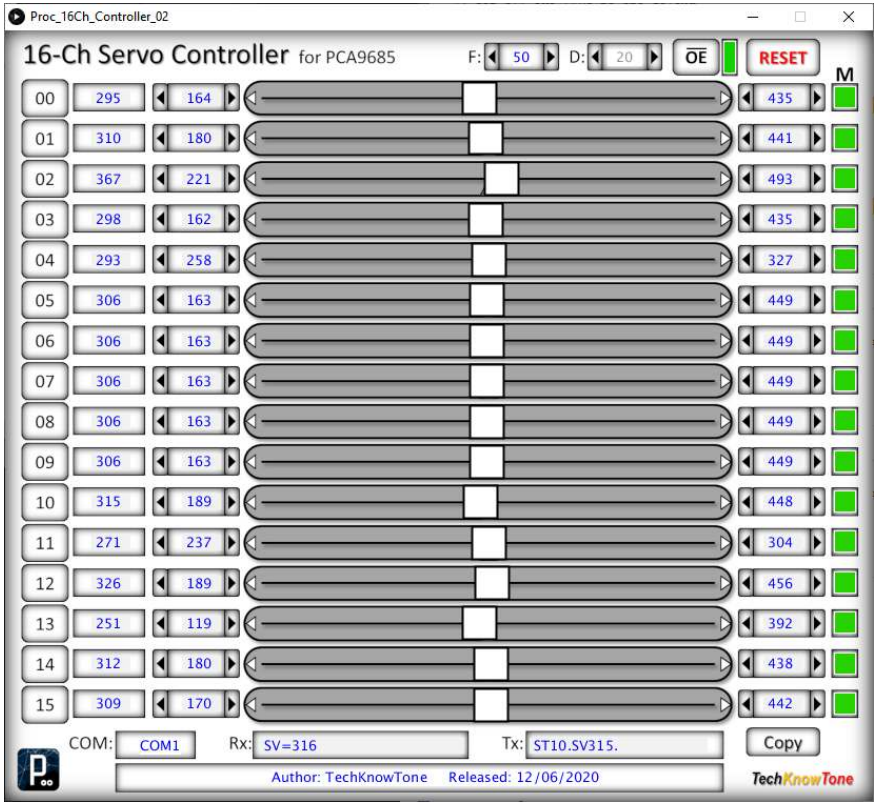
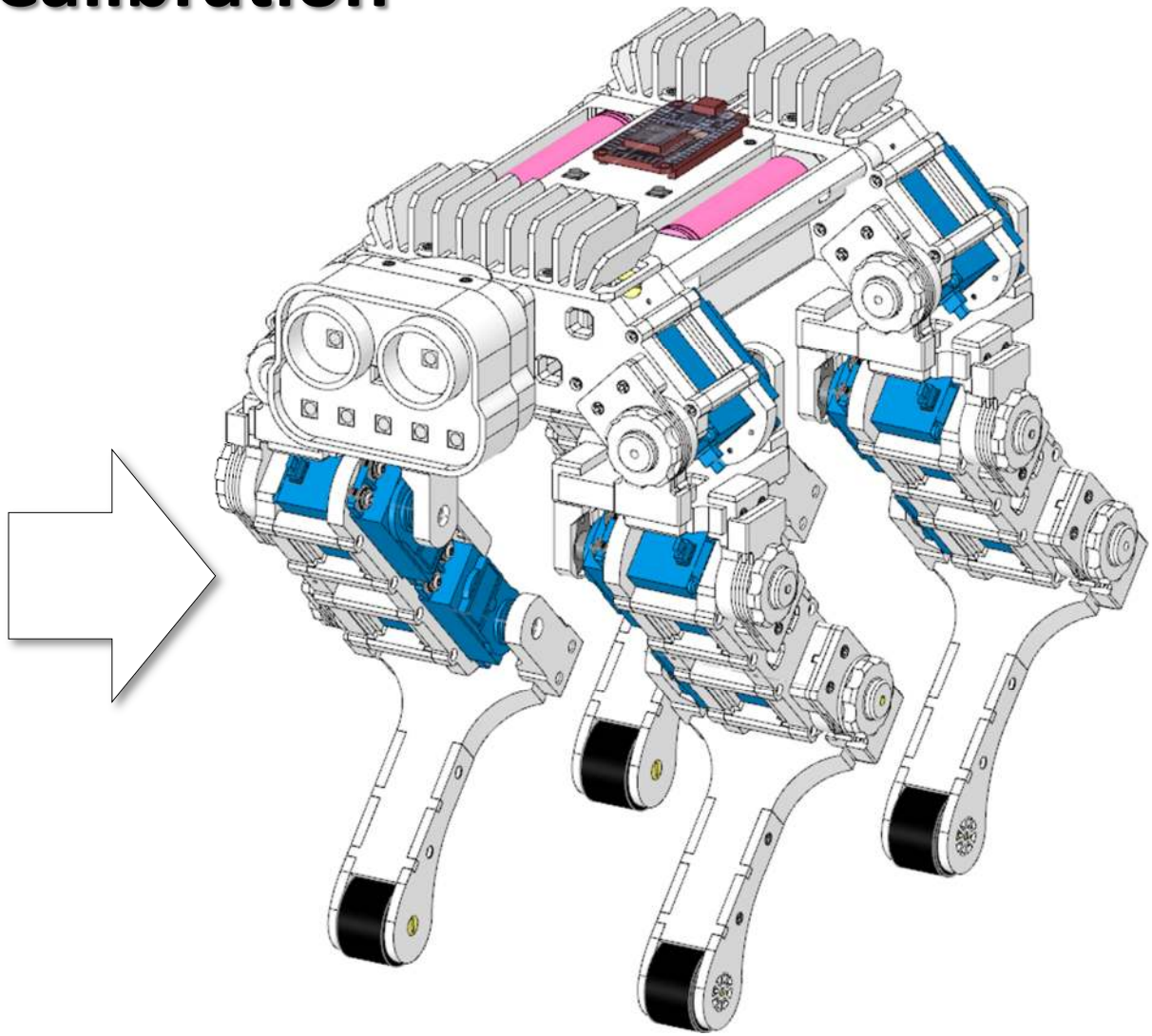
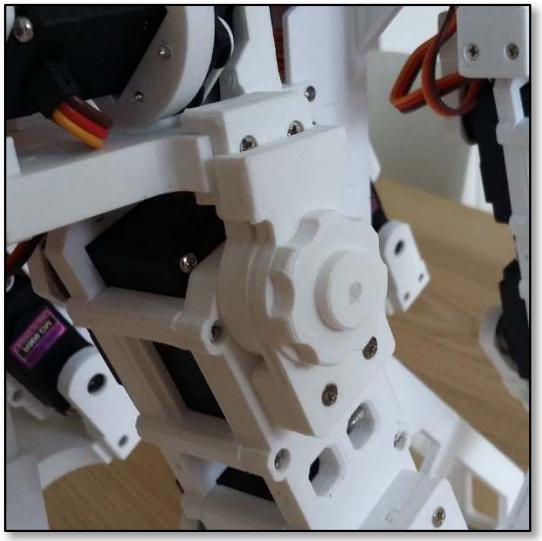
RoboDog

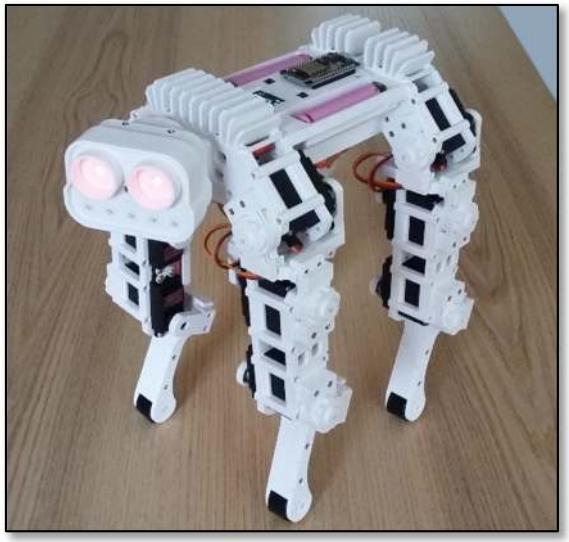
Servo Calibration





Course Calibration

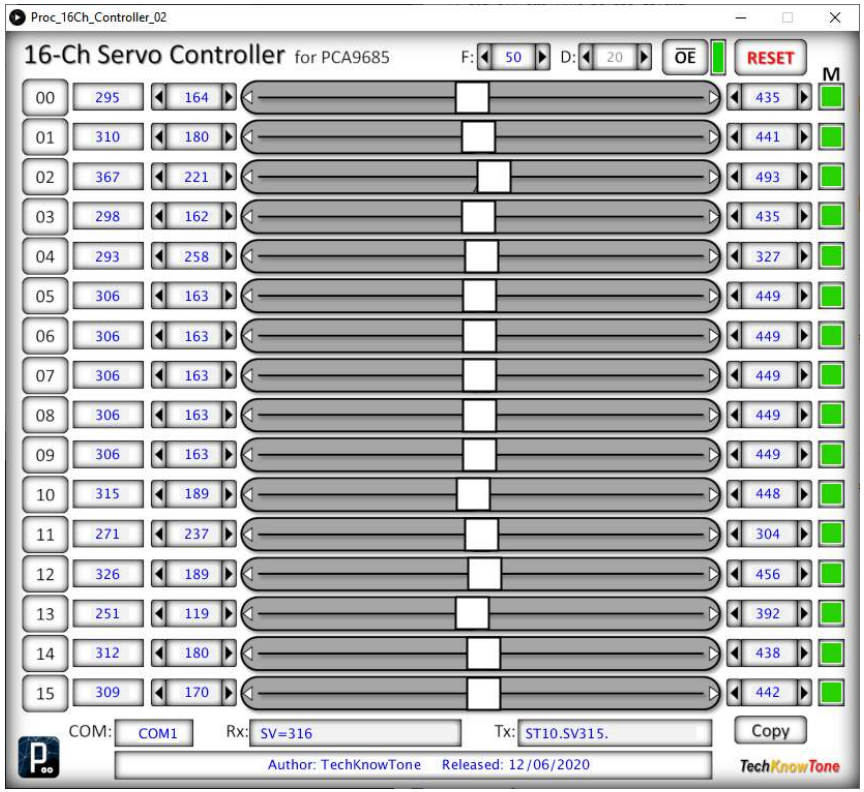




Use a servo tester when attaching the servos to your droid initially, to set the angles of the attached levers in their approximate positions. The next slide shows the PWM values to be set for each servo.

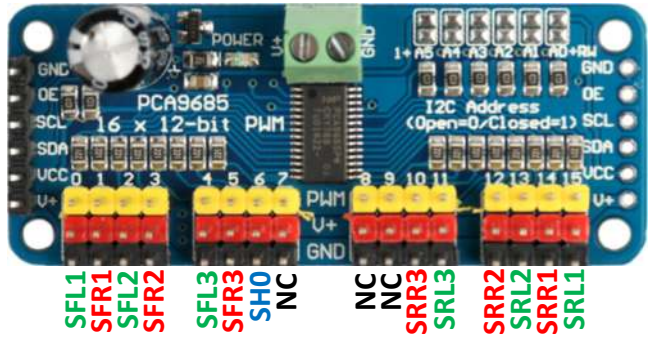
Once you have assembled and wired up your droid to the PCA9685 driver board you can use the application I have provided. This works with special code you need to install temporarily on the ESP8266 micro. With this app you can select each servo in turn and move the slider to determine values needed to achieve the calibration angles shown in the subsequent pages of this guide. With all of the values determined you simply press the COPY button and paste them directly into your C++ code in the IDE.

Note that as no two servos are alike, the values I have given in this guide, and included in the sample code, will be similar but different from the ones you derive from your robot. That's the nature of servos!

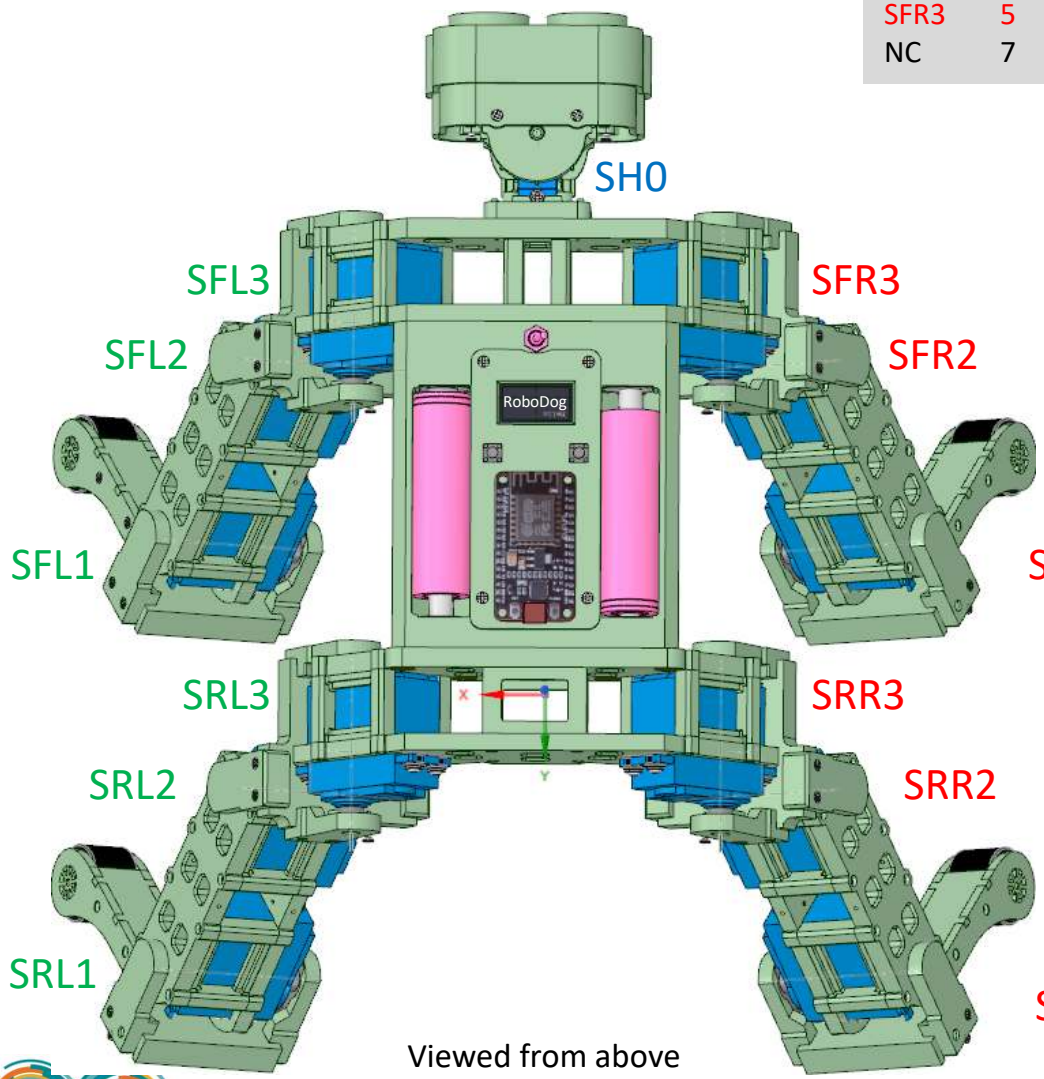


Servo Names & Channels

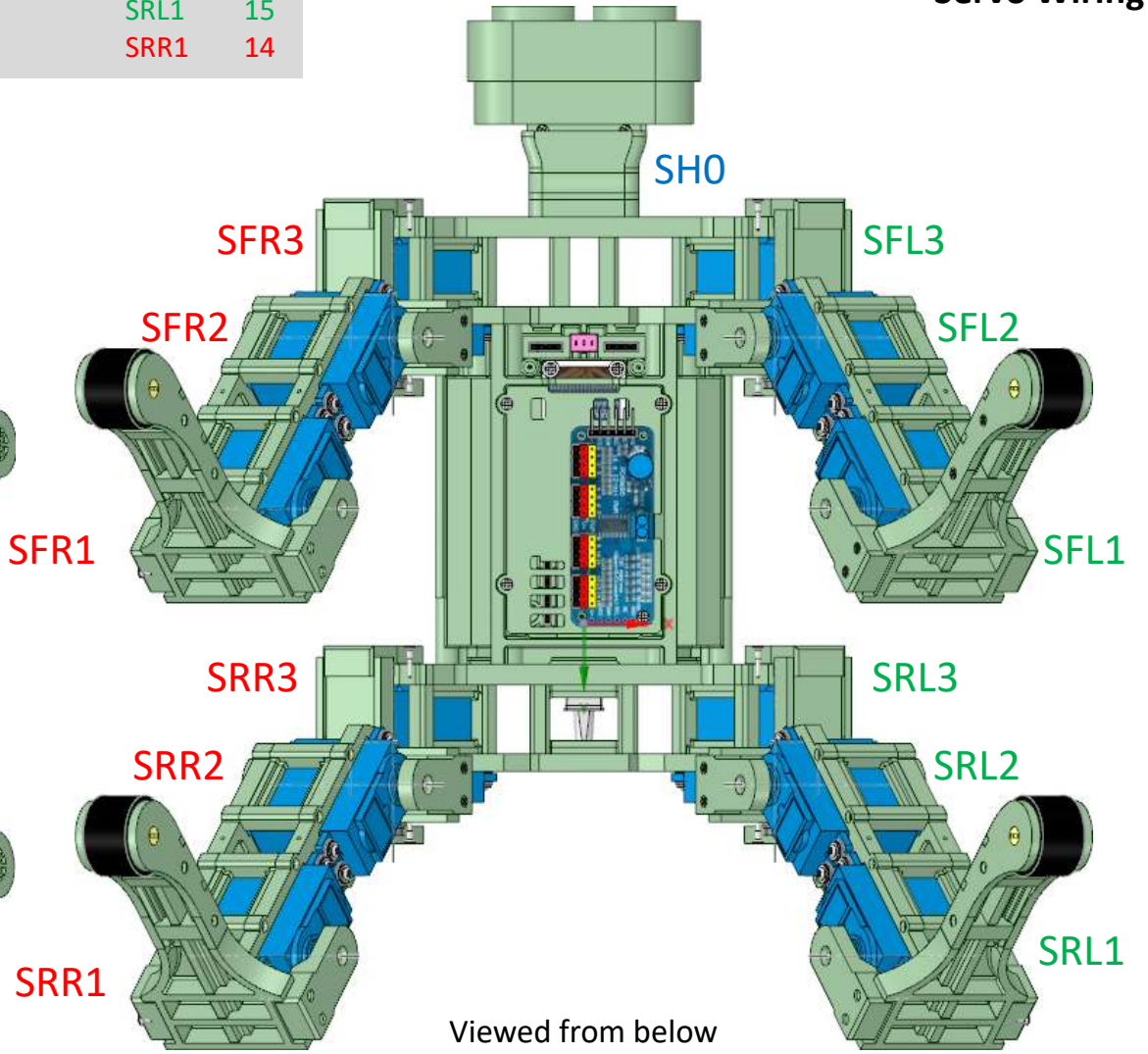
Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14



Servo Wiring

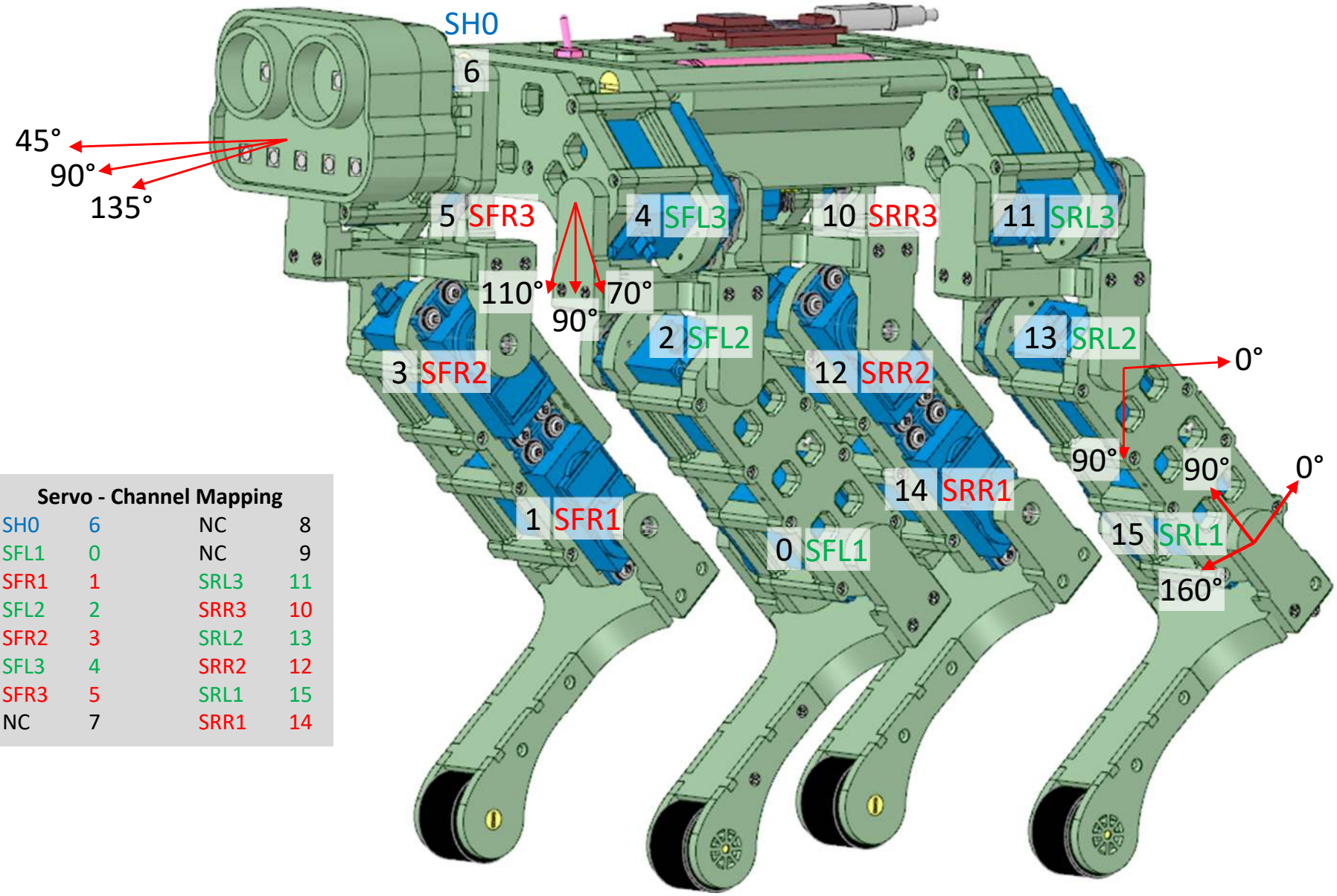


Viewed from above



Viewed from below

Angle summary



Servo - Channel Mapping

SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

Head Calibration

Start by calibrating the head servo SH0, which is connected to channel 0 of the PCA9685 driver board. Whilst the MG90D servo may move over a range of 180° it is not desirable to drive it to its mechanical end stops, as excessive current will be drawn, wasting battery power and reducing the life of the servo. So in this design I have chosen to move it through 90°, +/- 45° from the centre position.

Enable channel Ch6 only on the 16-Ch controller app and move the corresponding slider left to determine the lower setting. Note that the memory 'M' lamp for channel 6 will change from green to yellow. It should be possible to move the servo just beyond this target point if the servo arm was fitted correctly during the build process. If this is not the case the arm will need to be removed and reattached to the servo in a more counter-clockwise position. With the head just short of its rightmost position, record that value and click in the lower limit text field of the 16-Ch controller to set this channel 6 lower limit to the current slider PWM position.

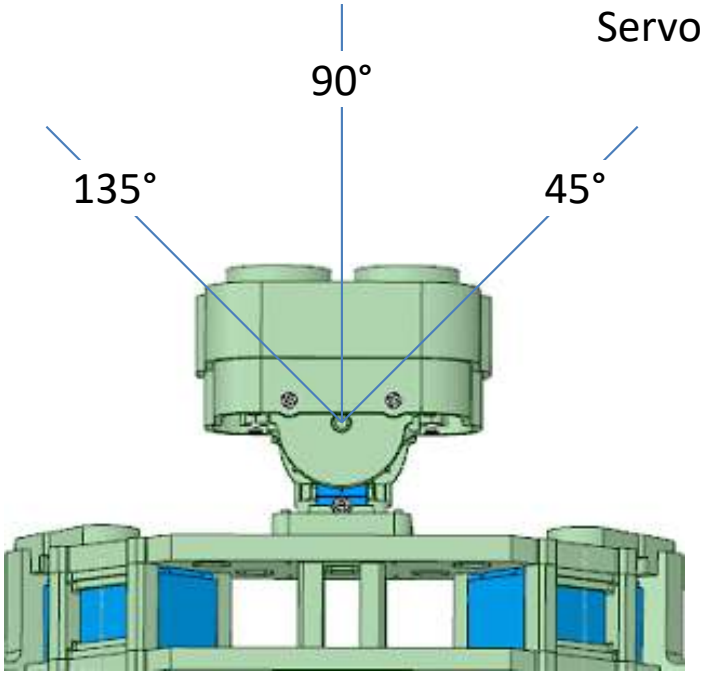
Now move the channel 6 slider to the right, and in the same way determine the PWM value needed to reach the leftmost 135° position. Record this value and click in the upper limit text field of the 16-Ch controller to set the channel 6 upper limit to the current slider position.

Finally move the slider towards the centre 90° position to determine the PWM value needed for position. If the servo is linear the value should be half-way between the lower 45° and upper 135° limits found, but this may not quite be true, as seen in the values here.

Now click on the memory 'M' lamp for channel 6, holding the mouse key down for more than 1 second for it to turn from yellow to blue. The values you have set will then be memorised by the app, and will be included in the data copied to the clipboard for pasting into your code later.

You should now be able to move the channel 6 slider freely from left to right between the lower and upper limits, to swing the head from right to left. Finally turn OFF channel 6.

Servo **SH0**
Ch6



Angle	PWM	
45°	229	LL
90°	332	Centre
135°	424	UL

Centre PWM = LL + ((UL – LL)/2)
= 229 + ((424 – 229)/2)
= 326

The calculated and measured centre values may not match if the servo is not linear.

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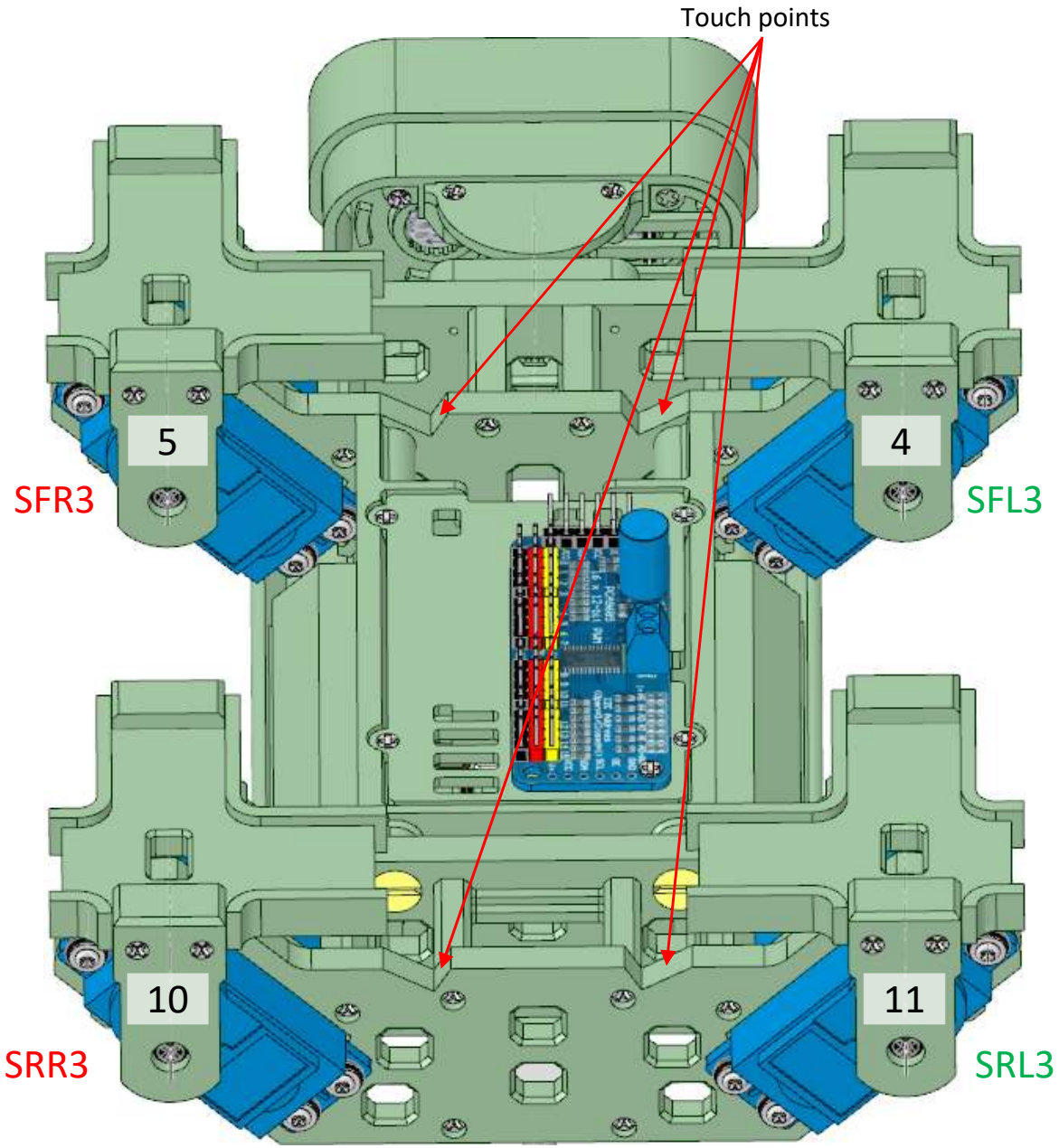
Shoulder setup

Place the droid on its back.
Start with servo SFR3 on PCA9685 channel 14.
Set the PWM value to 130 and try to fit the leaver arm with the plate touching. If not possible vary the value between 130 – 140 to get this to fit. Now confirm that you can get the arm to touch the body, at the point shown, and record its value.

Repeat this process for the other three servos SFL3, SRR3, SRL3.

Values recorded:

SFR3	121
SFL3	460
SRR3	141
SRL3	471



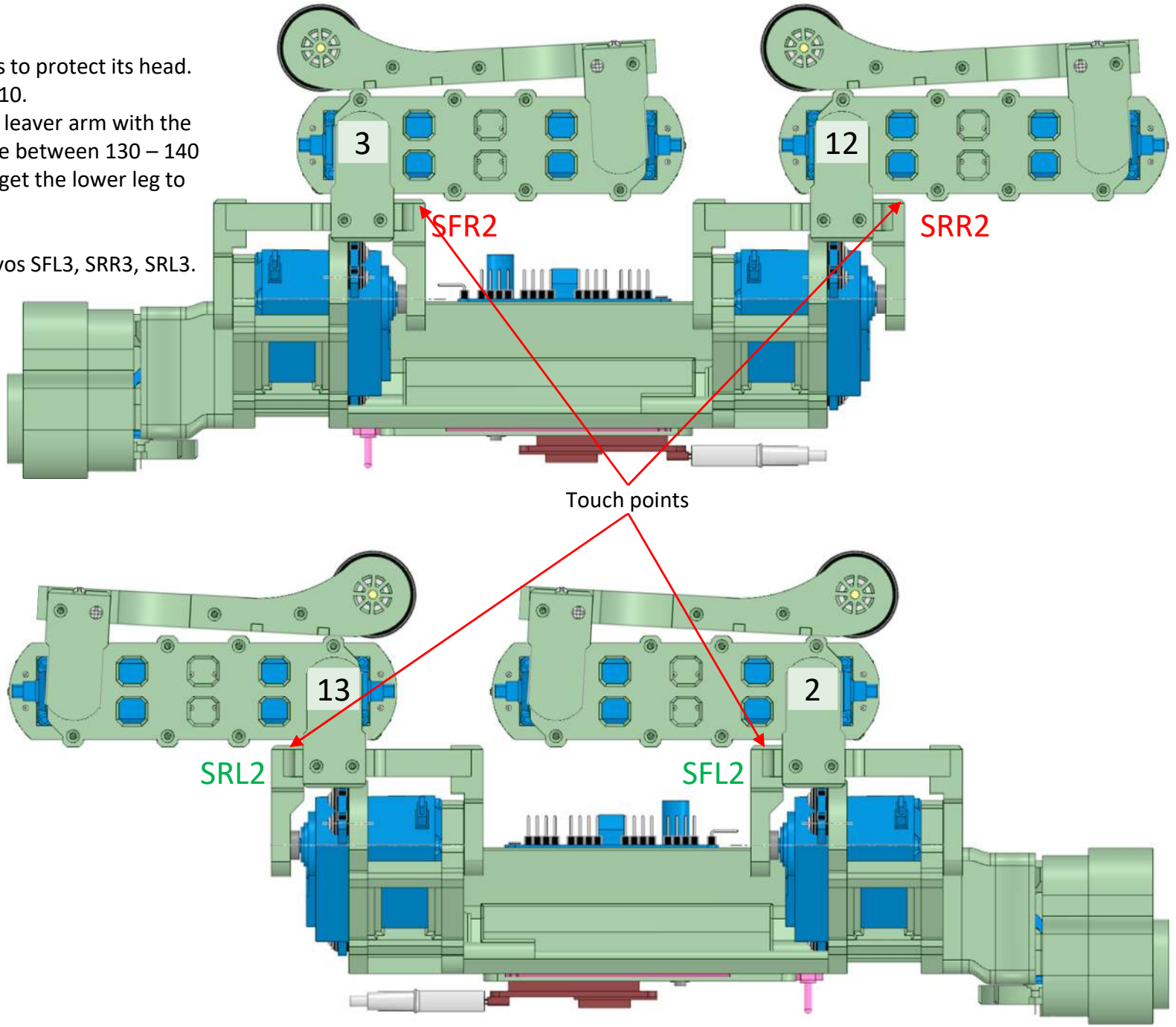
Upper leg setup

Place the droid on its back on its two stands to protect its head.
Start with servo SFR1 on PCA9685 channel 10.
Set the PWM value to 130 and try to fit the leaver arm with the plate touching. If not possible vary the value between 130 – 140 to get this to fit. Now confirm that you can get the lower leg to touch the upper leg and record its value.

Repeat this process for the other three servos SFL3, SRR3, SRL3.

Values recorded:

SFR2	113
SRR2	116
SFL2	473
SRL2	487



Servo - Channel Mapping

SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

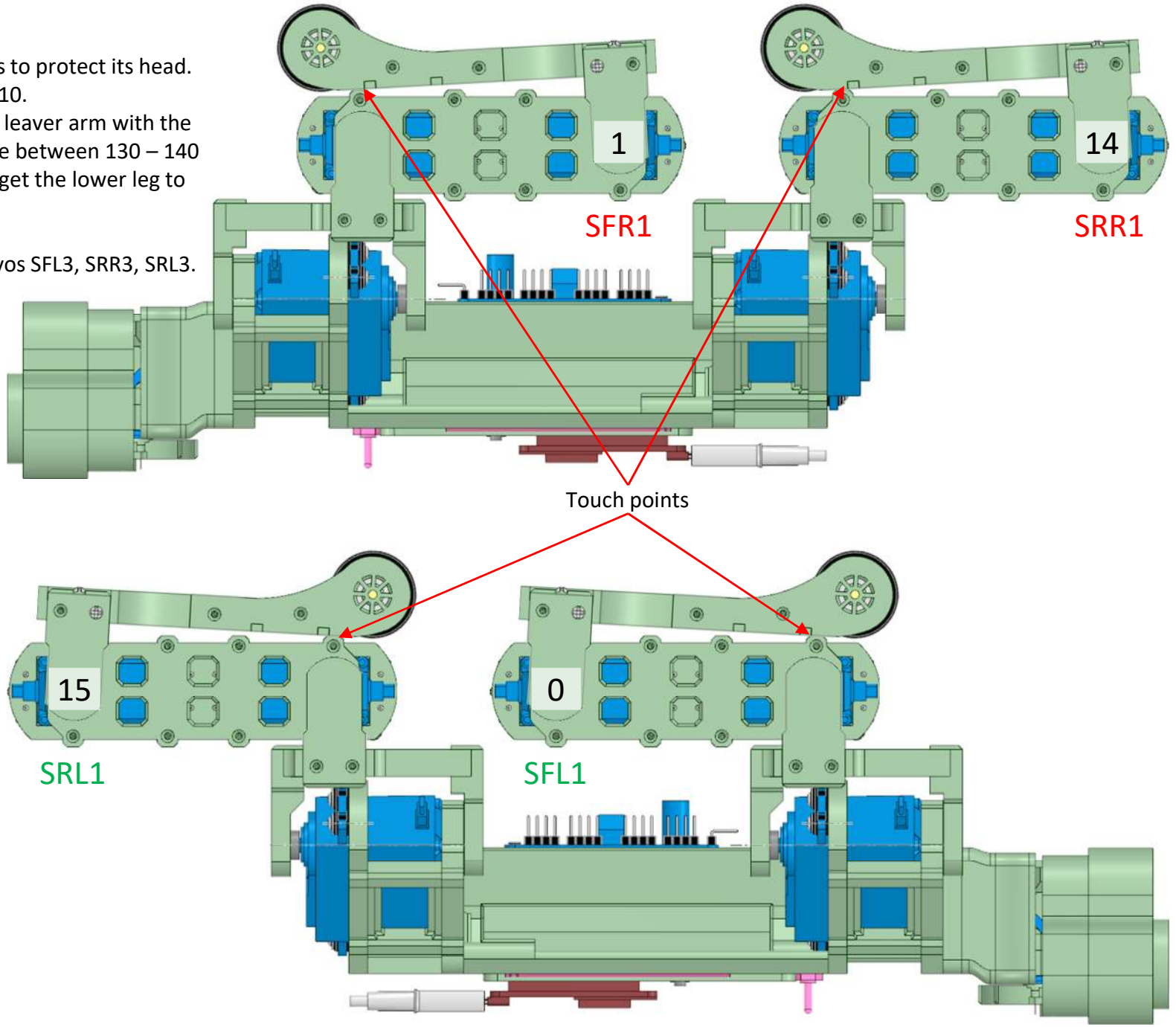
Lower leg setup

Place the droid on its back on its two stands to protect its head.
Start with servo SFR1 on PCA9685 channel 10.
Set the PWM value to 130 and try to fit the leaver arm with the plate touching. If not possible vary the value between 130 – 140 to get this to fit. Now confirm that you can get the lower leg to touch the upper leg and record its value.

Repeat this process for the other three servos SFL3, SRR3, SRL3.

Values recorded:

SFR1	120
SRR1	130
SFL1	471
SRL1	476



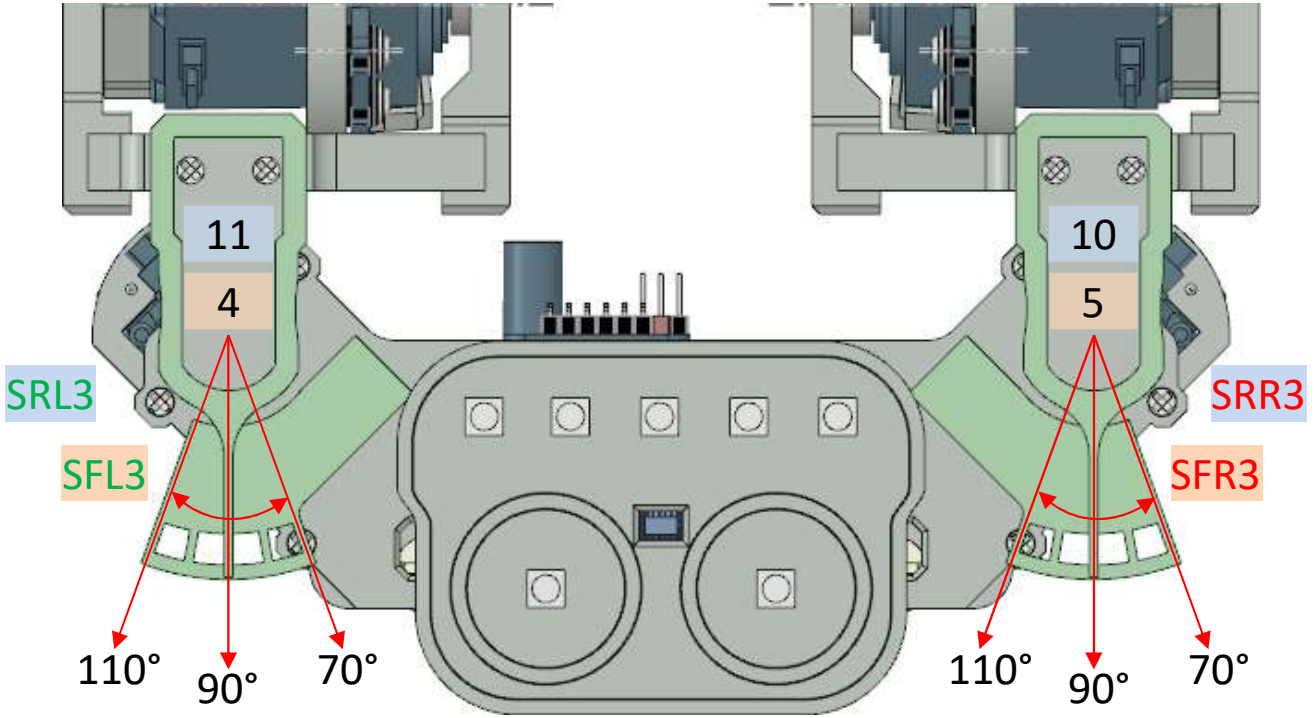
Servo - Channel Mapping

SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

Shoulder angles

Place the droid on its back.
Start with servo SFR3 on PCA9685 channel 5.
Attach the angle gauge and pointer to the shoulder.
Adjust the PWM value to position the should at the three angles 70°, 90° and 110°, and record their corresponding PWM values.

Repeat this process for the other three servos SFL3, SRR3, SRL3.



Values recorded:

Servo	70°	90°	110°
SFL3	344	394	440
SFR3	143	189	230
SRL3	357	404	446
SRR3	160	209	251

Servo - Channel Mapping

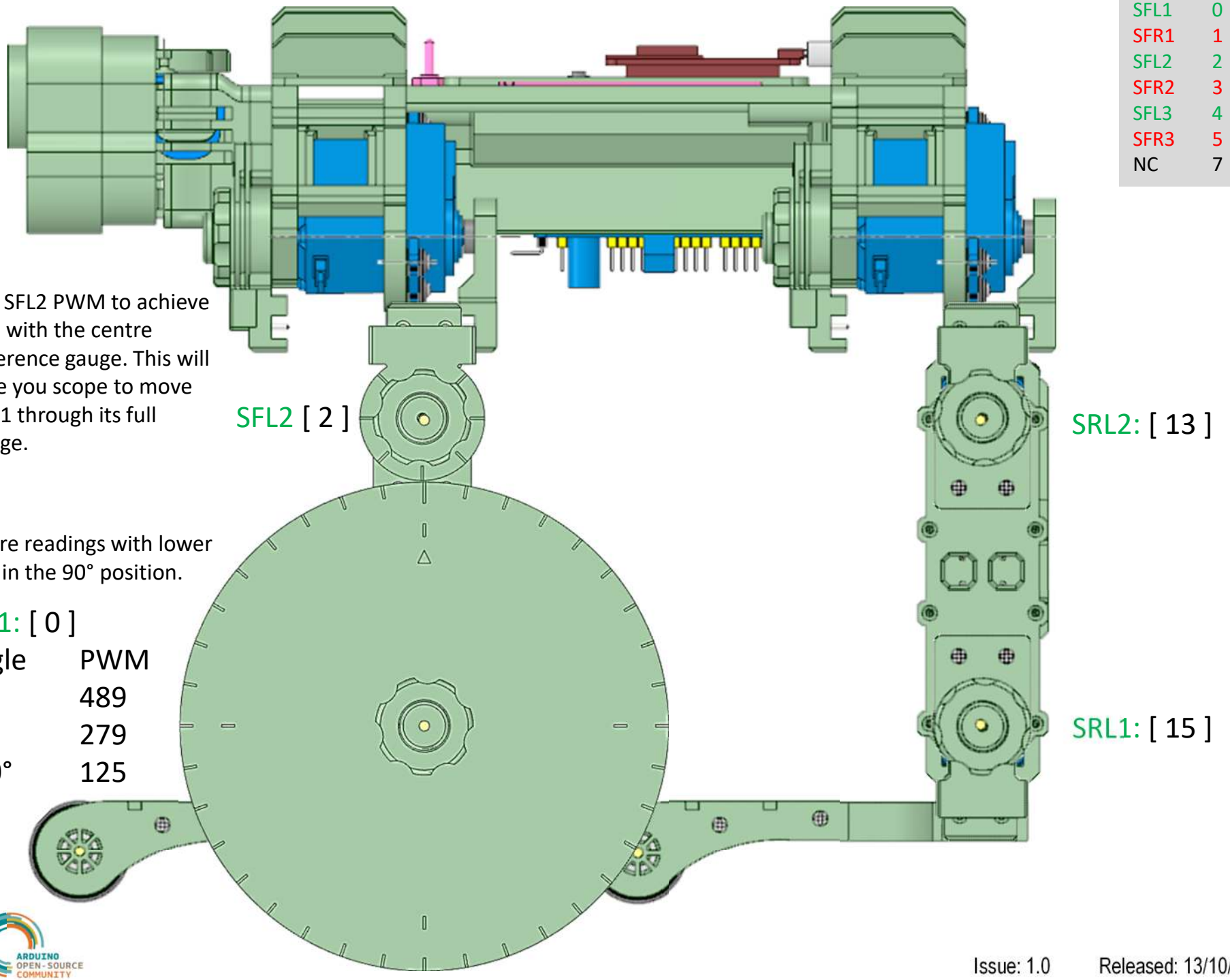
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

Calibration of SFL1:

Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

Set SFL2 PWM to achieve 45° with the centre reference gauge. This will give you scope to move SFL1 through its full range.

Store readings with lower leg in the 90° position.

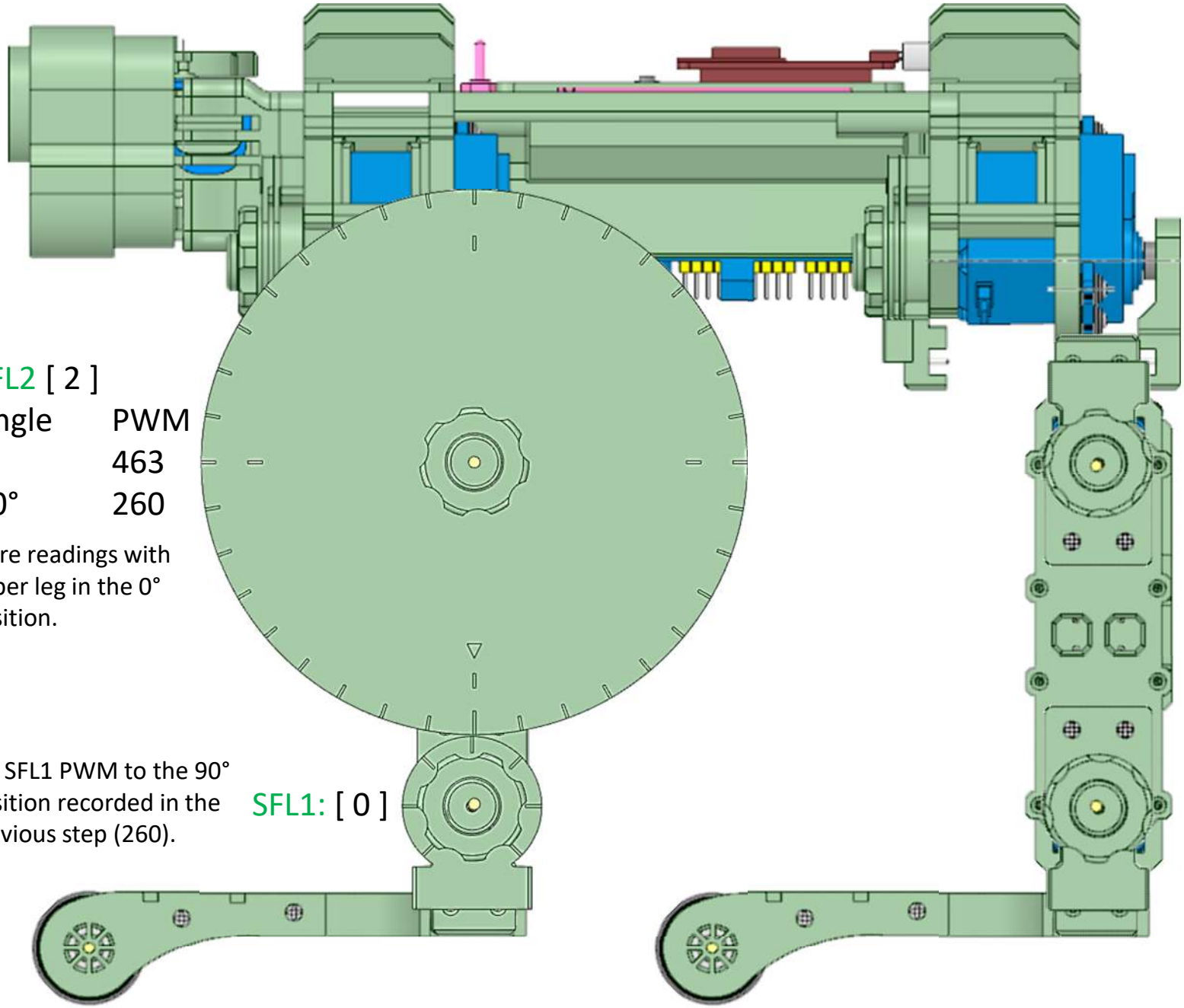


SFL1: [0]

Angle	PWM
0°	489
90°	279
160°	125

Calibration of SFL2:

Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14



SFL2 [2]

Angle	PWM
0°	463
90°	260

Store readings with upper leg in the 0° position.

Set SFL1 PWM to the 90° position recorded in the previous step (260).

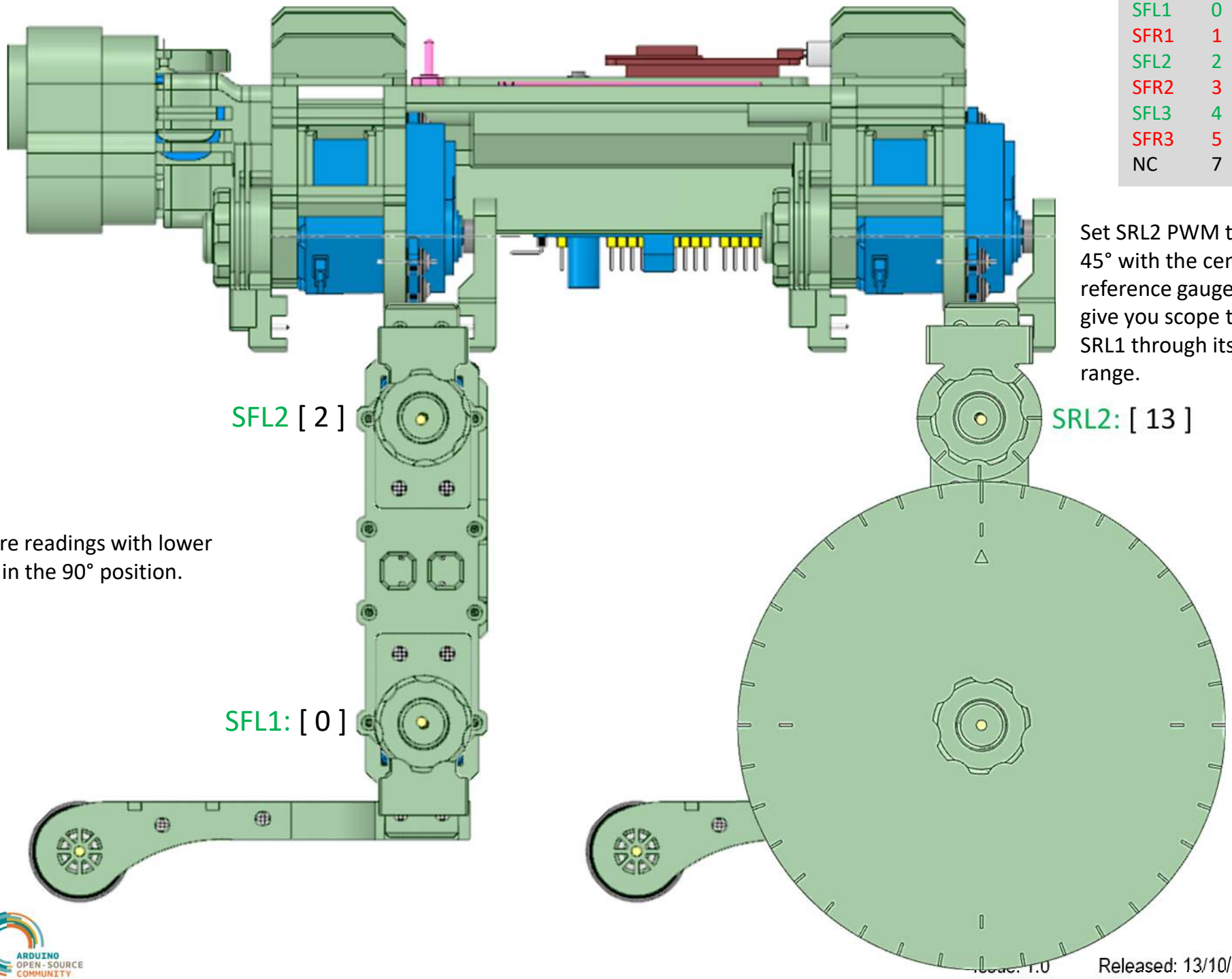
SFL1: [0]

SRL2: [13]

SRL1: [15]

Calibration of SRL1:

Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14



Set SRL2 PWM to achieve 45° with the centre reference gauge. This will give you scope to move SRL1 through its full range.

Store readings with lower leg in the 90° position.

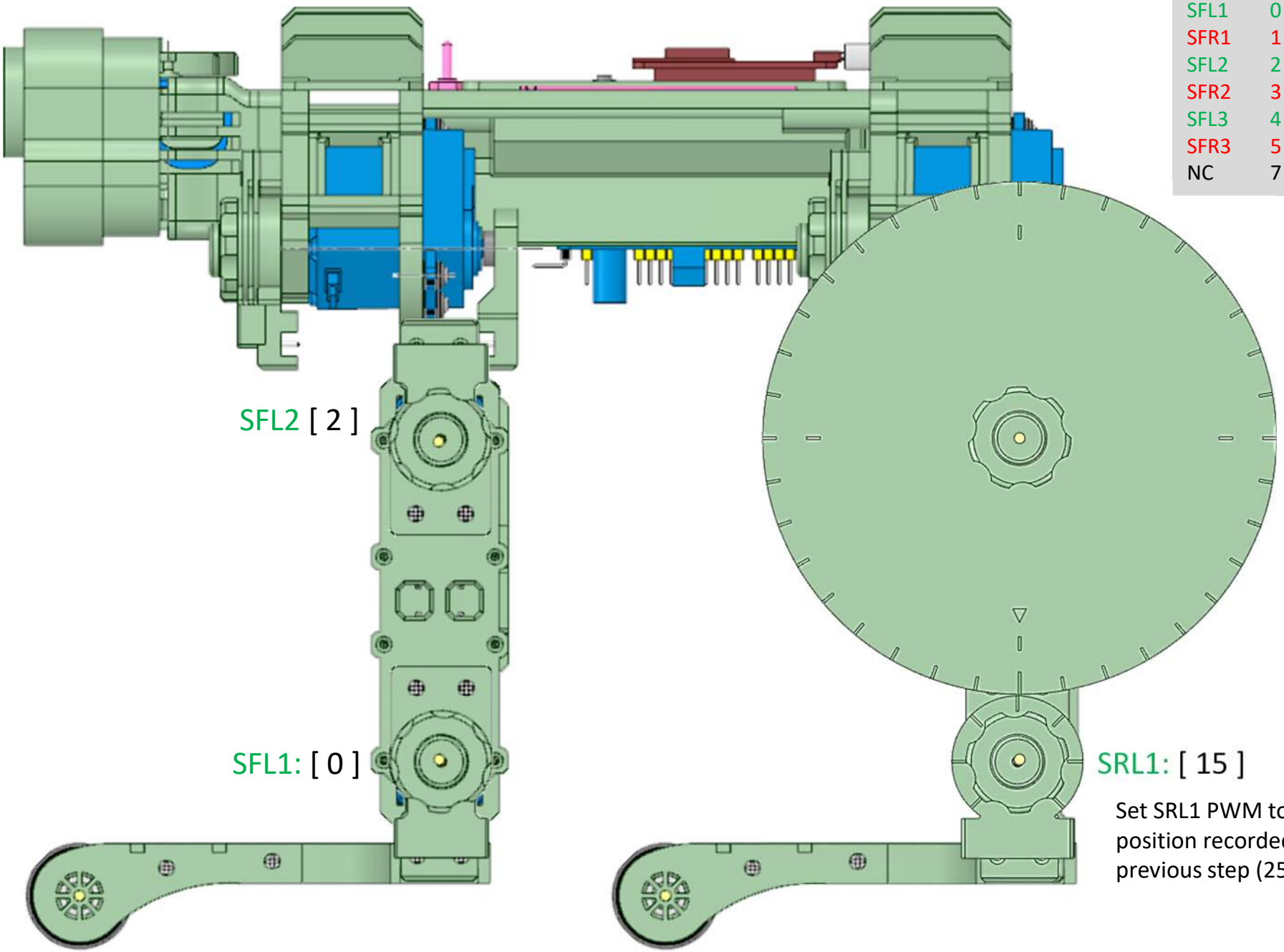
Store readings with lower leg in the 90° position.

SRL1: [15]

Angle	PWM
0°	472
90°	253
160°	101

Calibration of SRL2:

Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14



SRL2: [13]

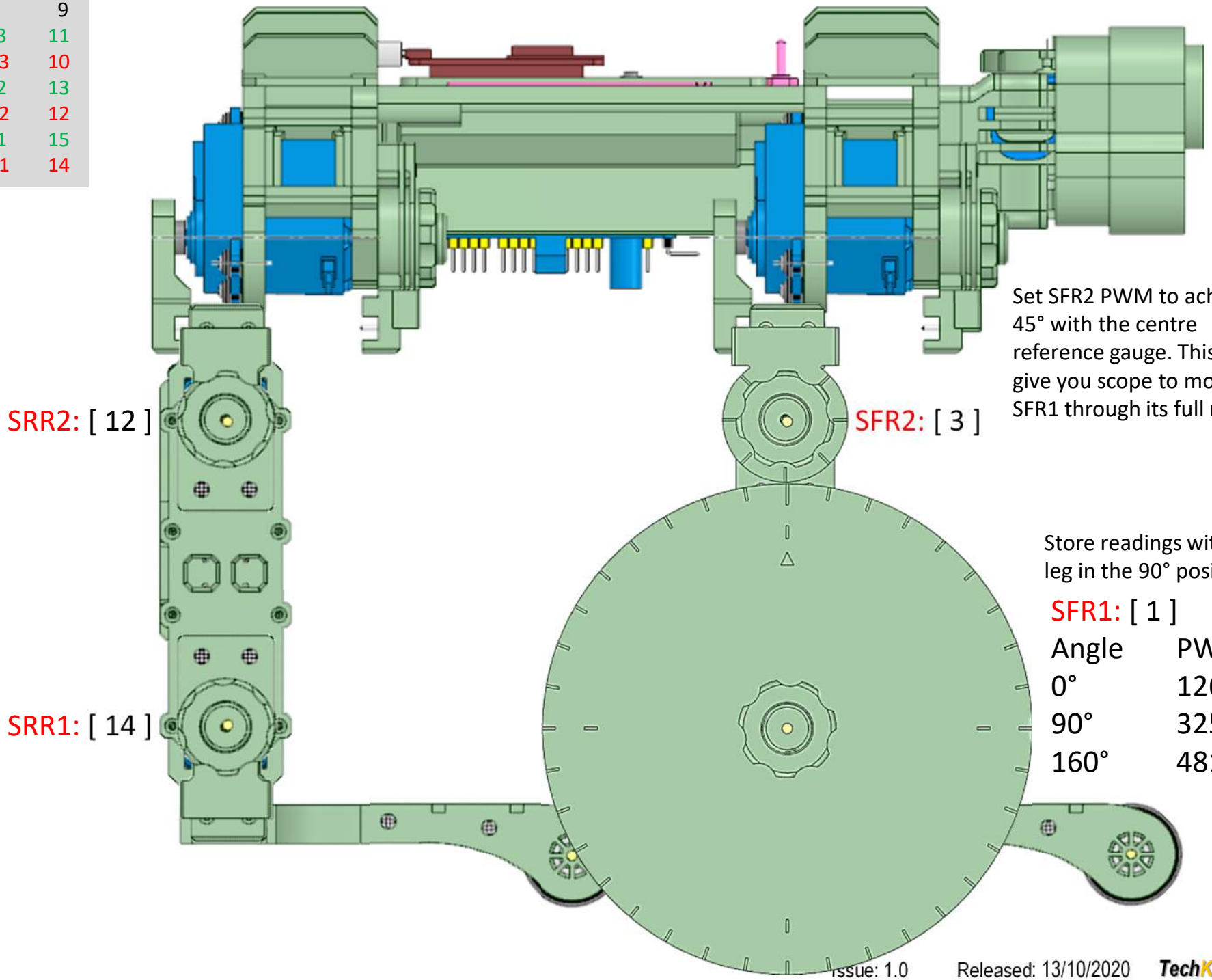
Angle	PWM
0°	478
90°	268

Store readings with upper leg in the 0° position.

Set SRL1 PWM to the 90° position recorded in the previous step (253).

Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

Calibration of SFR1:



Set SFR2 PWM to achieve 45° with the centre reference gauge. This will give you scope to move SFR1 through its full range.

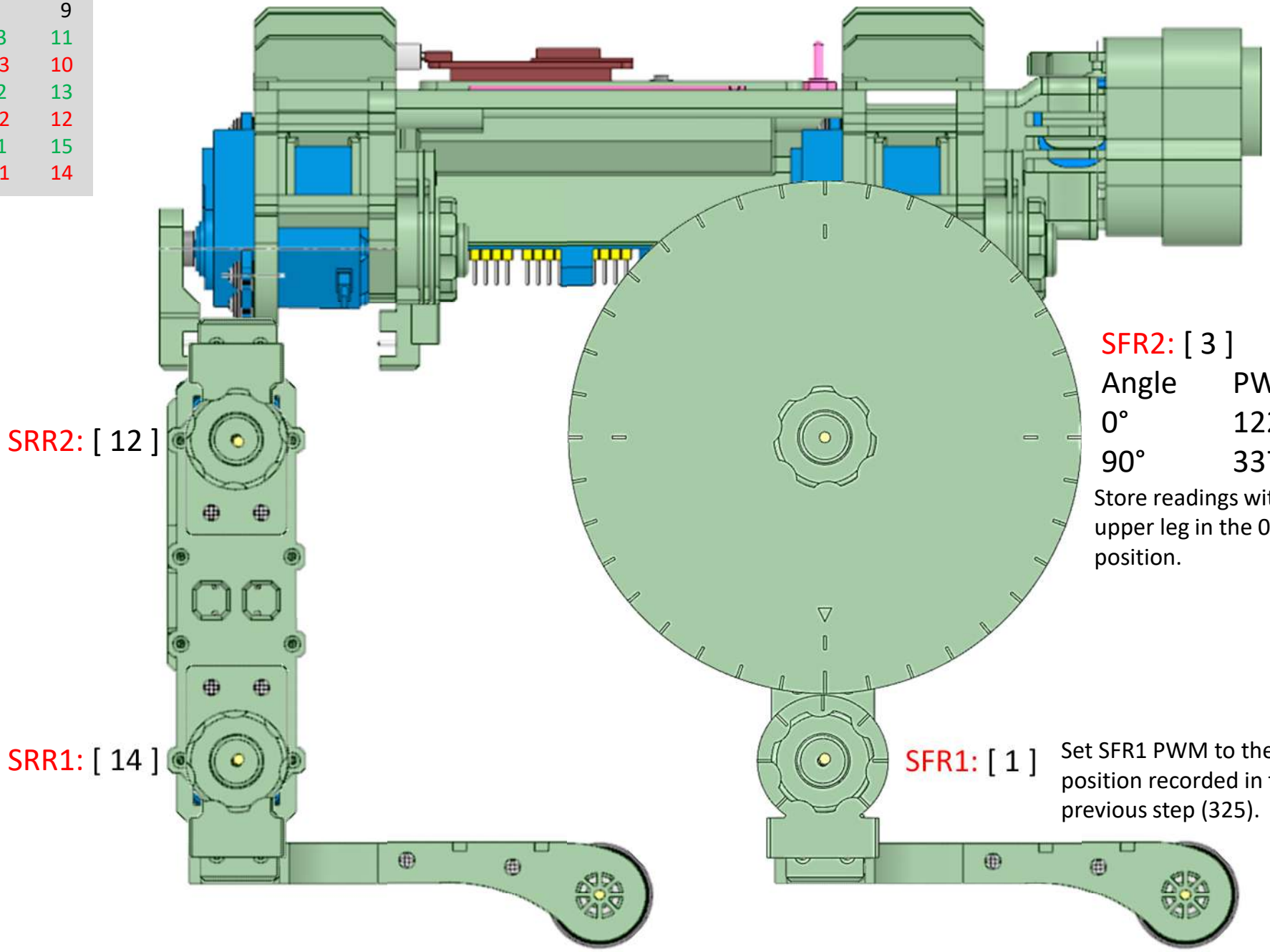
Store readings with lower leg in the 90° position.

SFR1: [1]

Angle	PWM
0°	126
90°	325
160°	481

Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

Calibration of SFR2:



SRR2: [12]

SRR1: [14]

SFR2: [3]

Angle	PWM
0°	122
90°	337

Store readings with upper leg in the 0° position.

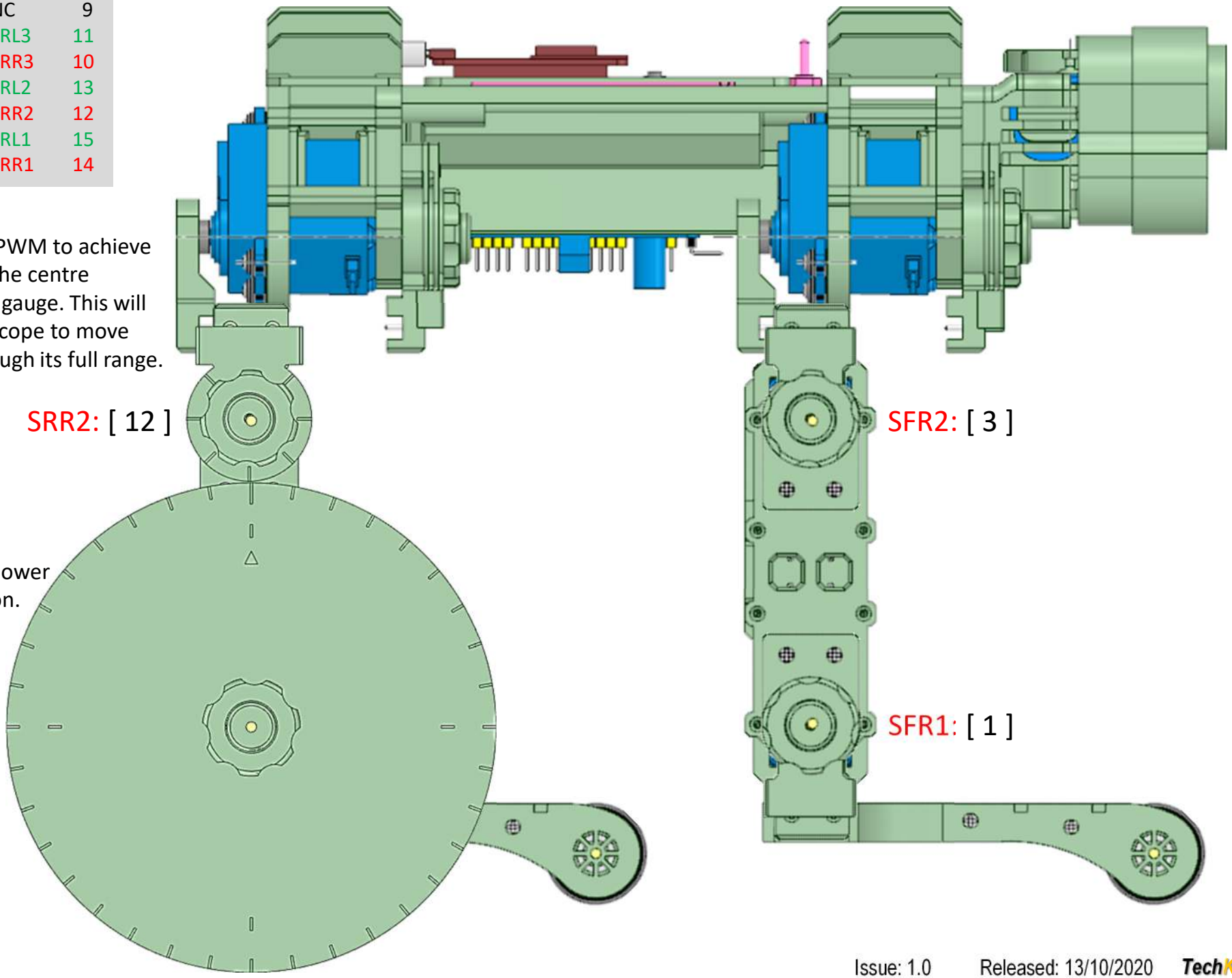
SFR1: [1]

Set SFR1 PWM to the 90° position recorded in the previous step (325).

Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

Calibration of SRR1:

Set SRR2 PWM to achieve 45° with the centre reference gauge. This will give you scope to move SRR1 through its full range.



Store readings with lower leg in the 90° position.

SRR1: [14]

Angle	PWM
0°	135
90°	340
160°	506

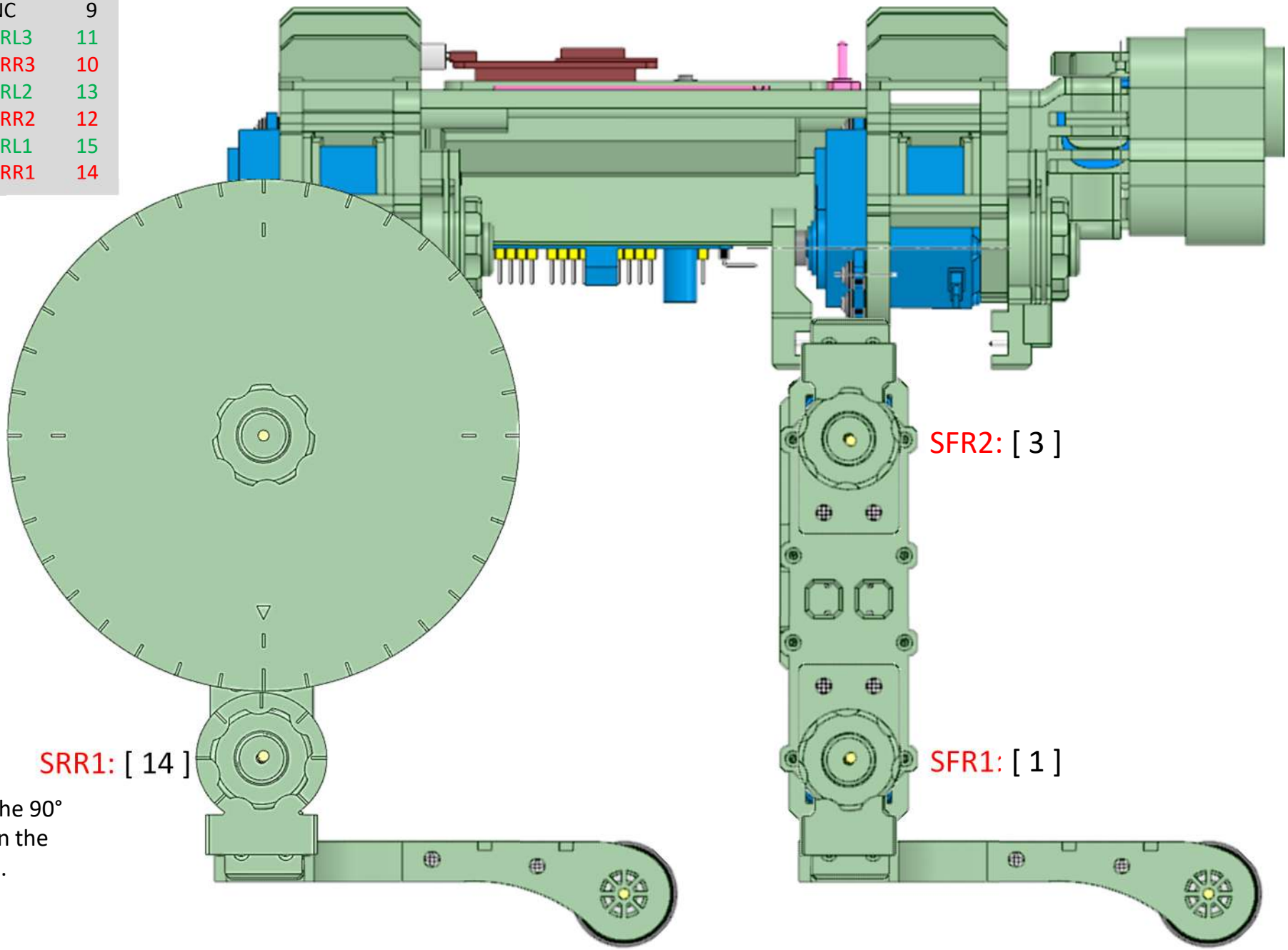
Servo - Channel Mapping			
SH0	6	NC	8
SFL1	0	NC	9
SFR1	1	SRL3	11
SFL2	2	SRR3	10
SFR2	3	SRL2	13
SFL3	4	SRR2	12
SFR3	5	SRL1	15
NC	7	SRR1	14

Calibration of SRR2:

SRR2: [12]

Angle	PWM
0°	122
90°	333

Store readings with upper leg in the 0° position.



Set SRR1 PWM to the 90° position recorded in the previous step (340).