

## Test Plan

### 1.) Entire Apparatus Test

Date completed:

Performed by:

Requirement #	Importance	Metric	Unit	Target Value	Subsystem
S1	9	Cost	\$	200	Entire Apparatus
S2	6	Weight of tester	lbs	50	Entire Apparatus
S8	7	Repeatability using gauge R&R	%	10% due to measurement error	Entire Apparatus

### Equipment:

- Base/Pivot Point
- Clamp
- Arduino
- Power Supply
- Motor
- Motor Shield
- Strain Gauge
- Strain Gauge Shield
- Wooden Dowel

### Cost and Weight Test:

Equipment	Cost
Base/Pivot Point	
Clamp	
Arduino	
Power Supply	
Motor	
Motor Shield	
Strain Gauge	
Strain Gauge Shield	
Wooden Dowel	
<b>Total Weight:</b>	<b>Total Cost:</b>

**Gauge R&R:** Measures the amount of variation in the measurement system arising from the measurement device and the people taking the measurements

- 1.) Three team member will set up the system and run it using 5 different hands (for a collection of 15 data points)
- 2.) Collect the data for each trial on each team member
- 3.) Plug into minitab or another statistical software
- 4.) Determine the variability between users and equipment

Variation due to measurement error:	
-------------------------------------	--

**2.) Motor Test**

Date completed:

Performed by:

Requirement #	Importance	Metric	Unit	Target Value	Subsystem
S3	5	Duration of Test	min	5	Motor
S5	8	Torque	oz/in	250	Motor
S7	8	Angle Measurement Accuracy	°	+/- 2	Motor

**Equipment:**

- Base/Pivot Point
- Arduino
- Motor
- Motor Shield
- Power Supply/Computer

**Duration test:**

Start test and time how long it takes until the fingers of the hand reach 45 degrees.

Test #	Duration
#1	
#2	
#3	
#4	
<b>Average:</b>	

**Torque Test:**

- 1) Attach a bar to the end of the stepper.
- 2) Add weights to the end of the bar.
- 3) See chart below.

Weight (lbs)	Pass/Fail	Time Between Steps (s)
<b>Weight of Bar:</b>		
<b>Length of Bar:</b>		

**Angle Measurement Accuracy Test:**

- 1) Mount protractor to base with 0 degrees being our neutral position.
- 2) Input number of steps and measure angle using the protractor.
- 3) See chart below.

Number of Steps	Angle Measured (Protractor)	Theoretical Angle (Stepper)	Error ( $\pm$ )
<b>Average:</b>			

### 3.) Strain Gauge Test

Date completed:

Performed by:

Requirement #	Importance	Metric	Unit	Target Value	Subsystem
S4	9	Max Force of Sensor	lbs	50	Load Cell
S6	8	Force Measurement Accuracy	oz	+/- 1	Load Cell

#### Equipment

- Power Supply/Computer
- Arduino
- Strain Gauge Shield
- Strain Gauge
- Wooden Dowel

#### Max Force Test and Force Measurement Accuracy Test:

- 1) Attach load cell to one of the dowel halves and hang the assembly horizontally.
- 2) Hangs weights off the load cell.
- 3) See chart below.

Weight (lbs)	Pass/Fail	Error ( $\pm$ )
<b>Average:</b>		
<b>Max Weight Needed for Test:</b>		