# Mini-Lab 2 Hardware Assembly Instructions

Due to the absolute encoders in the Dynamixel motors and the use of gravity compensation in the code for mini-lab #2, the motors used for the mini lab #2 need to be set to the proper absolute joint positions before assembly. The angles used for gravity compensation are defined relative to the horizontal. To be consistent with this angle definition and prevent the base motor from trying to perform a rotation larger than 180 deg, the base and top motors should have their absolute angles at 180 deg when the manipulator is in the vertical orientation. The instructions below detail one way to achieve this.

1. Unscrew all parts from the motor's shafts.

2. Connect the base motor via Dynamixel Wizard.

3. Disable torque by flipping the switch labeled "Torque" to its off state as shown below
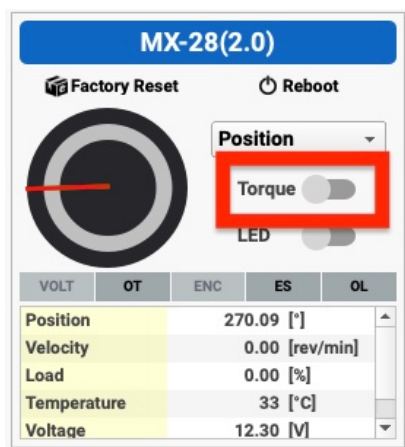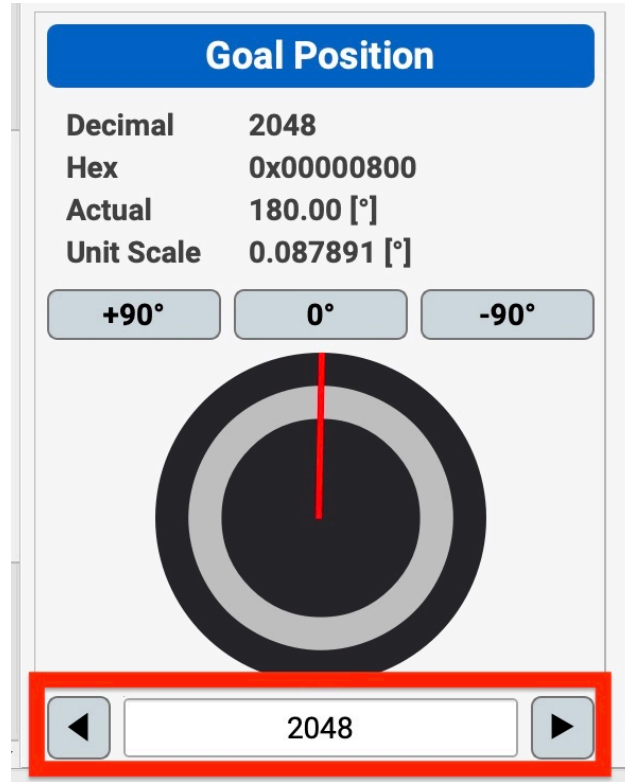

4. Click the dropdown above the switch labeled "Torque" and select "Position" (this sets the Dynamixel to position mode).
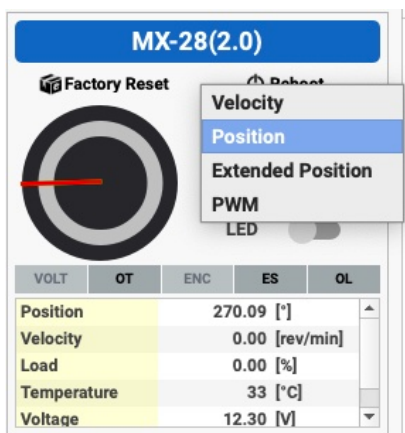
5. In the table in the center of the Dynamixel Wizard window, select the row with "Goal Position" in it's "Item" column.

Address	Item	Decimal	Hex	Actual
84	Position P Gain	850	0x0352	
88	Feedforward 2nd Gain	0	0x0000	
90	Feedforward 1st Gain	0	0x0000	
98	Bus Watchdog	0	0x00	Disable
100	Goal PWM	885	0x0375	100.00 [%]
104	Goal Velocity	230	0x000000E6	52.67 [rev...
108	Profile Acceleration	0	0x00000000	0.00 [rev...
112	Profile Velocity	0	0x00000000	0.00 [rev...
116	Goal Position	3072	0x00000C00	270.00 [°]
120	Realtime Tick	22415	0x578F	22415 [ms]
122	Moving	0	0x00	Idle
123	Moving Status	1	0x01	
124	Present PWM	-7	0xFFF9	-0.79 [%]
126	Present Load	-8	0xFFF8	-0.80 [%]
128	Present Velocity	0	0x00000000	0.00 [rev...
132	Present Position	3073	0x00000C01	270.09 [°]
136	Velocity Trajectory	0	0x00000000	0.00 [rev...
140	Position Trajectory	3072	0x00000C00	270.00 [°]

6. In the bottom right corner of the Dynamixel Wizard window, set the enter the value of 2048 in the provided text field and then press return, as shown below. Note that your motor will move.

Goal Position

Decimal	2048
Hex	0x00000800
Actual	180.00 [°]
Unit Scale	0.087891 [°]

+90°   0°   -90°

◀   2048   ▶

7. For the top motor, perform the same steps as above.

8. Lastly, for each motor, **with torque enabled** screw the manipulator assembly together so that it is in the vertical orientation, as shown below:

Vertical Orientation

Motor Connectors
on Same Side

Isometric View

Side View