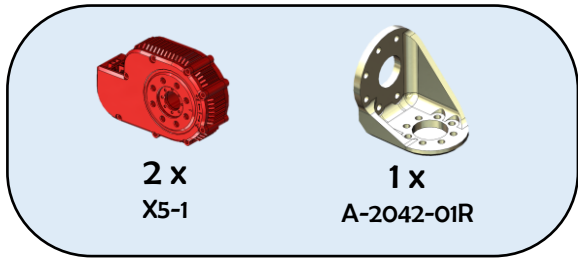
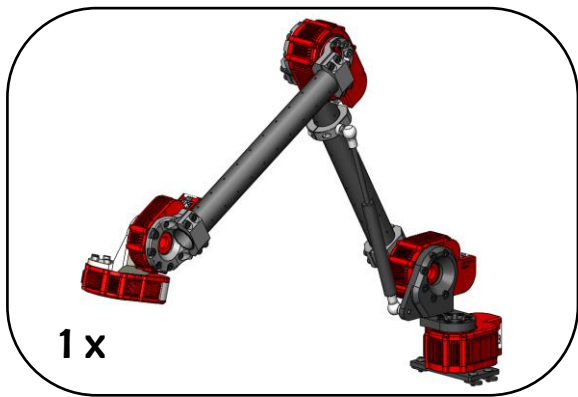
M5x8mm



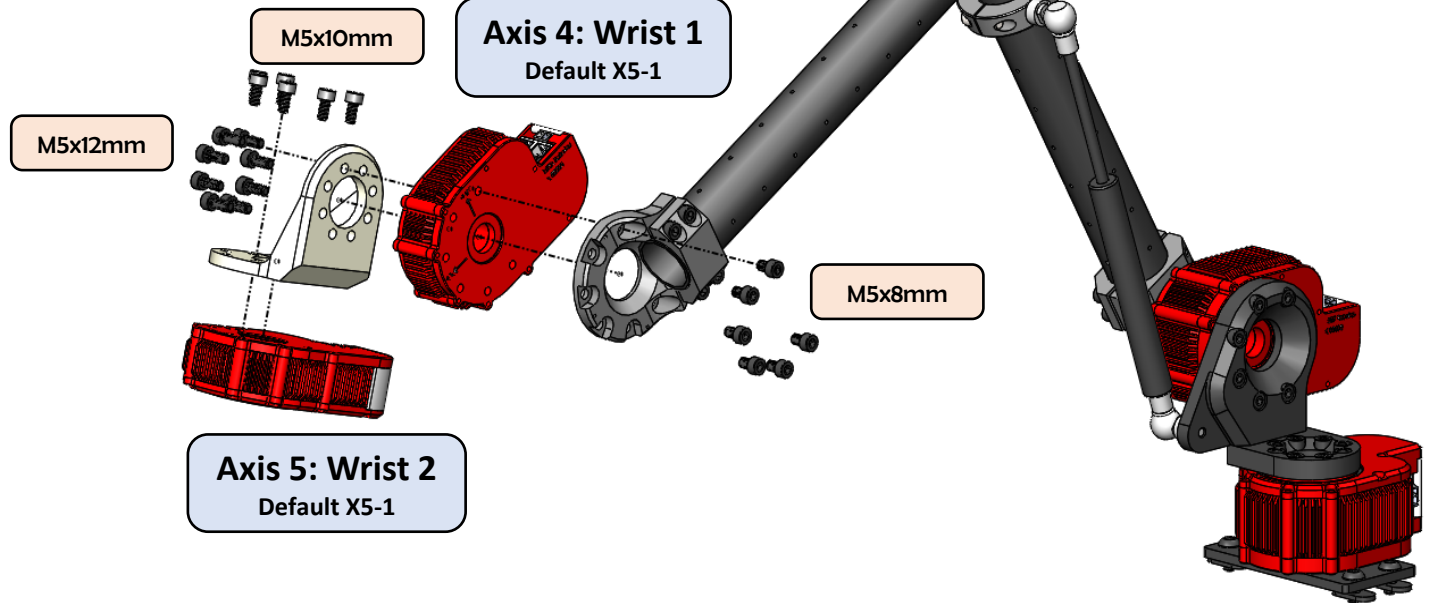
Align with actuator
output hub tick mark
(Tube aligns with tick mark)

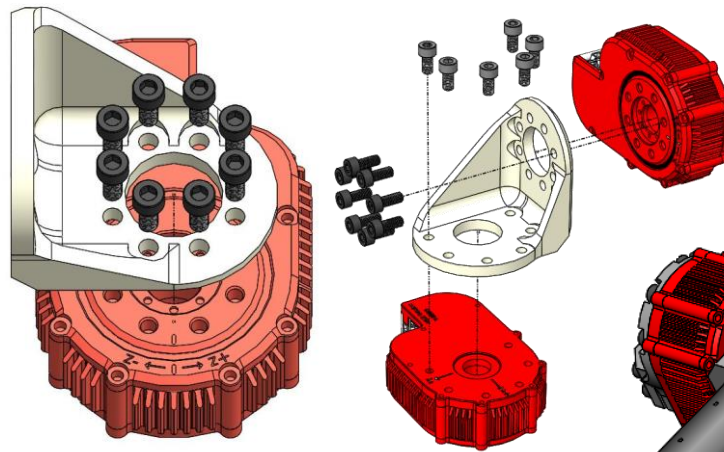
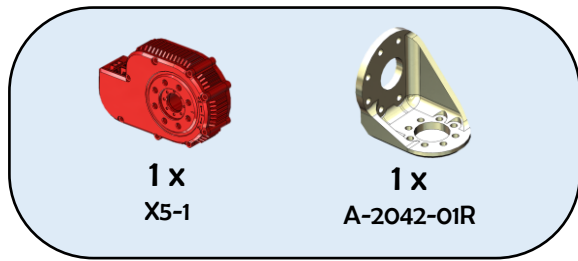
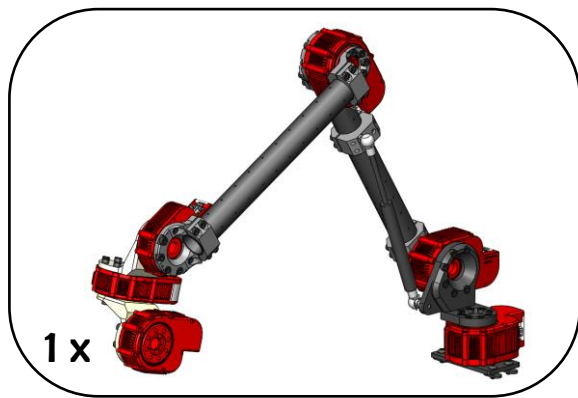
Axis 3: Elbow
Default X8-9



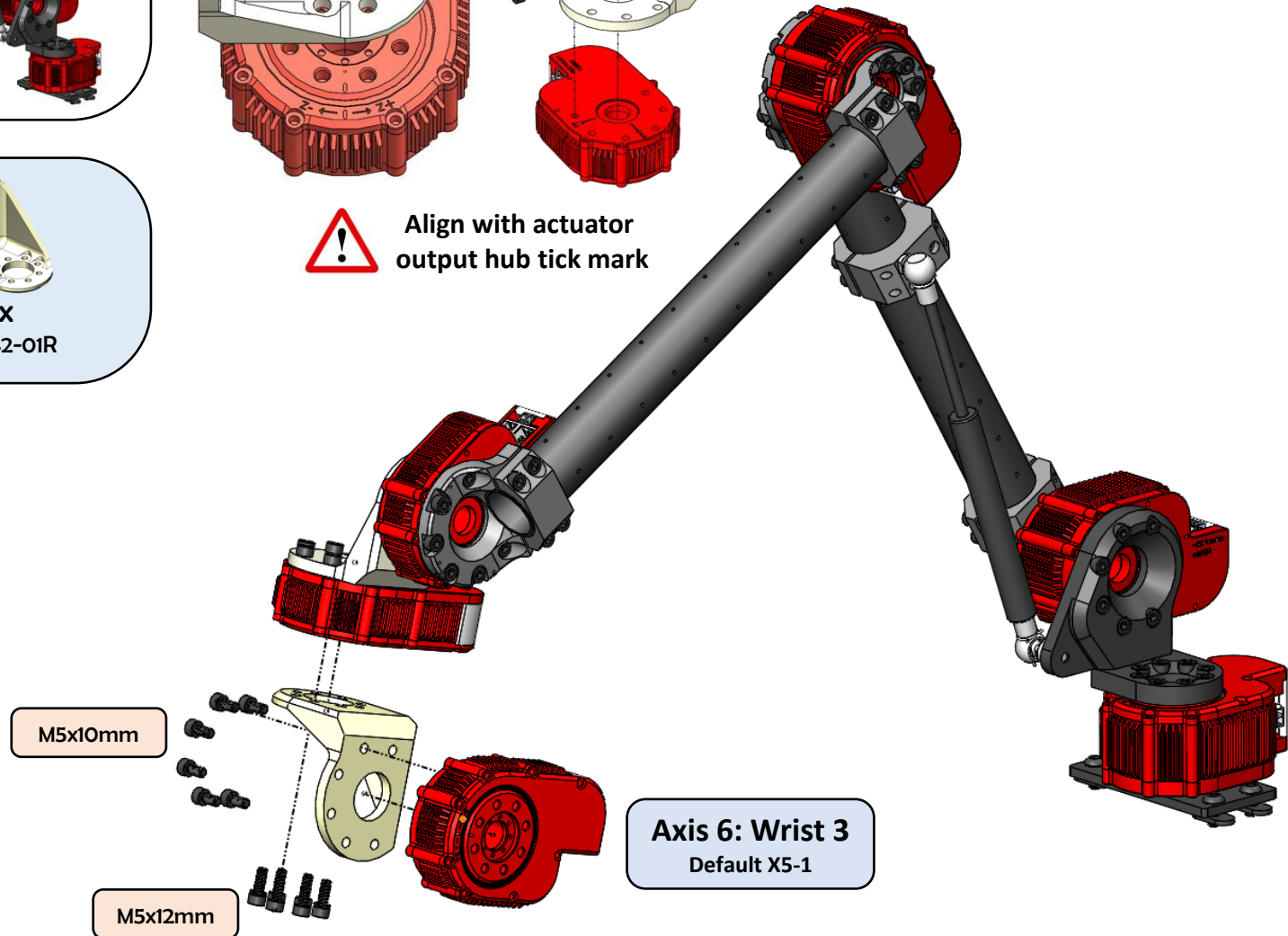


Align with actuator
output hub tick mark

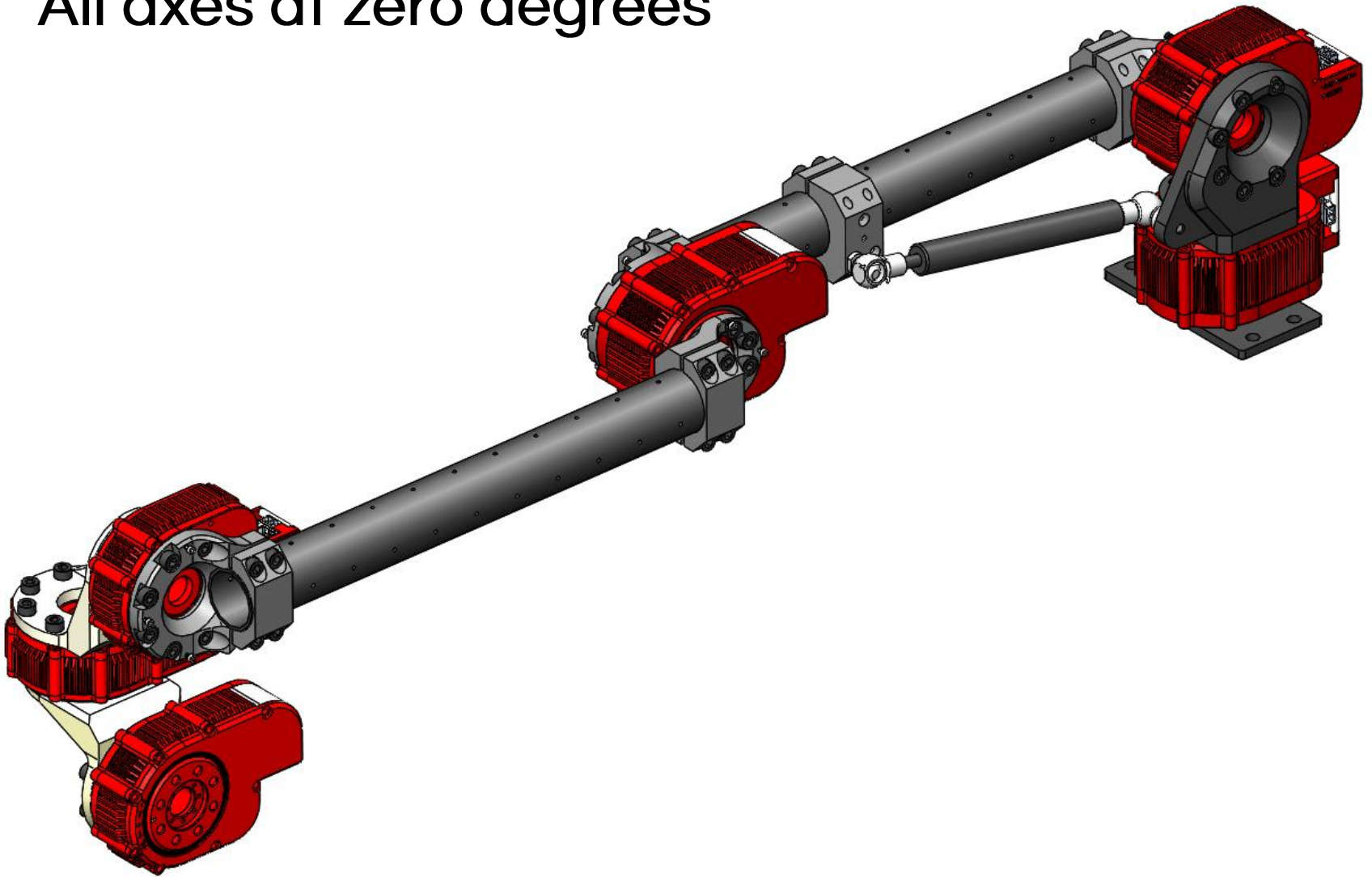




Align with actuator
output hub tick mark

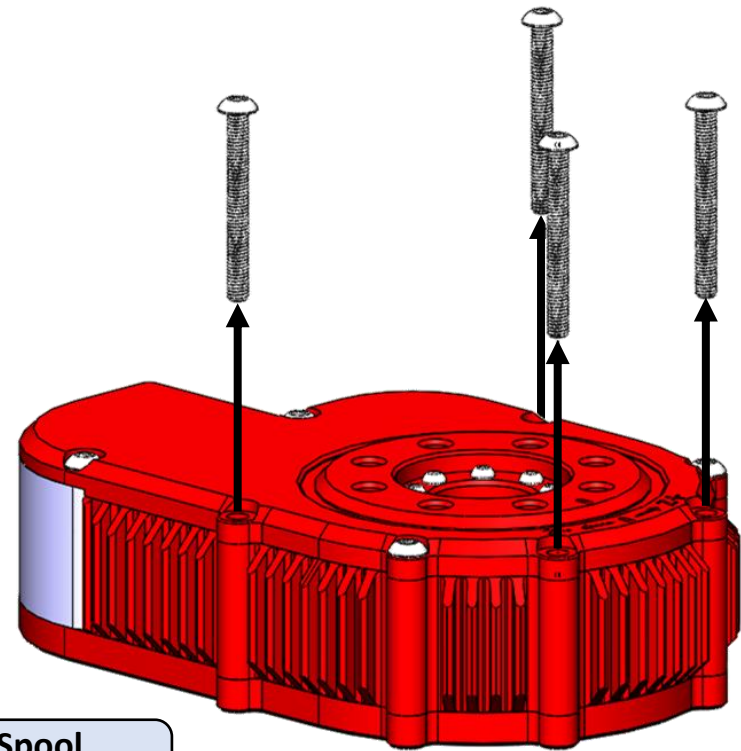
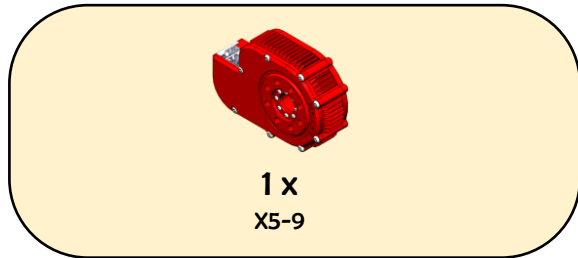
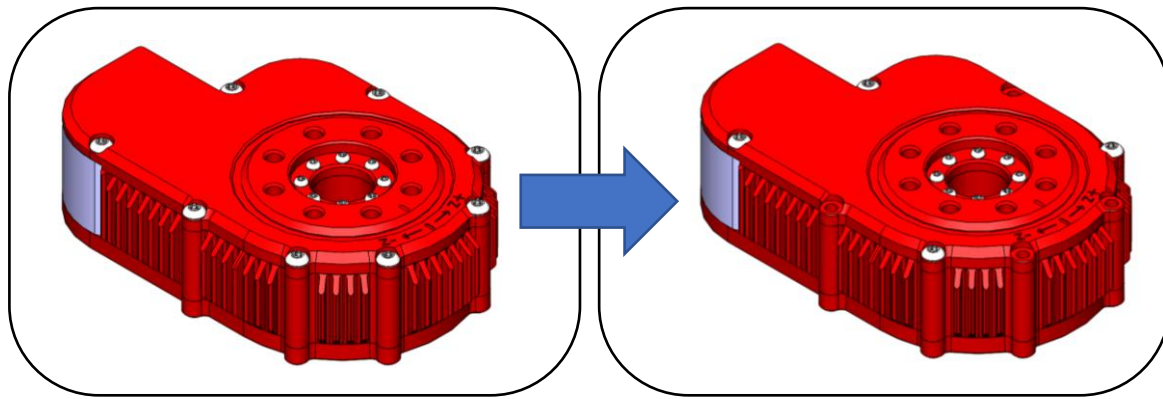


All axes at zero degrees

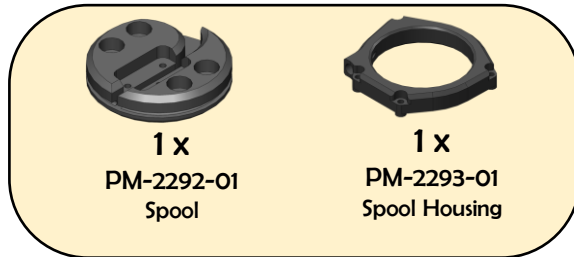
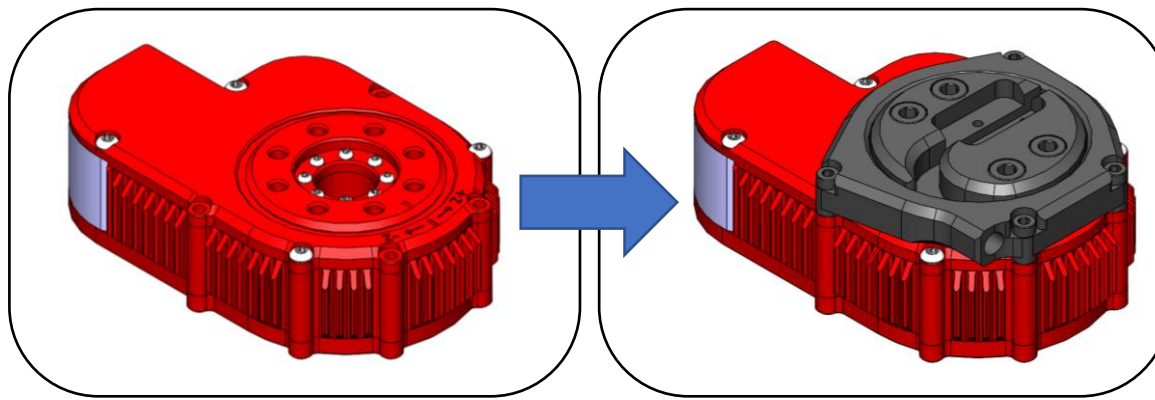




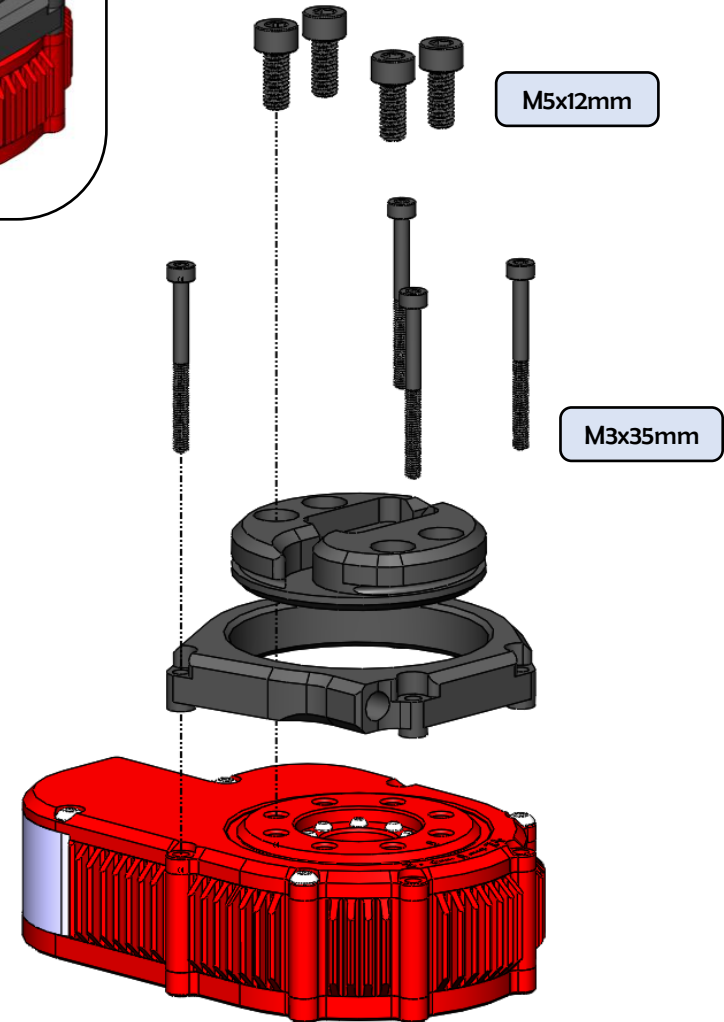
Gripper



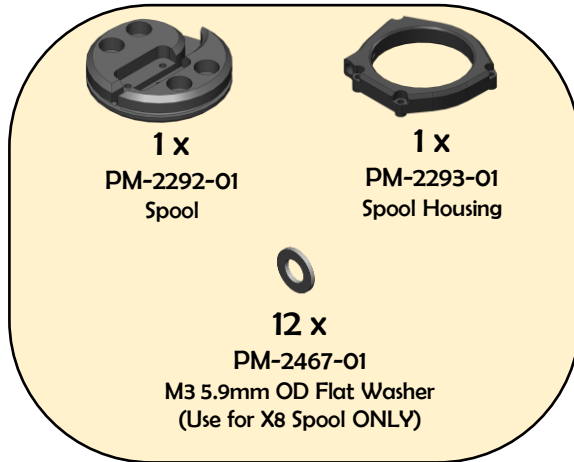
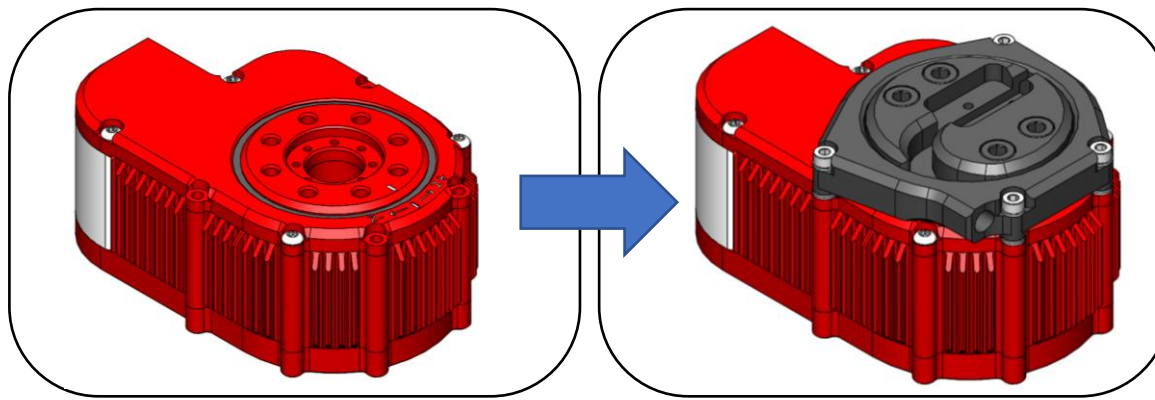
Spool
Default X5-9



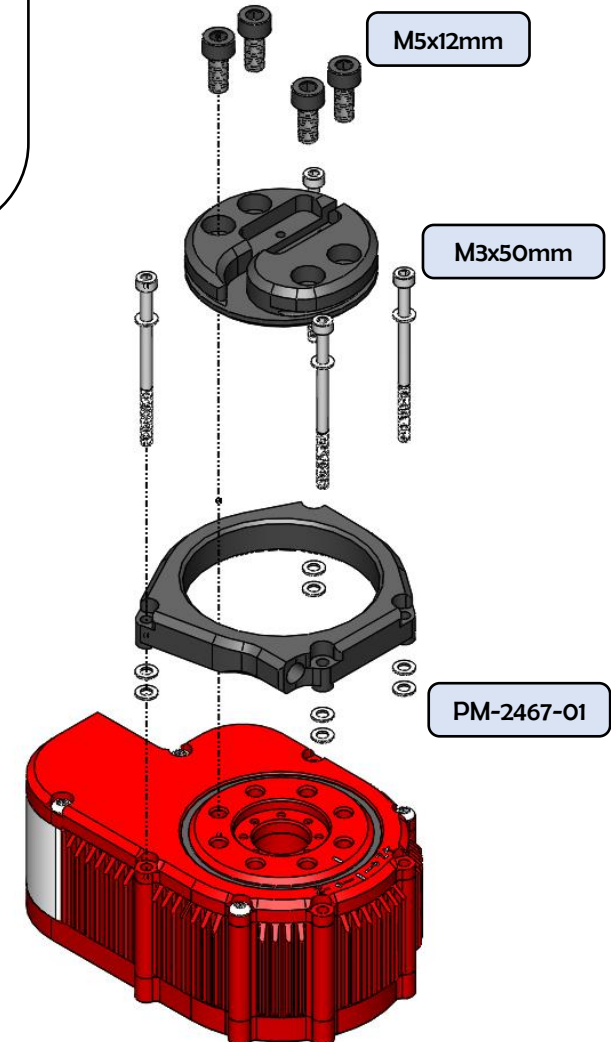
***If the spool module is an X8 MODULE,
SKIP this page and go to the NEXT Page.
Rest of the steps are the same for both.**



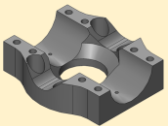
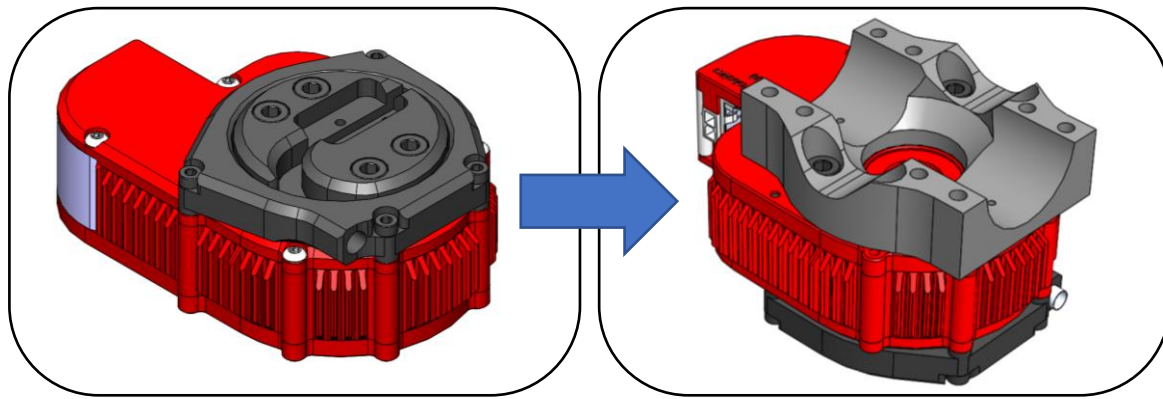
***Clocking for the Spool does not matter**



***For using an X8 MODULE ONLY.
If the spool module is an X5, SKIP this page.**

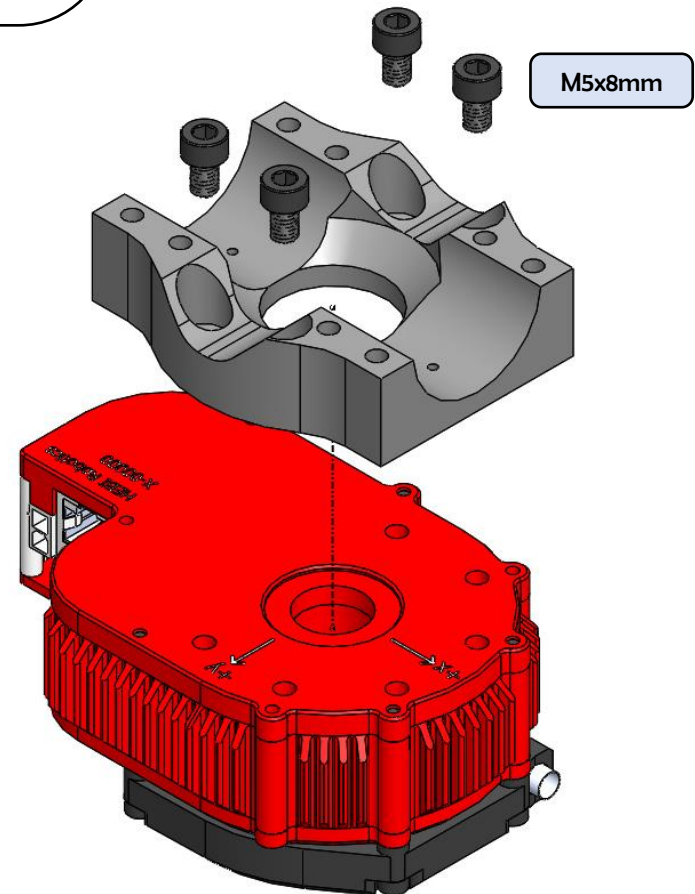


***Clocking for the Spool does not matter**

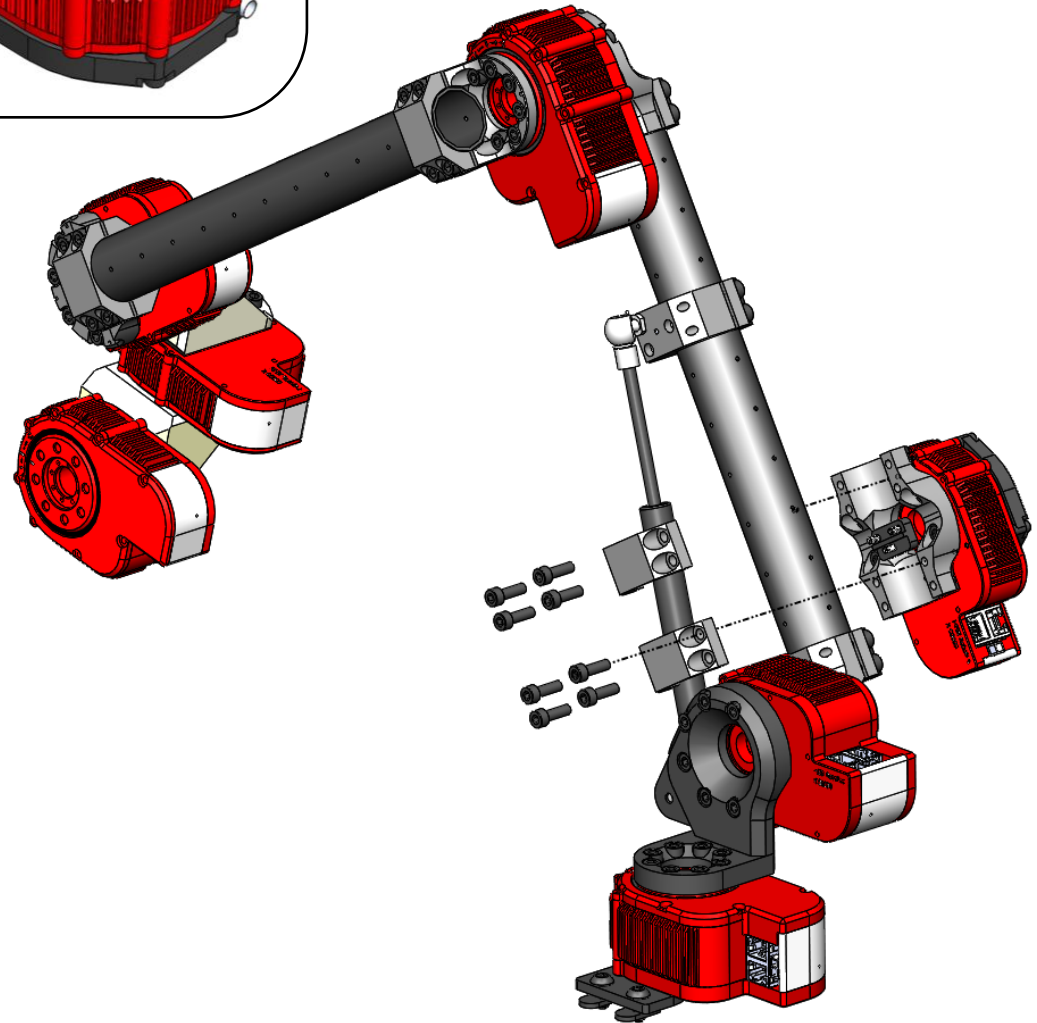
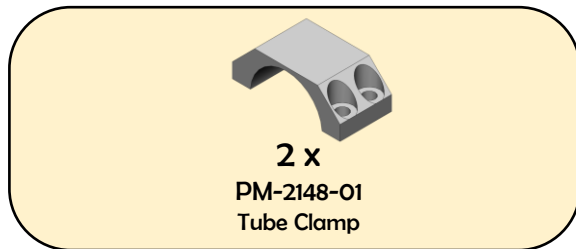
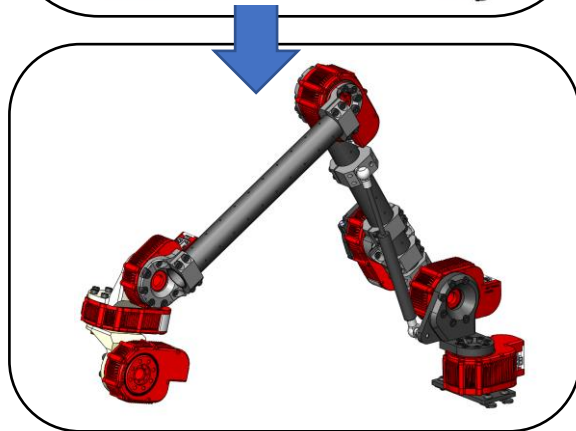
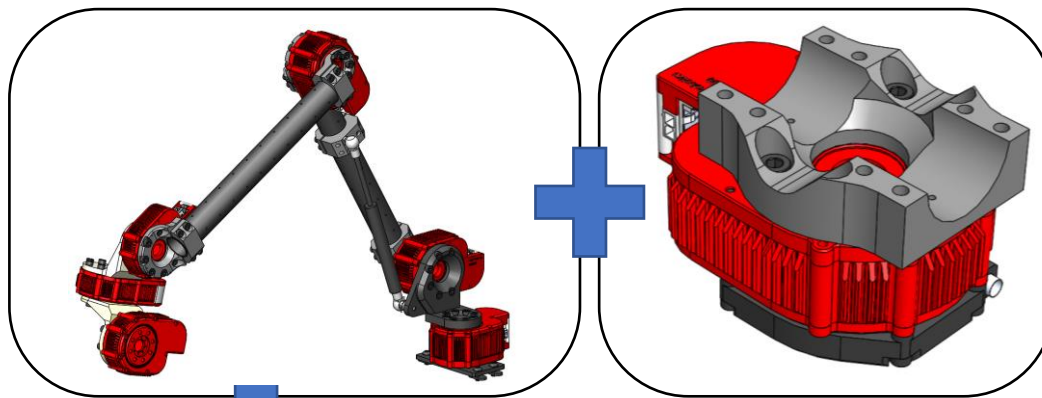


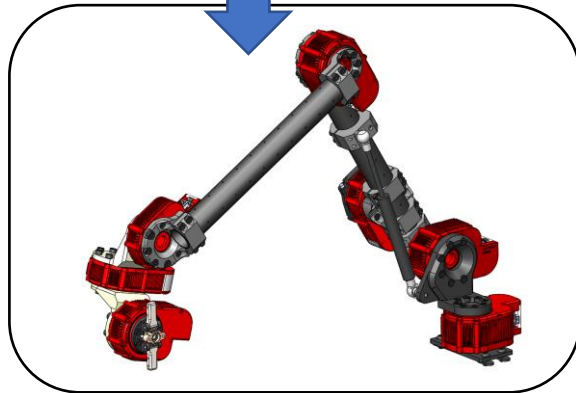
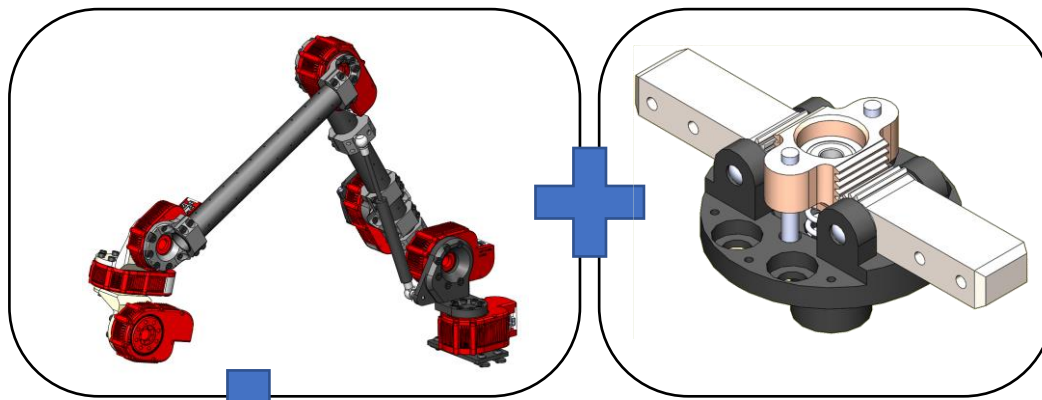
1 x

PM-2190-03 (A-2089-02)
Housing Mid-Tube Adapter

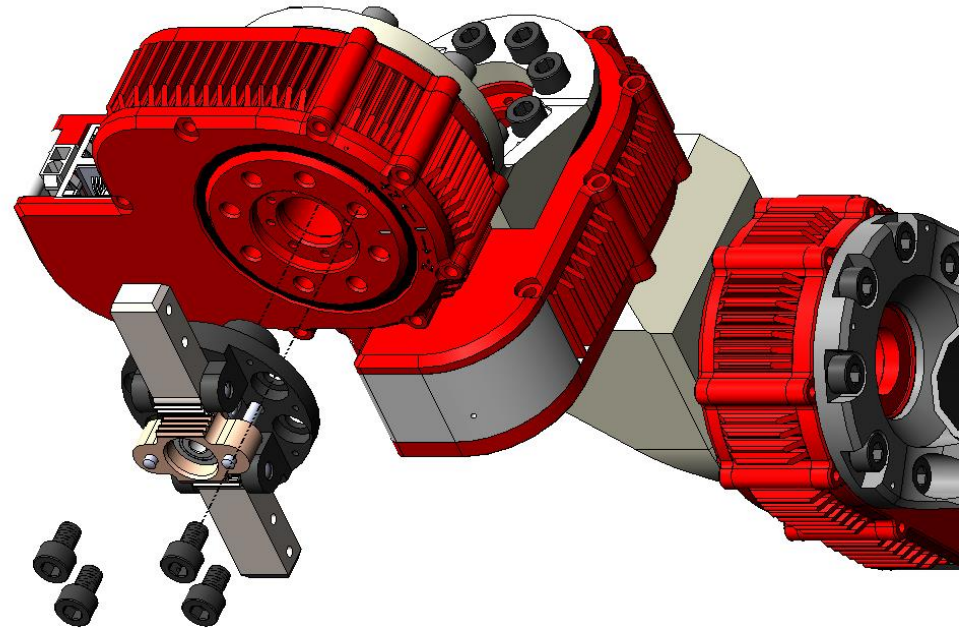


M5x8mm





The Last Module on the Arm



M5x8mm

 **Align with actuator
output hub tick mark**
(Fingers perpendicular to the tick mark)

Wiring Notes

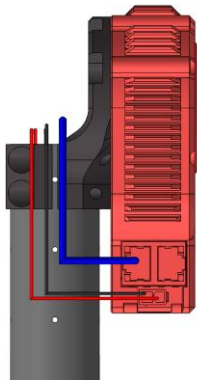
- Keeping wires organized will help prevent tangling and add a nice aesthetic.
 - Spiral sleeving is a good accessory for organizing loose wires
- HEBI X-Series actuators have a thru bore specifically designed to fit ethernet and power connectors.
 - Please pass connectors thru bore hole 1 at a time.

For more information visit: docs.hebi.us

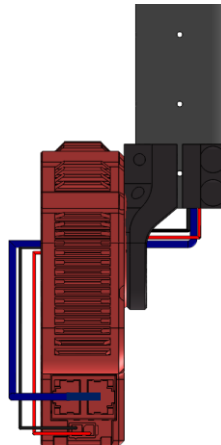


[Spiral sleeving]

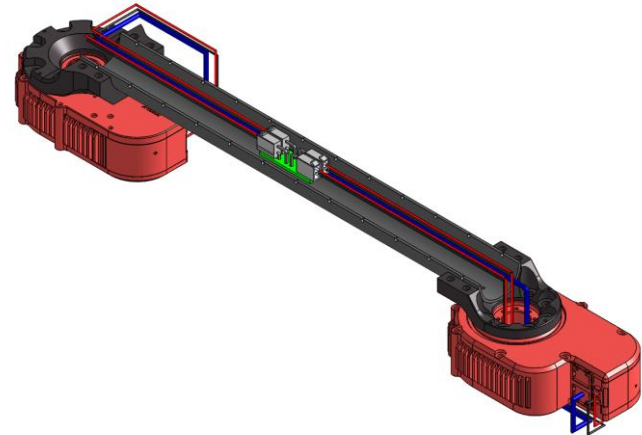
Wires that come from the previous joint should be inserted directly to actuator ports.



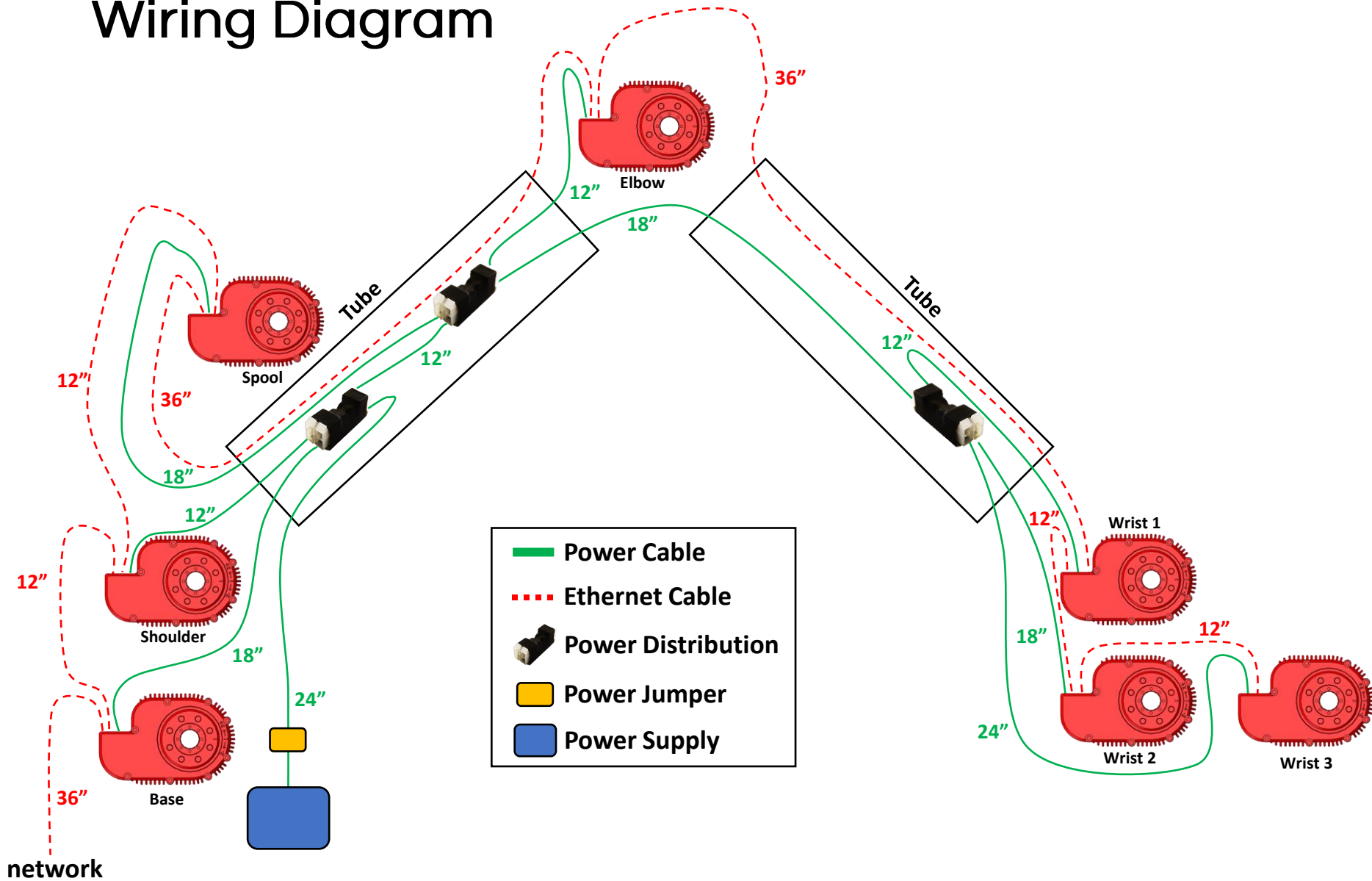
Wires that connect to the next joint should be threaded through the actuator's bore hole.



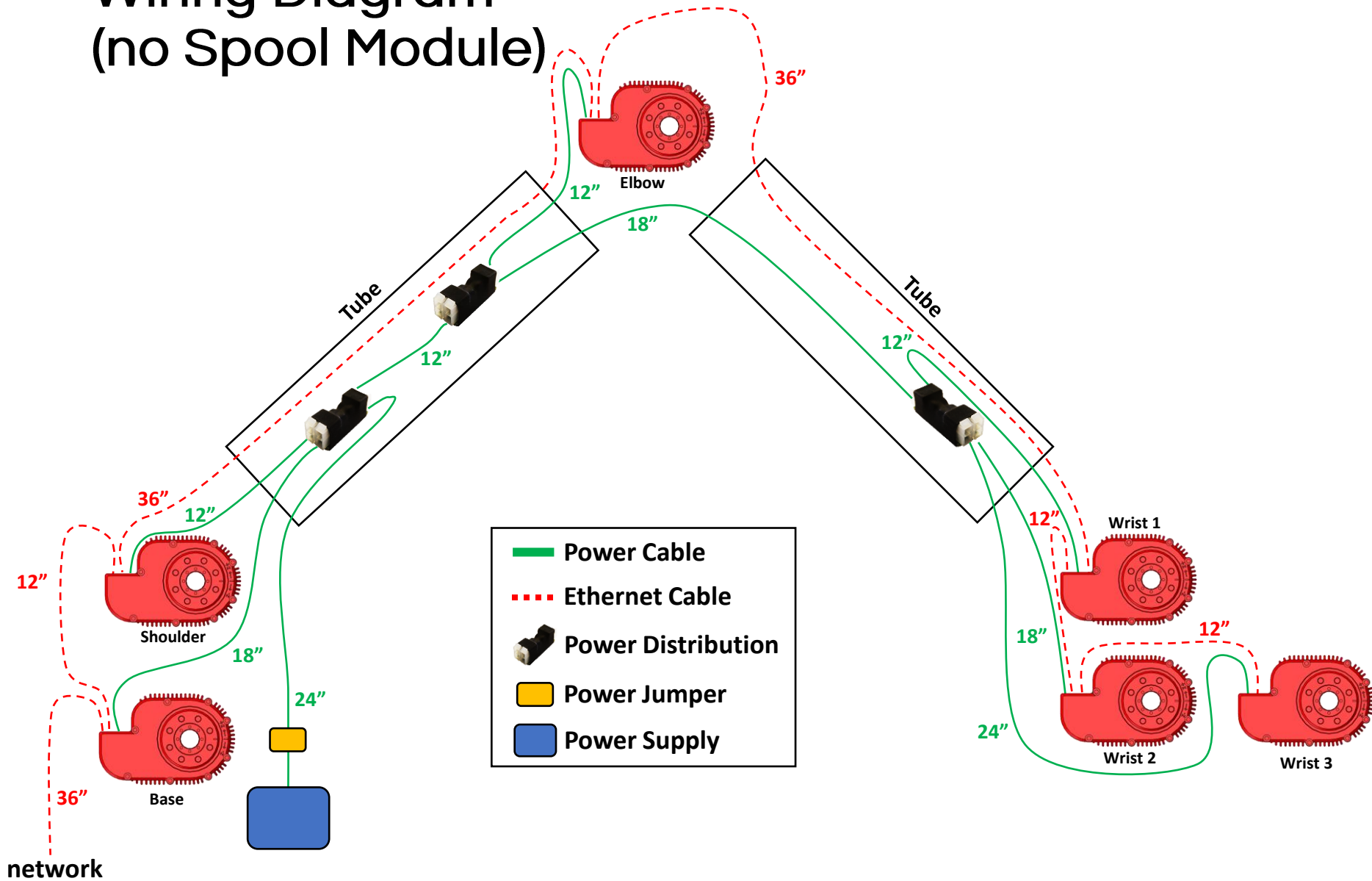
Power distribution boards are included to help daisy-chain power connections. These fit well within the tubes between actuators.



Wiring Diagram

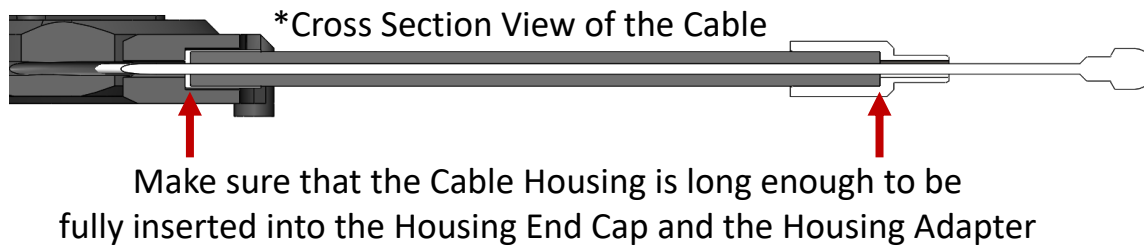


Wiring Diagram (no Spool Module)




Running the Cable Through

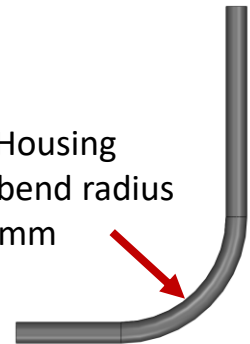
- Make sure to use a Standard Road Bike Brake Cable.
- Run the cable to fit your system.
- Run both the cable and the cable housing before cutting them to ensure that the cable is long enough.
- Cut the cable housing first, and then cut the cable.

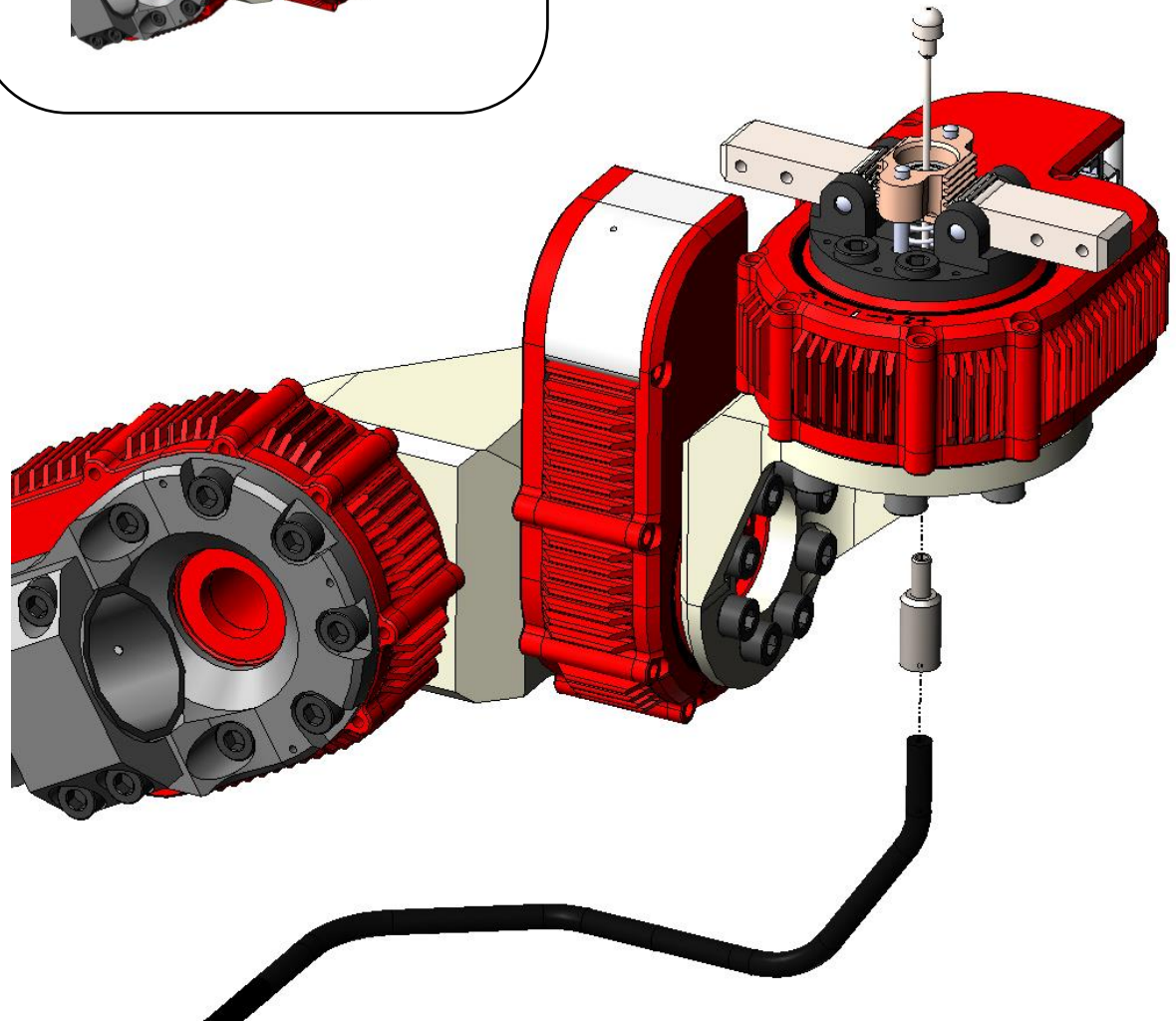
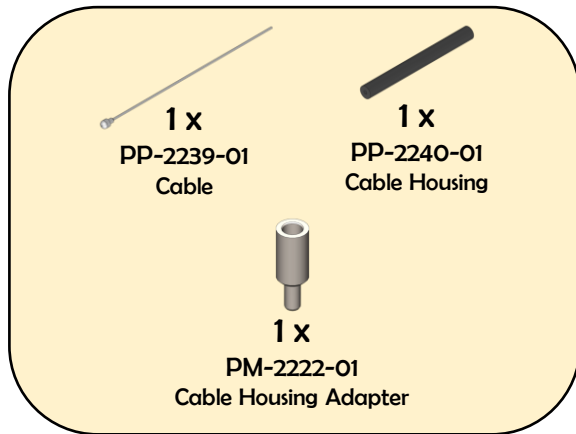
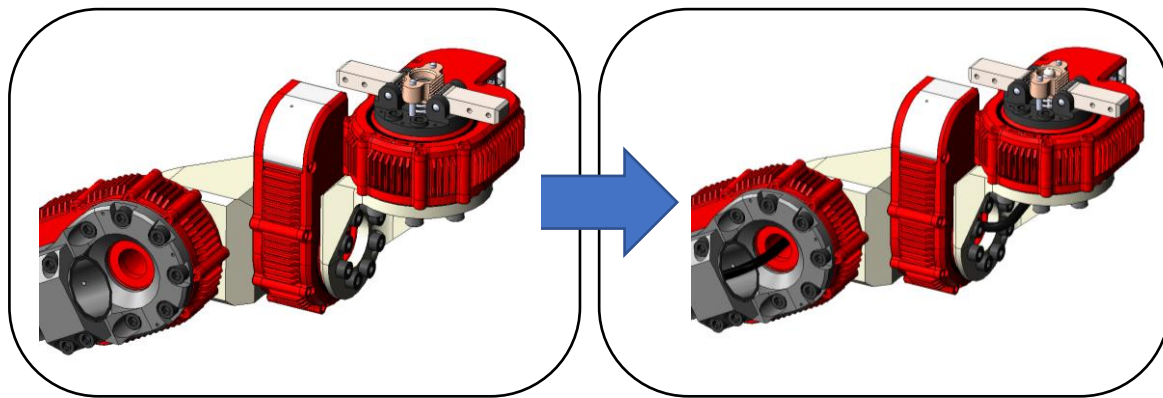


About 100mm of Cable should stick out from the Cable Housing

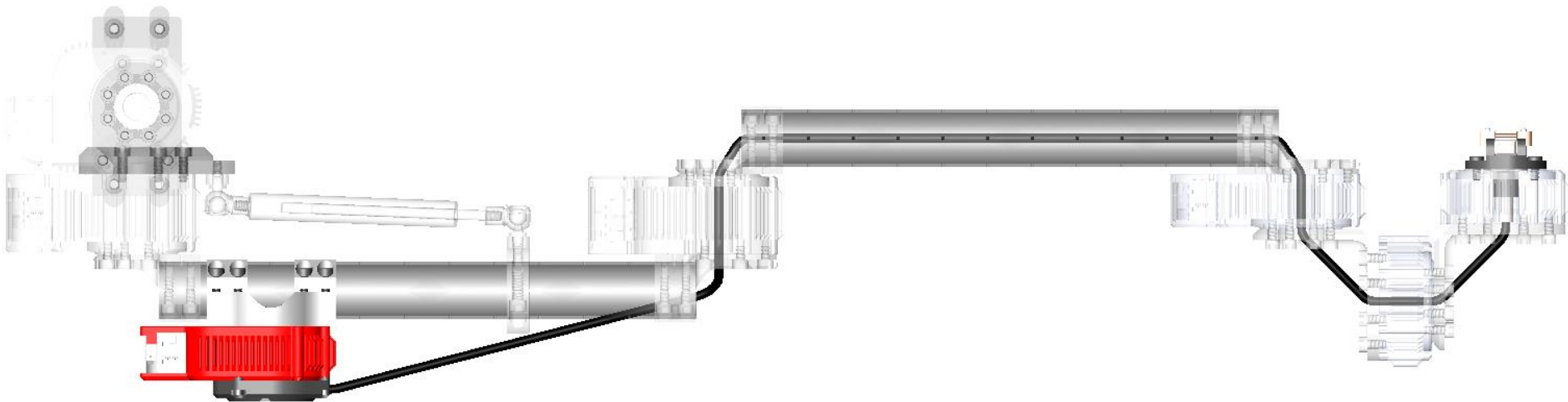


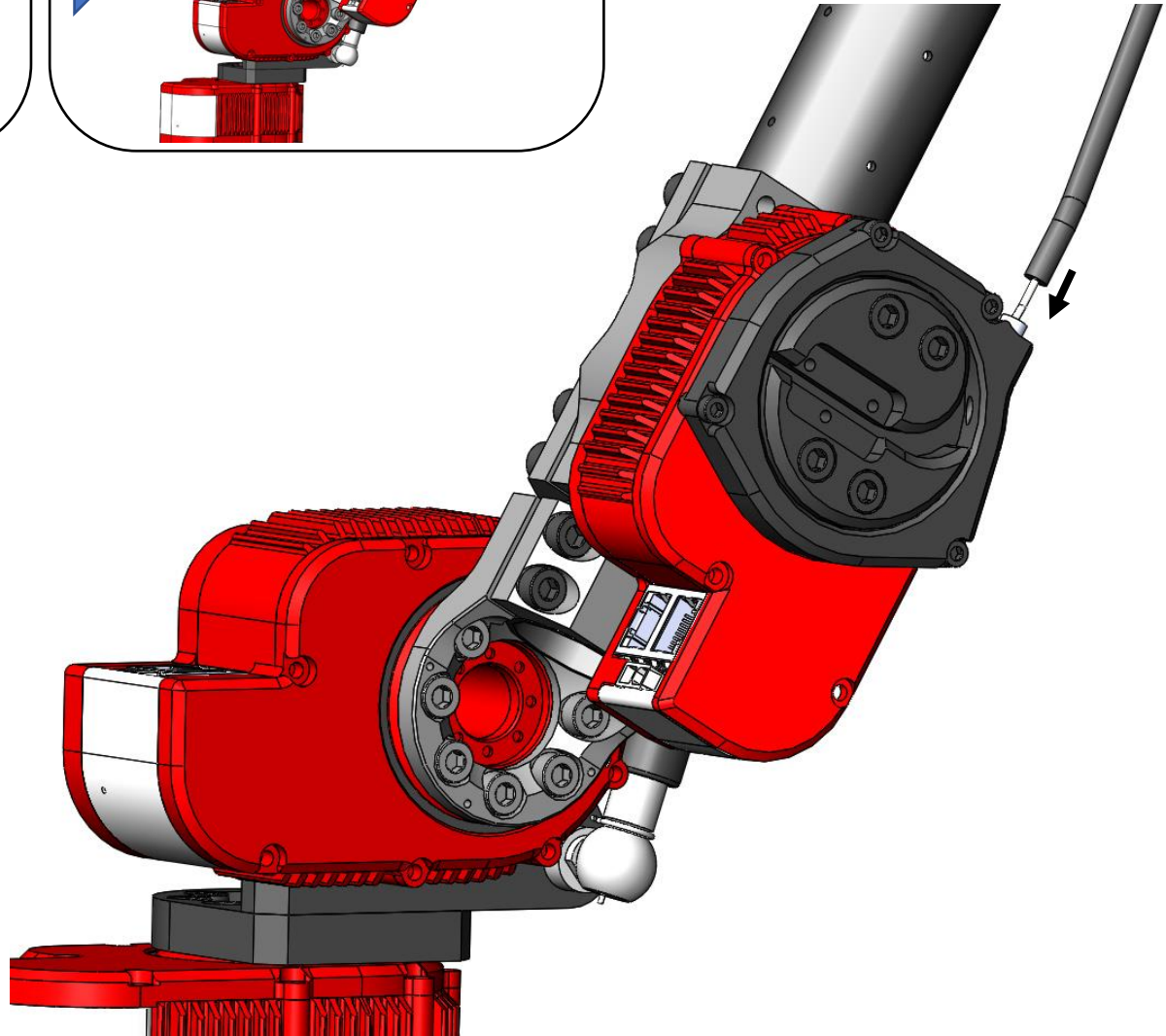
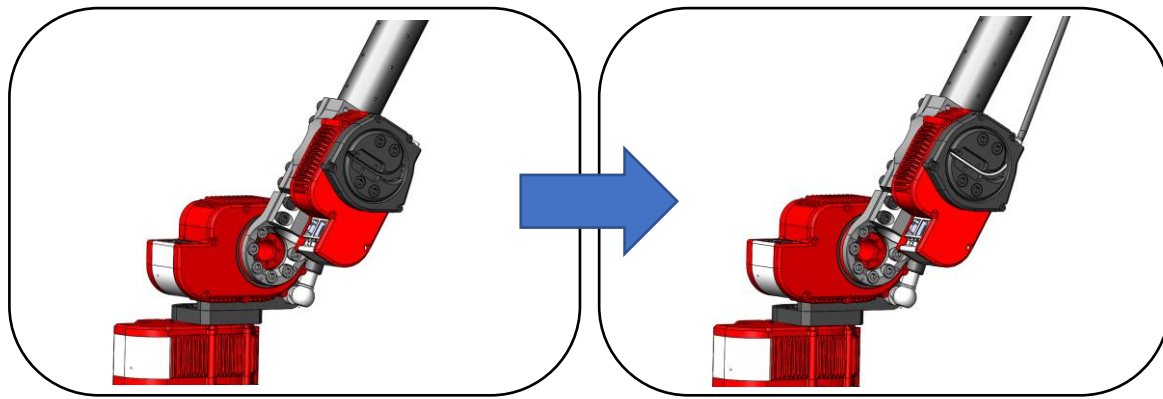
 Cable Housing minimum bend radius 25mm

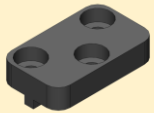
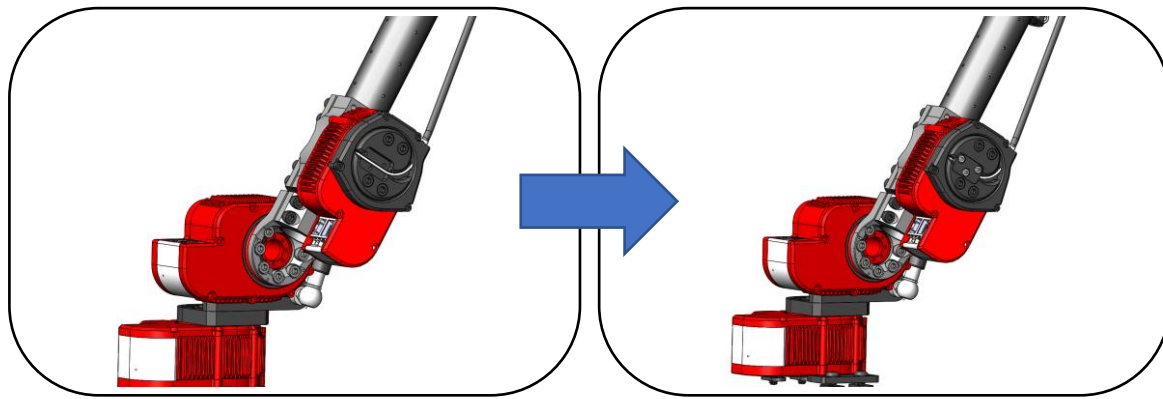




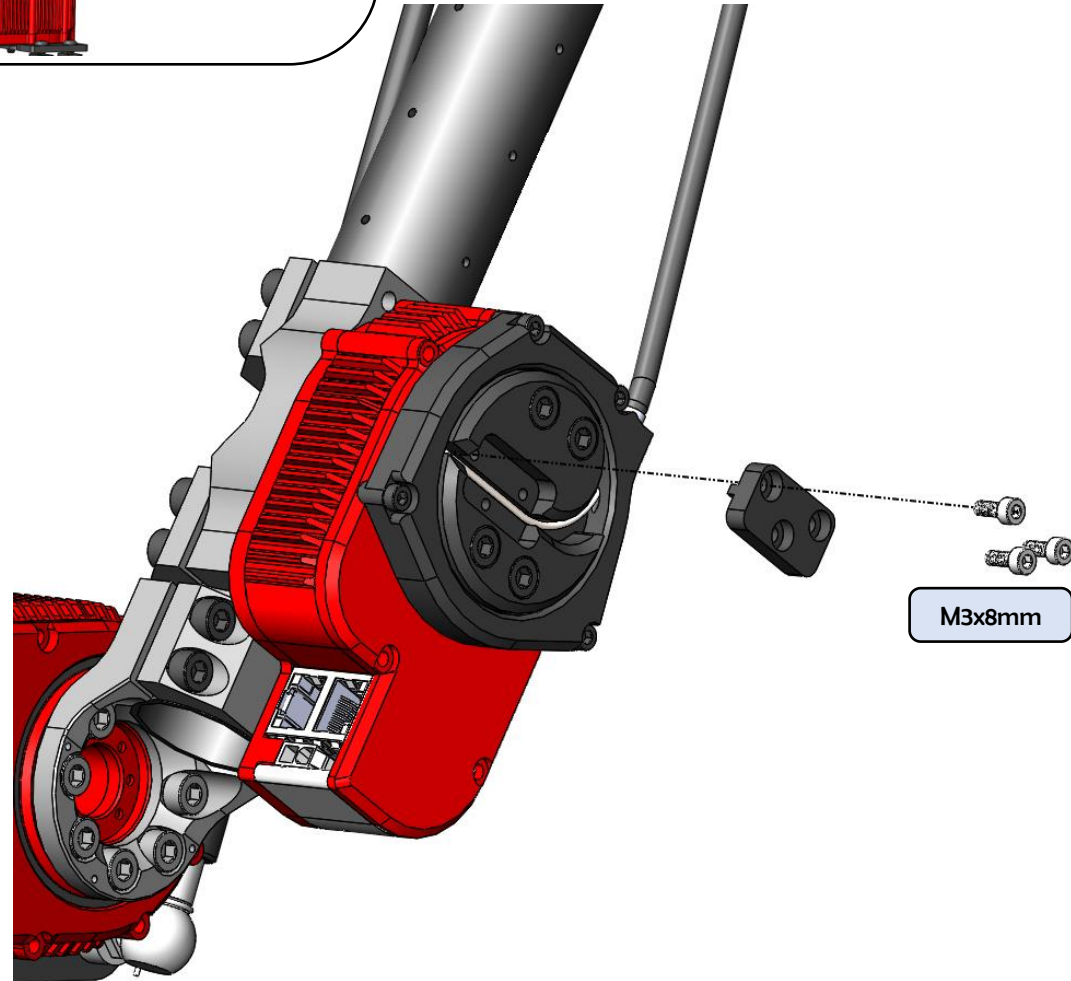
Gripper Cable Routing



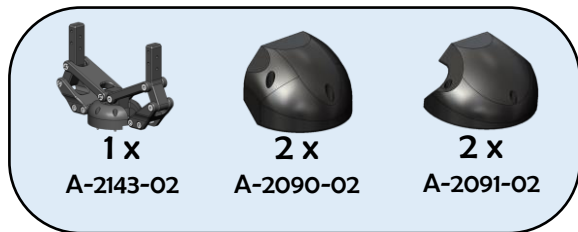
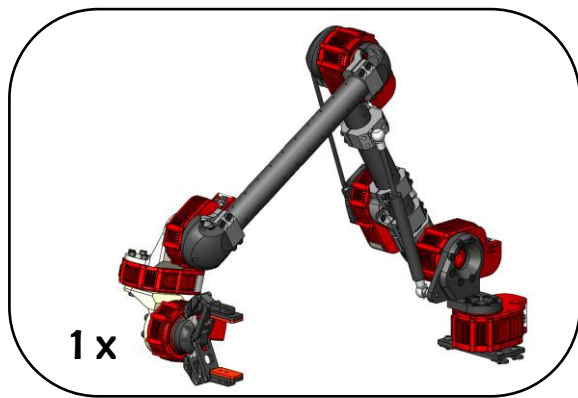




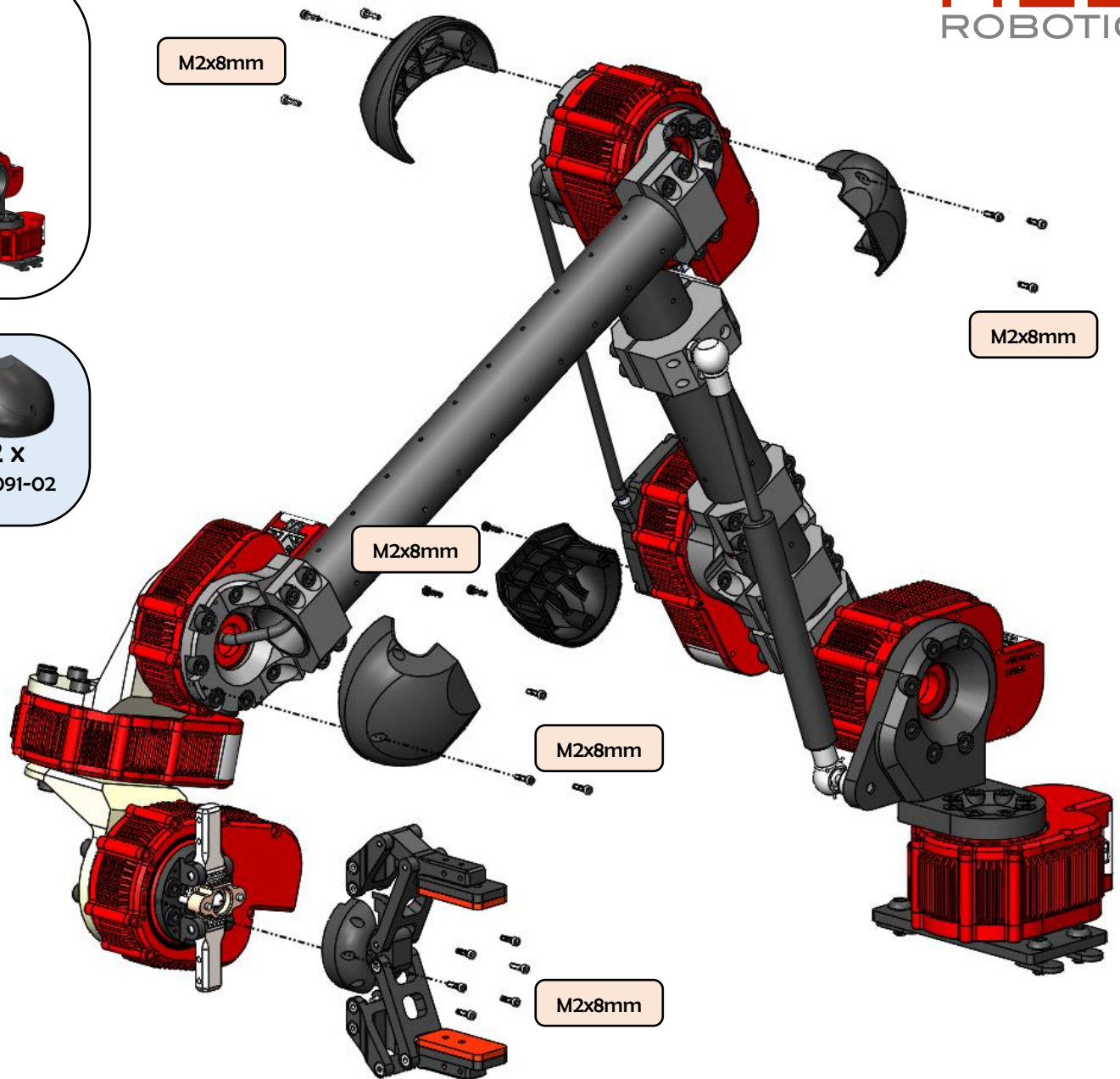
1 x
PM-2290-01
Cable Clamp



M3x8mm

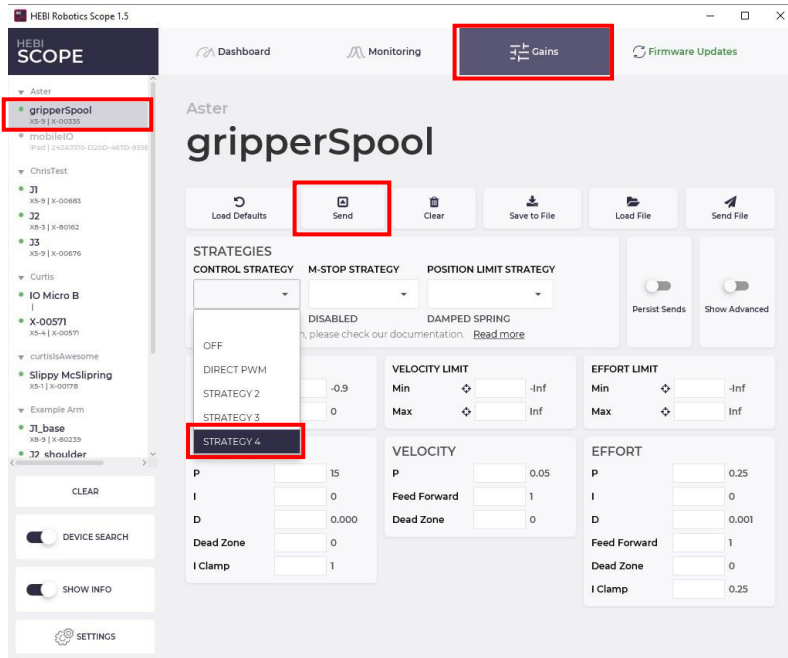


Install cables before
adding caps

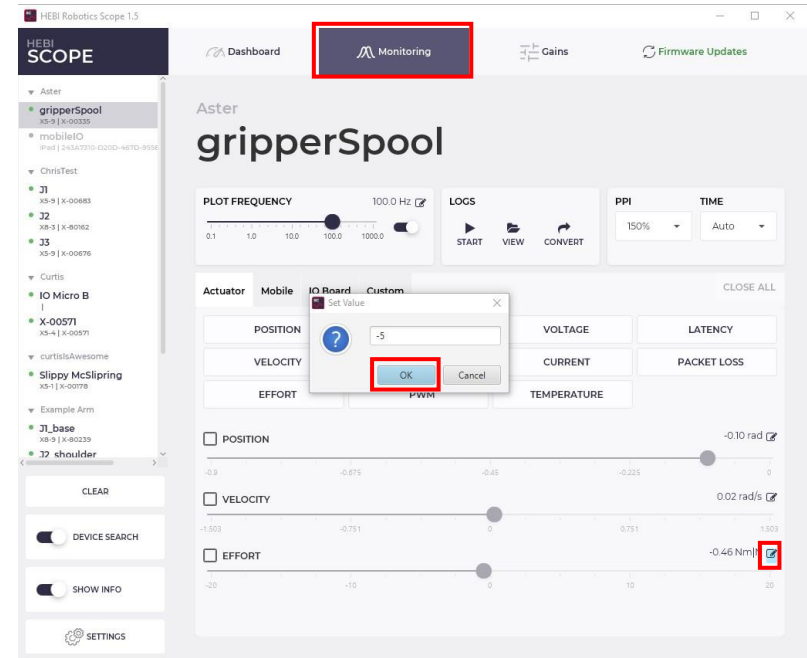


Initializing the Spool, pt. 1

- I. Connect the Spool Module into the network, and turn it on
- II. Open HEBI Scope GUI



- III. Set the Strategy of the Spool Module to “STRATEGY_4”
 1. Click on your Spool Module
 2. Go to “Gains” tab
 3. Use the Control Strategy drop down menu to select a Suitable Strategy for your Application
 4. Click “Send”

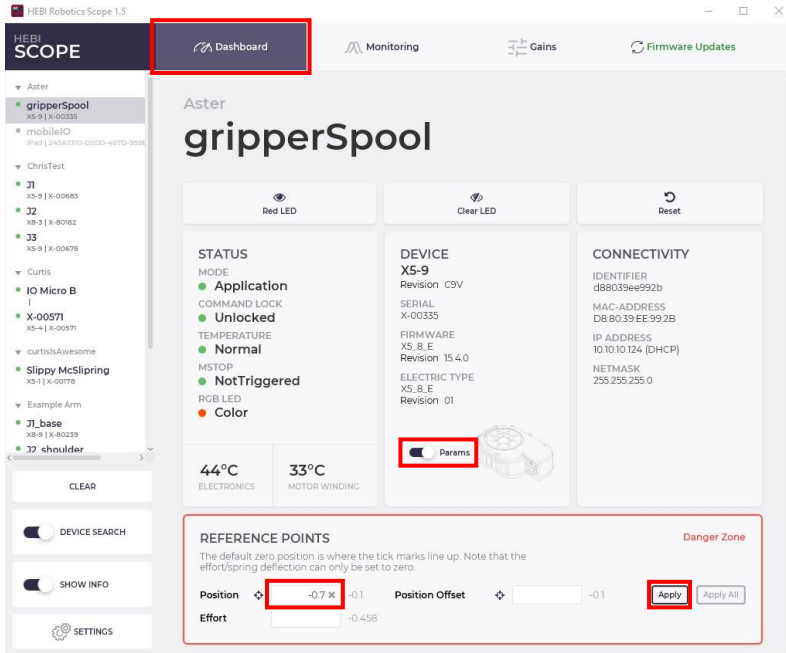


- IV. Command the Effort to -5 Nm
 1. Go to “Monitoring” tab
 2. Click the “Target Button” for the Effort
 3. Type “-5” and Click “OK”



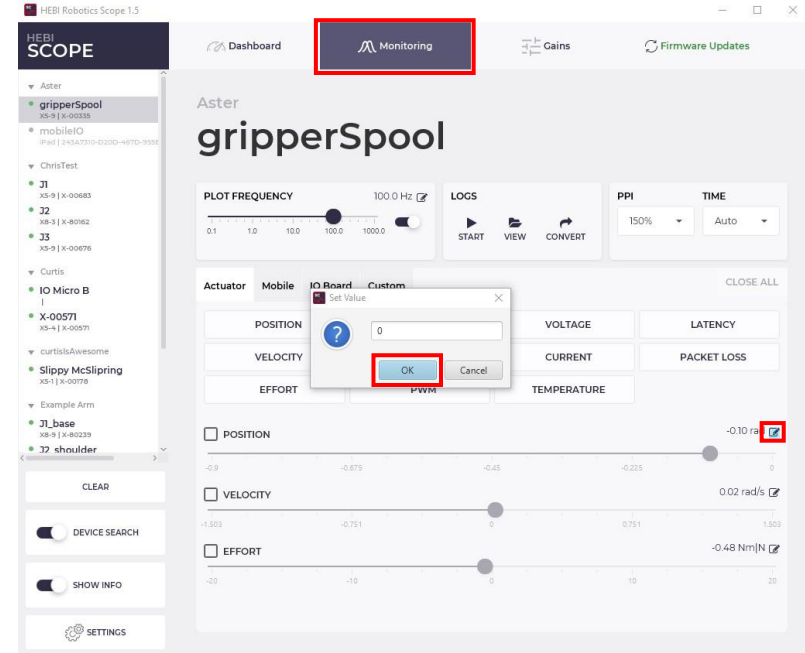
The Spool will wind the Cable and close the Fingers.

Initializing the Spool , pt. 2



V. While Commanding the Effort, set the current position to “-0.7”

1. Go to “Dashboard” tab
2. Toggle “Params” as shown
3. Type “-0.7” for Position
4. Click “Apply”



VI. Stop commanding the effort, and command the position to 0.

1. Go to “Monitoring” tab
2. Click the “Target Button” for Position
3. Type “0” and Click “OK”

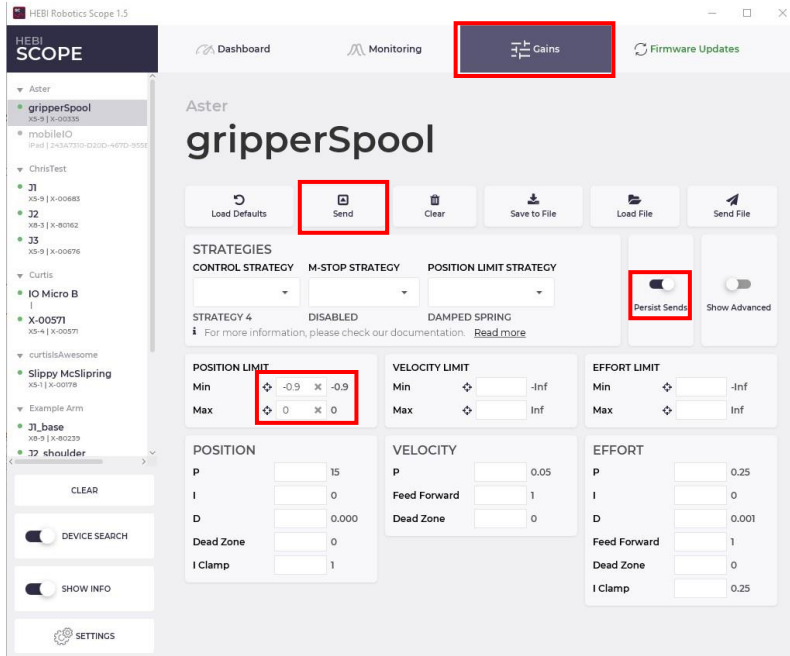


The Spool will unwind the Cable and open the Fingers.

To close the gripper, turn the spool clockwise.

To open the gripper, command the spool to zero position.

Initializing the Spool, , pt. 3



If the Safety Limits are not set, the spool can turn to a position greater than zero, and break the cable.

To close the gripper, turn the spool clockwise (negative effort).

To open the gripper, turn the spool counter-clockwise (positive effort)

VII. Set Safety Limits for the Spool

1. Go to "Gains" tab
2. Type "-0.9" for Min Position
3. Type "0" for Max Position
4. Toggle "Persist Sends" as shown
5. Click "Send"

Additional Accessories

- Power Supply, 24V 220W (A-2098-24)
 - Comes with correct Molex Minifit Jr 2 connector
- Magnet embedded end effector (A-2081-01)
 - Interfaces with hex shaft driver bits for screwing/bolting tasks
 - Screwdriver bits not included
- HEBI I/O Board (A-2116-01)
 - Integrate with 3rd party end effectors or tools using HEBI APIs



