Instructions for Setup of Active Elbow Orthosis 2017:

First calibrate the sensor:

1. Assemble the brace to the case with the gearbox inside and the potentiometer in the hole on top of the gearbox
2. Stabilize the top of the potentiometer in one position so that it will fit into the top of the case and will not move
3. Move the brace to 0 degrees
4. Using a DMM, measure the resistance of the potentiometer where the two wires connect to the potentiometer*
5. Move the brace to some other angle (suggested 90 degrees)
6. Again measure the resistance of the potentiometer
7. Repeat steps 3 to 6 for increased accuracy if desired. Keep the angles consistent
8. Input the resistance measurements and angles into the arduino code (the variables are Angle1, Angle2, Resistance1, and Resistance2 - lines 18 through 21 in Motor_Angle.ino). If multiple measurements are taken, average the resistance values
9. To test the accuracy, edit the arduino code in whatever editor preferred (suggestion: https://create.arduino.cc/editor). In AEO_HTTPS_Request.ino, go to the bottom where the setup and loop functions are. Comment out everything in those functions except “Serial.Begin(9600)”. Uncomment out “read_angle();” and “delay(1000);” so they are active
10. Connect the Arduino to the computer and upload the arduino code to the board
11. The Serial Monitor will display the measured angle of the AEO
12. If there is a constant shift in the values (ex. Measured angle is 8 but actual angle is 10 and then after movement measured angle is 88 but actual angle is 90), then use the AngleCorrectionFactor variable to remove this shift. The displayed angle will be the measured angle minus the AngleCorrectionFactor (line 164 in Motor_Angle.ino)
13. There is likely a different kind of offset in the measurements. In the past, the higher the angle of the AEO, the higher the error would be. Use the AdditionalAngleCorrector variable to remove this offset. The offset is linear so the AdditionalAngleCorrector is a linear equation used to remove this offset. To calibrate the AdditionalAngleCorrector, record the measured angle readings at different angles and use that data to create a linear equation for the AdditionalAngleCorrector (line 167 in Motor_Angle.ino)**
14. After adding in the equation for the AdditionalAngleCorrector to the Arduino code, upload the new code to the Arduino board
15. If the Serial Monitor is still not displaying the correct angle, then the potentiometer may not be stabilized
16. After the angle is being read correctly, in AEO_HTTPS_Request.ino, go to the bottom where the setup and loop functions are. Uncomment out “setup_wifi();”, “setup_motor();”, and “web_listen_for_clients();” so that they are active functions. Then comment out “read_angle();” and “delay(1000);”

*When the brace is at the 0 degree position, the resistance of the potentiometer should be around 1 kOhm. If it is not ~1 kOhm, remove the potentiometer from the top of the gearbox and rotate the potentiometer top until it reads ~1 kOhm.
**The Arduino code already has the AdditionalAngleCorrector set. If it is not working the first time, set the AdditionalAngleCorrector to 0 and then make recordings to create a new corrector.

Setup Rest of the AEO:

1. In the Arduino code, set the WiFi name and password in lines 5 and 6 of AEO_HTTPS_Request.ino to the preferred WiFi credentials***
2. Reprogram the Arduino code to the Arduino Board
3. Plug the Arduino battery into the Arduino and plug the motor battery into the adapter. Switch on the motor battery
4. Press the reset button on the Arduino then wait for the AEO to initialize

***Setting the WiFi credentials to an iPhone personal hotspot is convenient because it allows one to see when the Arduino connects