QUAD ROBOT
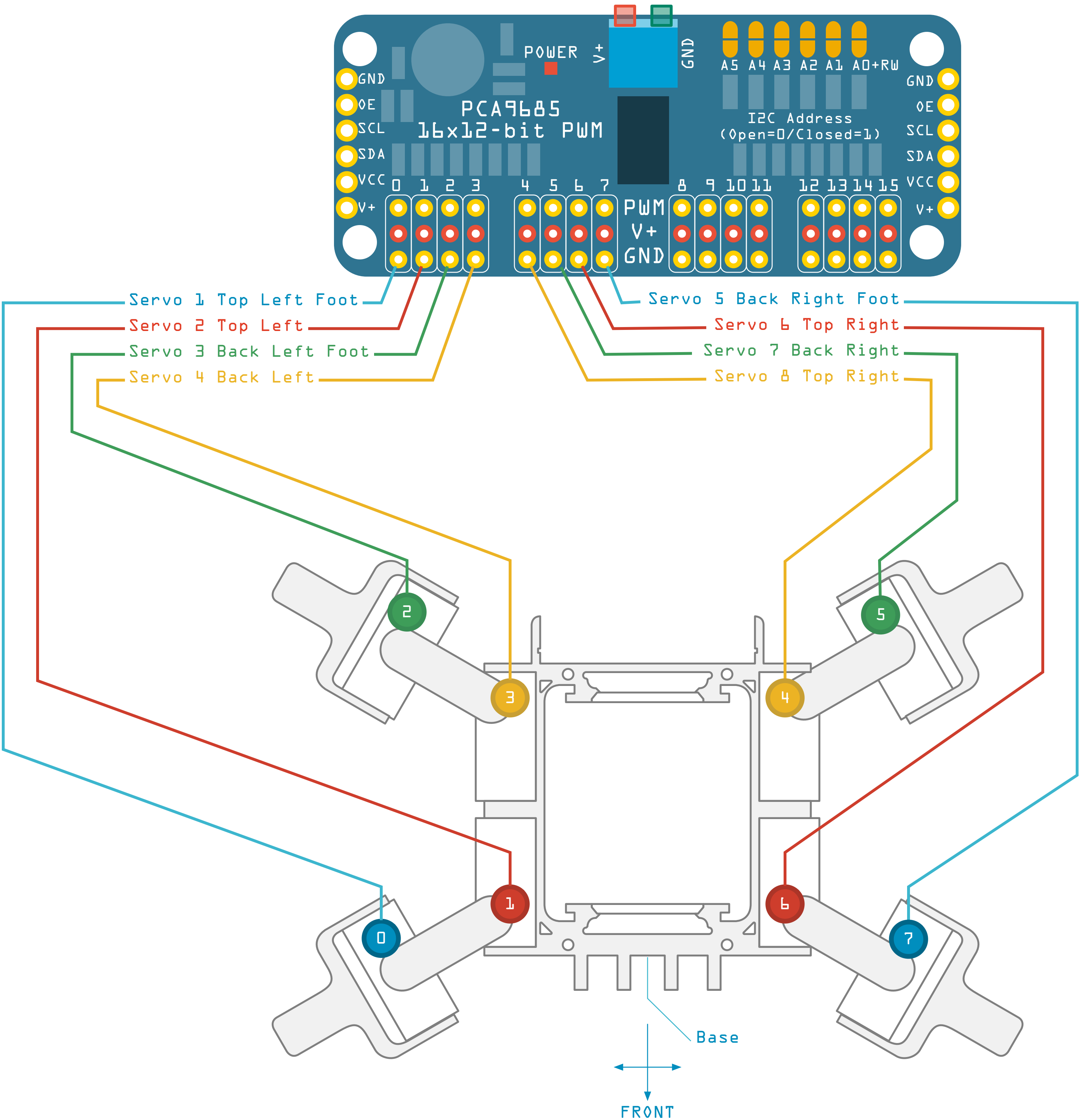# WIRING DIAGRAM

SMARS

Connect the Servos to the servo driver board using the corresponding port numbers as shown below.

POWER V+ GND

PCA9685
16x12-bit PWM

A5 A4 A3 A2 A1 A0+RW

I2C Address
(Open=0/Closed=1)

GND
OE
SCL
SDA
VCC
V+

GND
OE
SCL
SDA
VCC
V+

0 1 2 3   4 5 6 7   PWM V+ GND   8 9 10 11   12 13 14 15

Servo 1 Top Left Foot
Servo 2 Top Left
Servo 3 Back Left Foot
Servo 4 Back Left

Servo 5 Back Right Foot
Servo 6 Top Right
Servo 7 Back Right
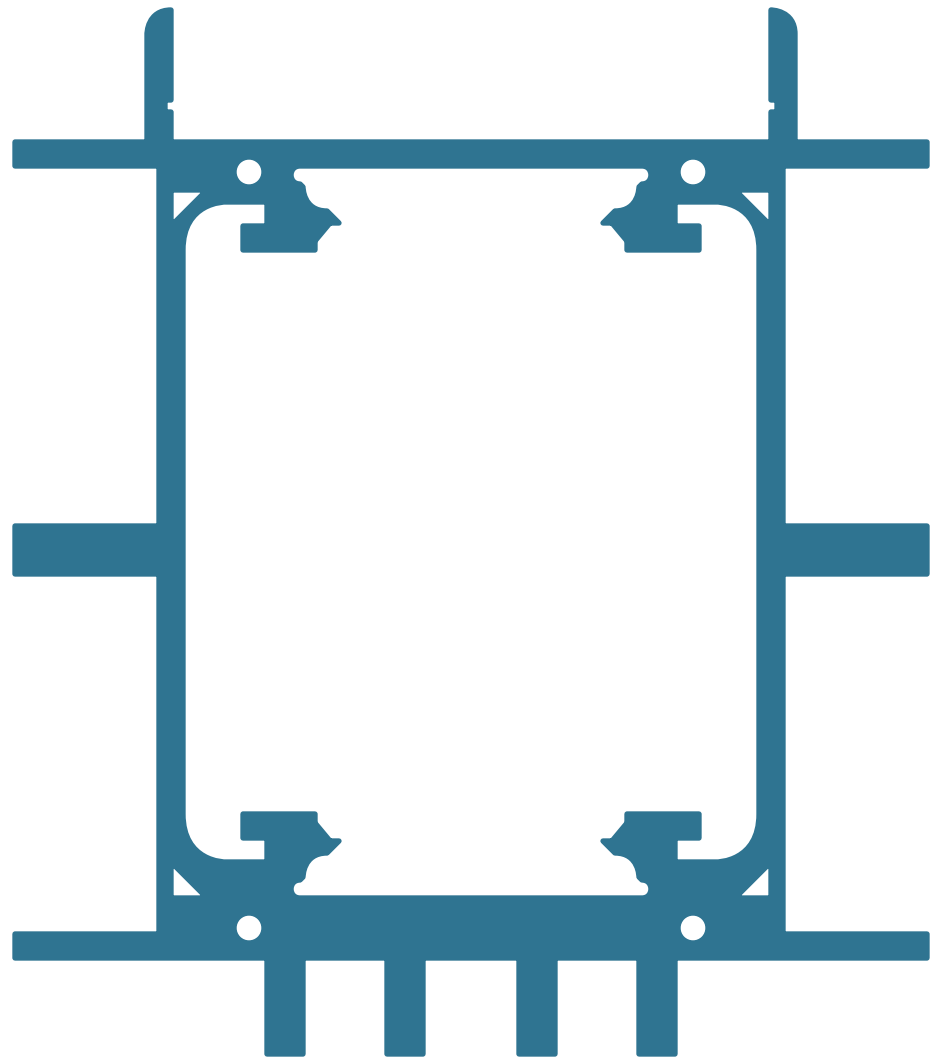Servo 8 Top Right

Base

FRONT
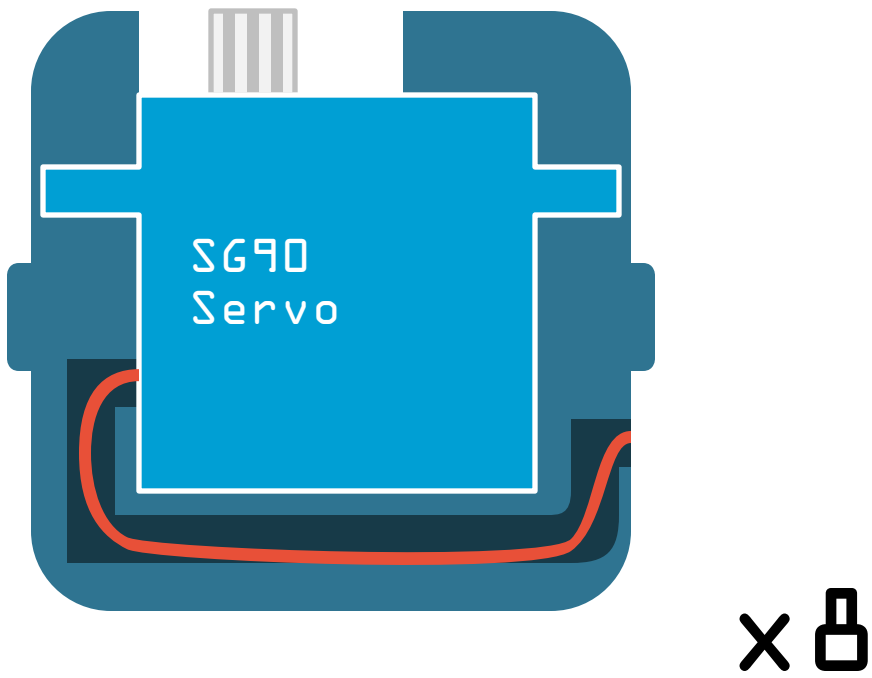
QUAD ROBOT PRINT PARTS

The following instructions show how to assemble the SMARS Quad Robot. A bill of materials is provided at the back of this guide along with links to where to buy the components from. Links to the 3d printed parts are also provided at the back of this guide.
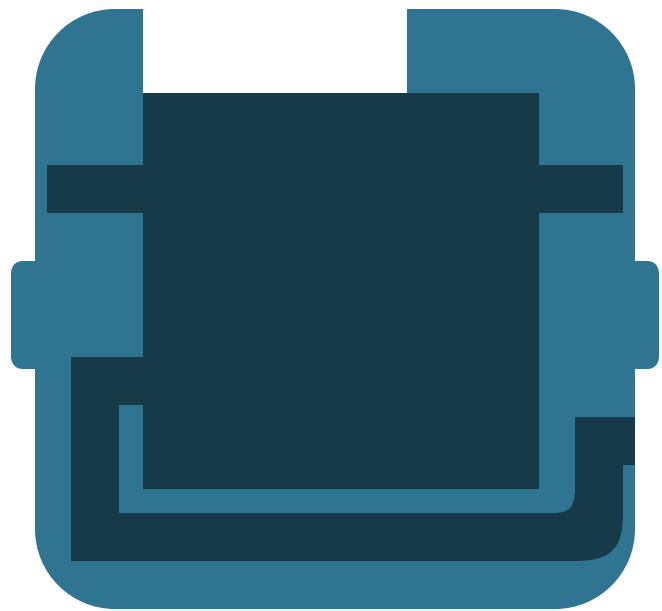
1 Print the frame

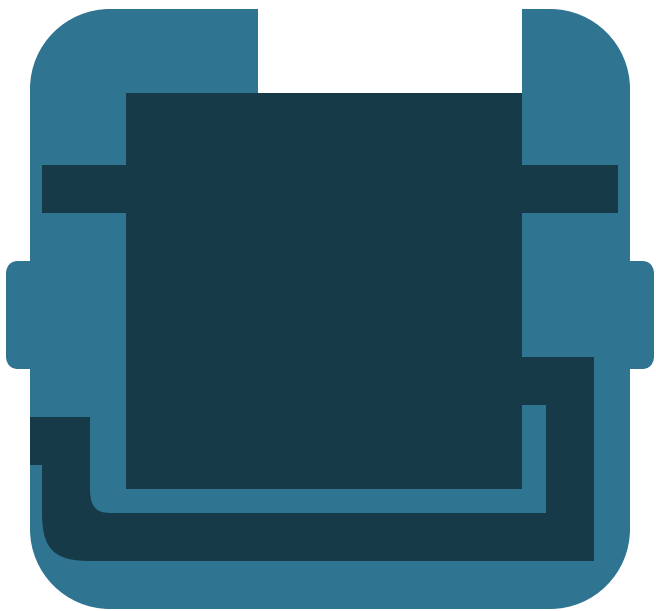## 3 Fit the servo into the servo holder

SG90 Servo

x8

2 Print the servo holders

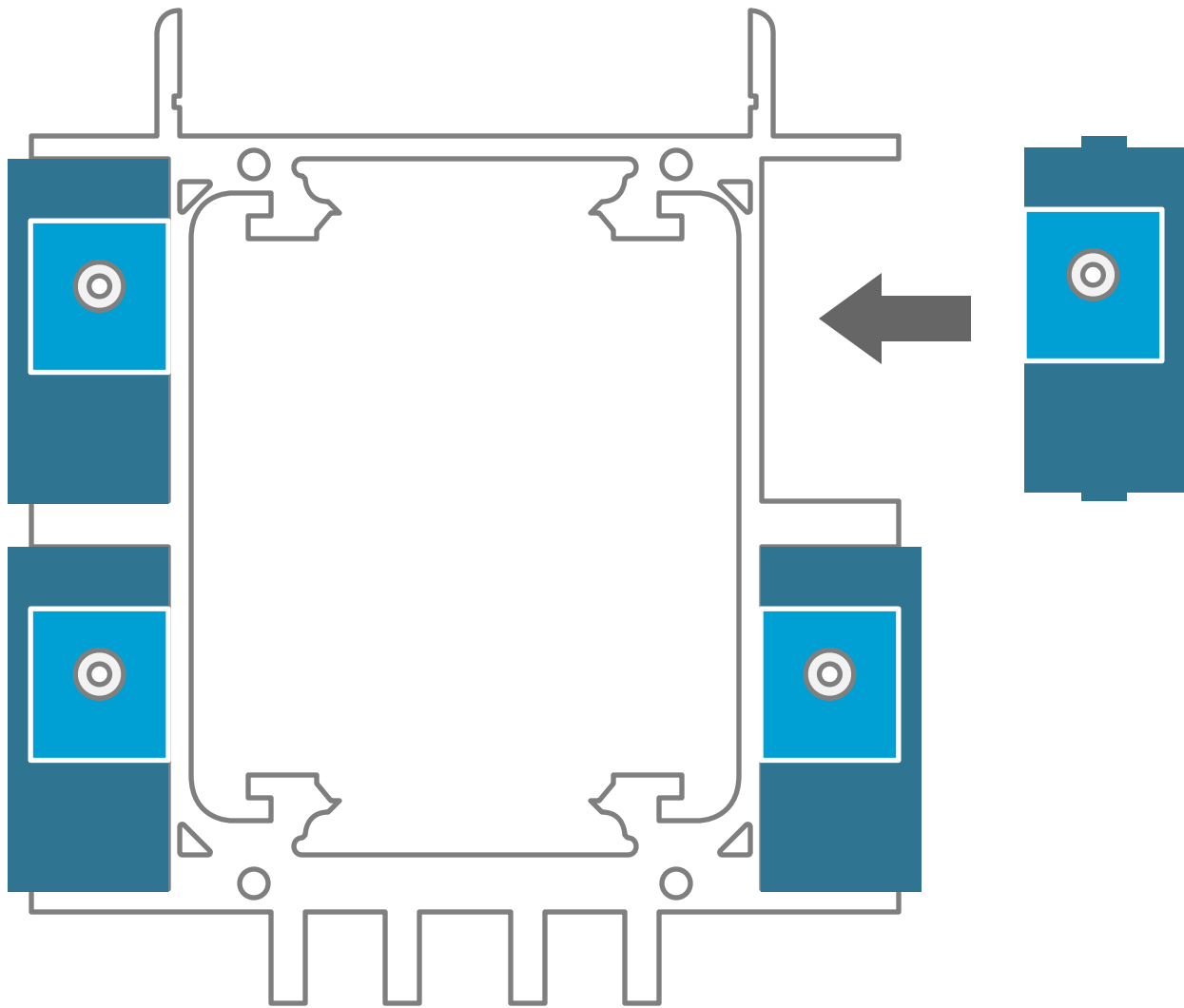Print 4x Servo holder & 4x Servo holder M (M is a mirror image of the servo holder)

Servo Holder

Servo Holder M

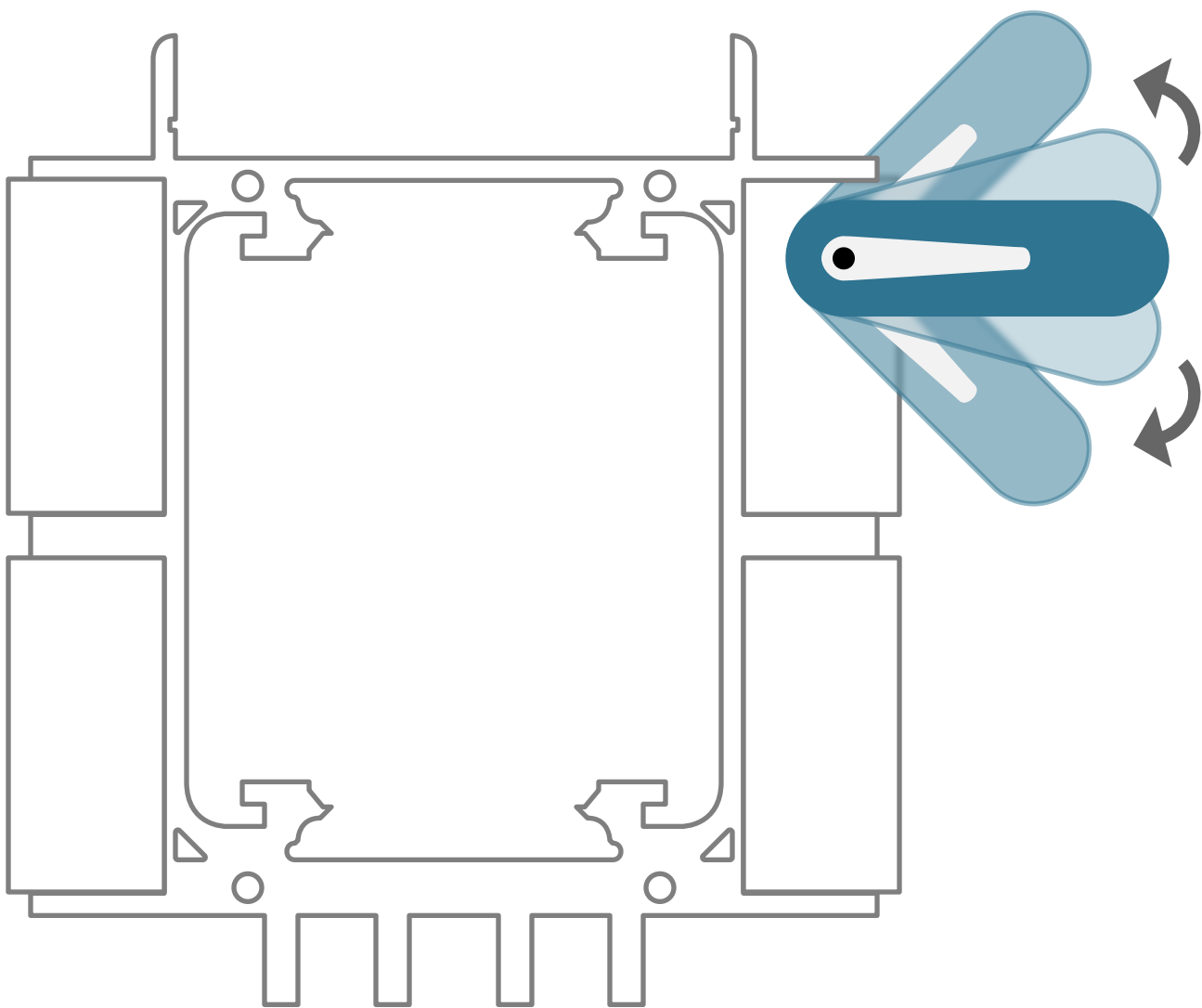## 4 Fit the servo holders into the frame

QUAD ROBOT
FITTING SERVOS

SMARS

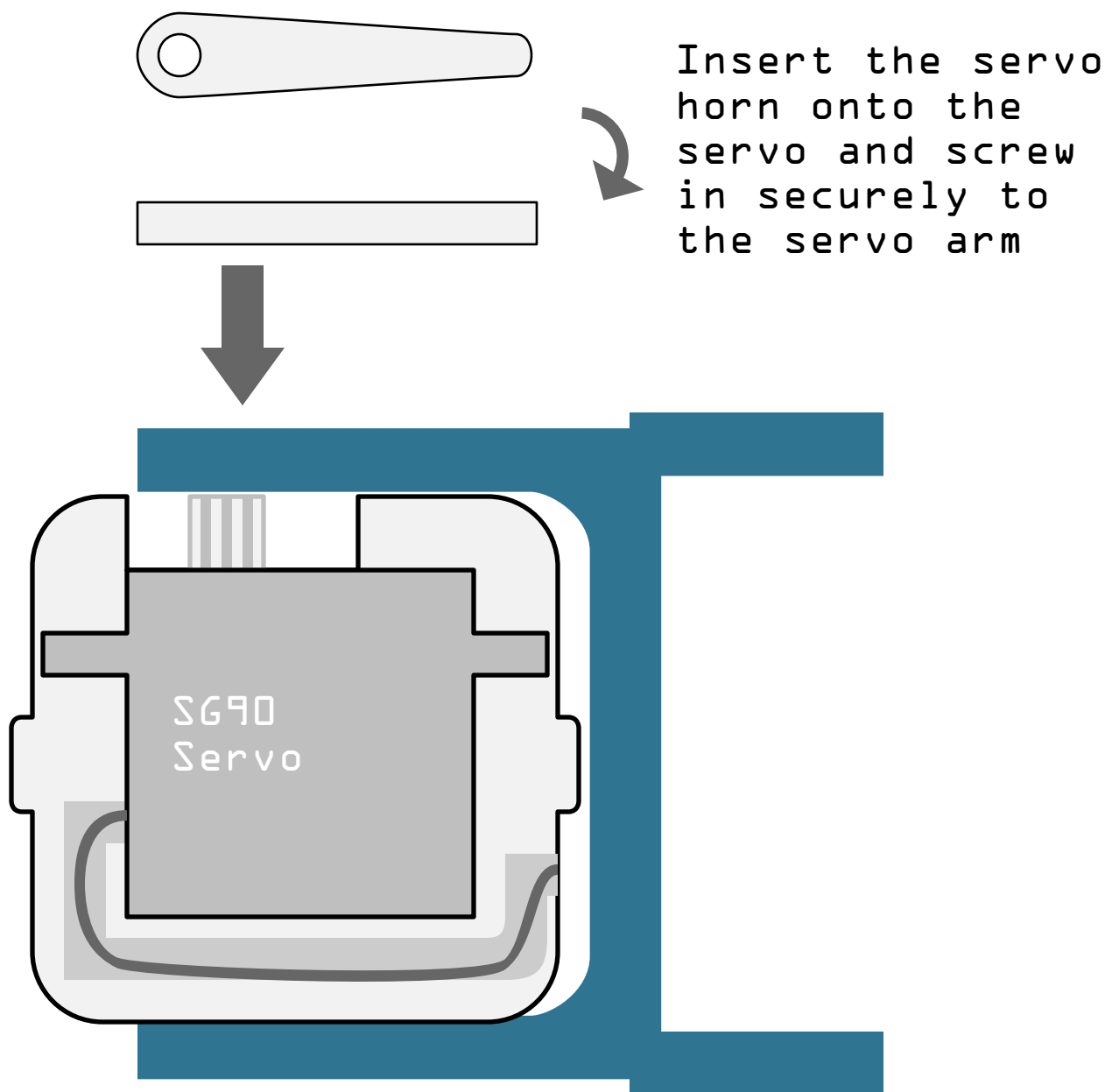**5** Print the servo arms
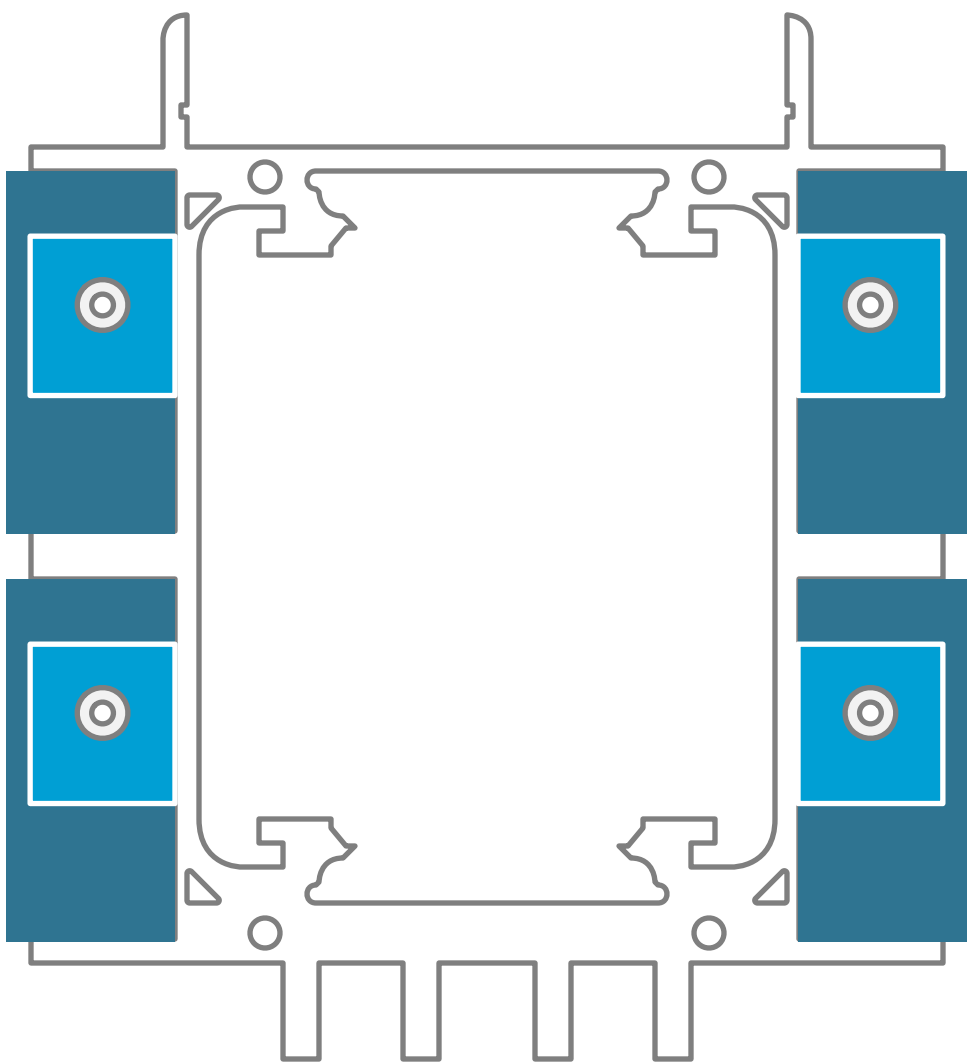
×4

---

7 Check the servo rotation

Ensure the servo can move equally in each direction before tightening the screw.

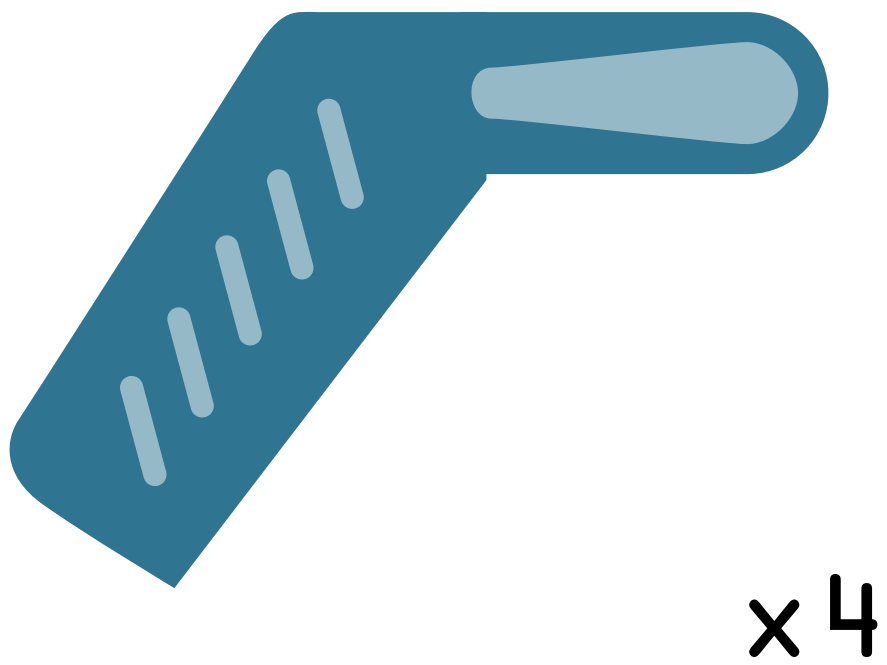**6** Mount the servo holder in the servo arm

Insert the servo horn onto the servo and screw in securely to the servo arm

SG90 Servo

---

8 Attach the other servo holders to the frame

---

9 Print the feet x4

x4

11 Check the servo rotation

Feet need a rotation of between 50° to 150° degrees
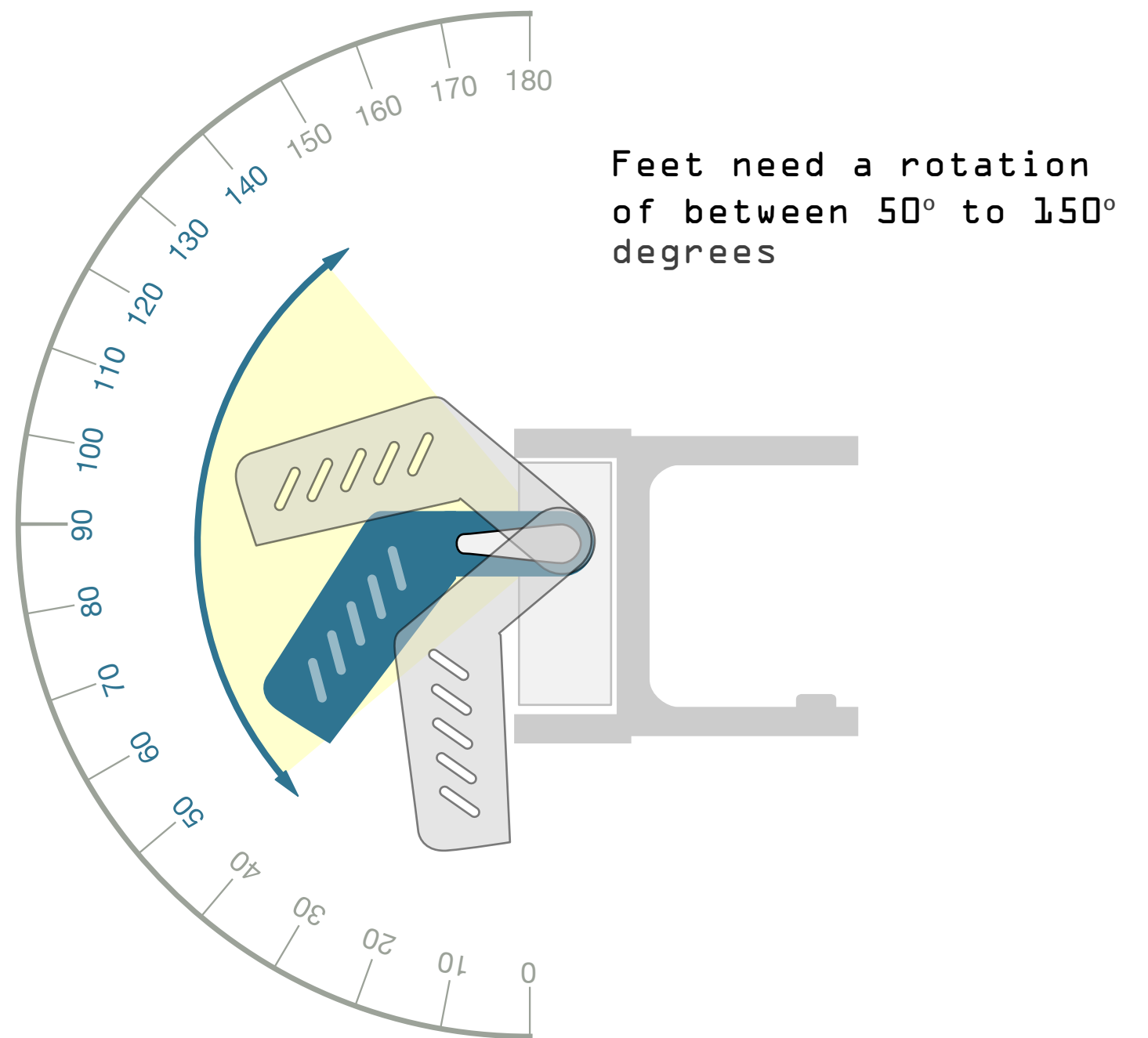
10 Mount the foot on the servo holder

x4
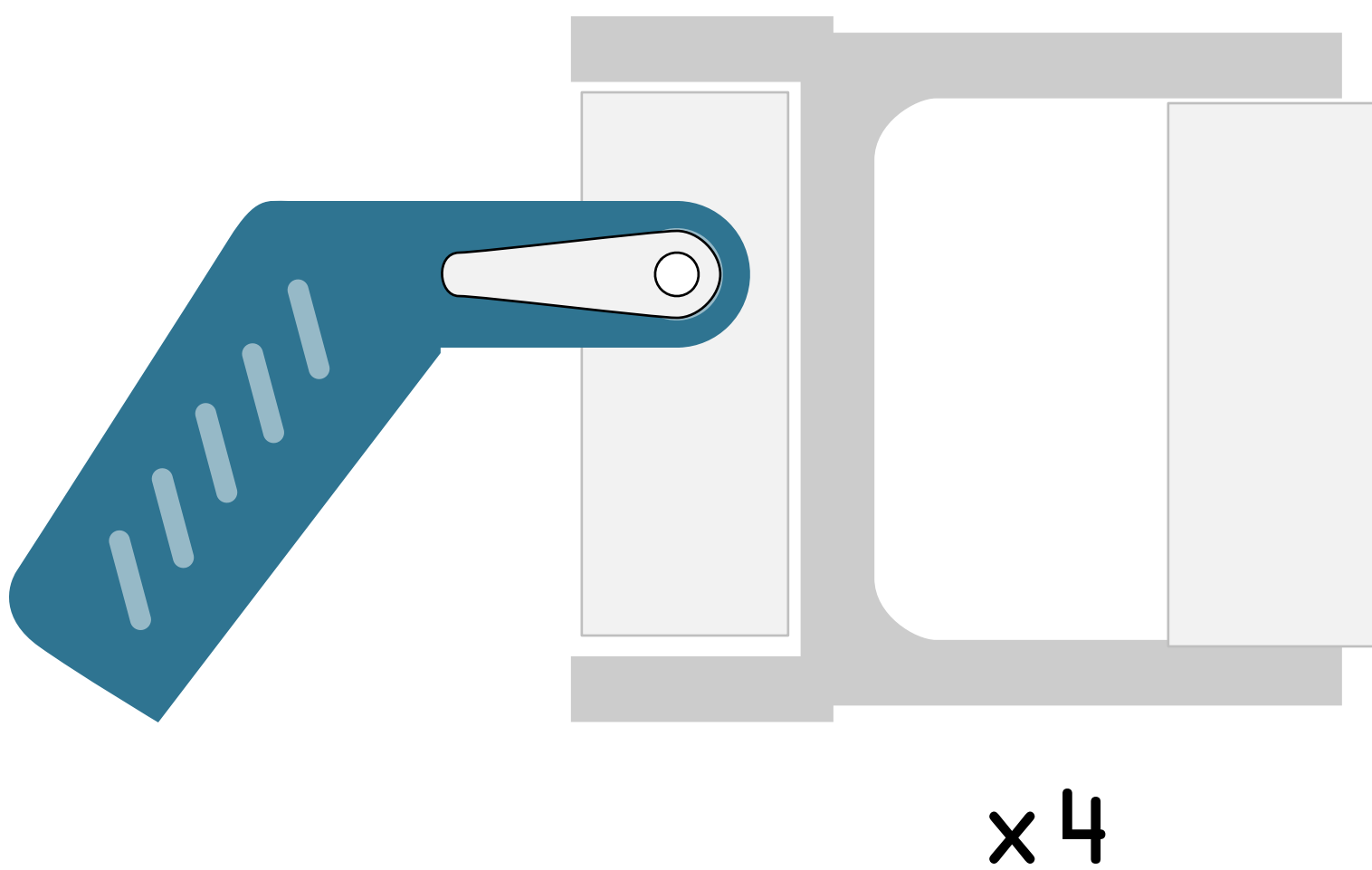
12 Download the python code

From the raspberry pi command line type:

git clone https://www.github.com/kevinmcaleer/smars

Then look in the folder at the python files.

```
cd smars
ls smars
```

SMARS

Connect the Raspberry pi Zero using the following pins:

PCA9685 GND to RPI Pin 39 (or Pin 6) - Black wire
PCA9685 V+ to RPI Pin 2   - Red wire
PCA9685 SCL to RPI Pin 5 (SCL)   - Green wire
PCA9685 SDA to RPI Pin 3 (SDA)   - Blue wire

Note that the input voltage for the PCA9685 is 3.3v or 5v into the VCC. The V+ is for powering the servo motors and requires more power than the raspberry pi can provide, which is why it is separate. You can use a 9v battery to drive this, using the SMARS 9v case.

The raspberry pi communicates with the servo driver board using I2C, which only requires 2 wires: System Clock (SCL) and System Data (SDA). These are marked on servo driver board, and on pins 3 & 7 on the Raspberry Pi Zero.
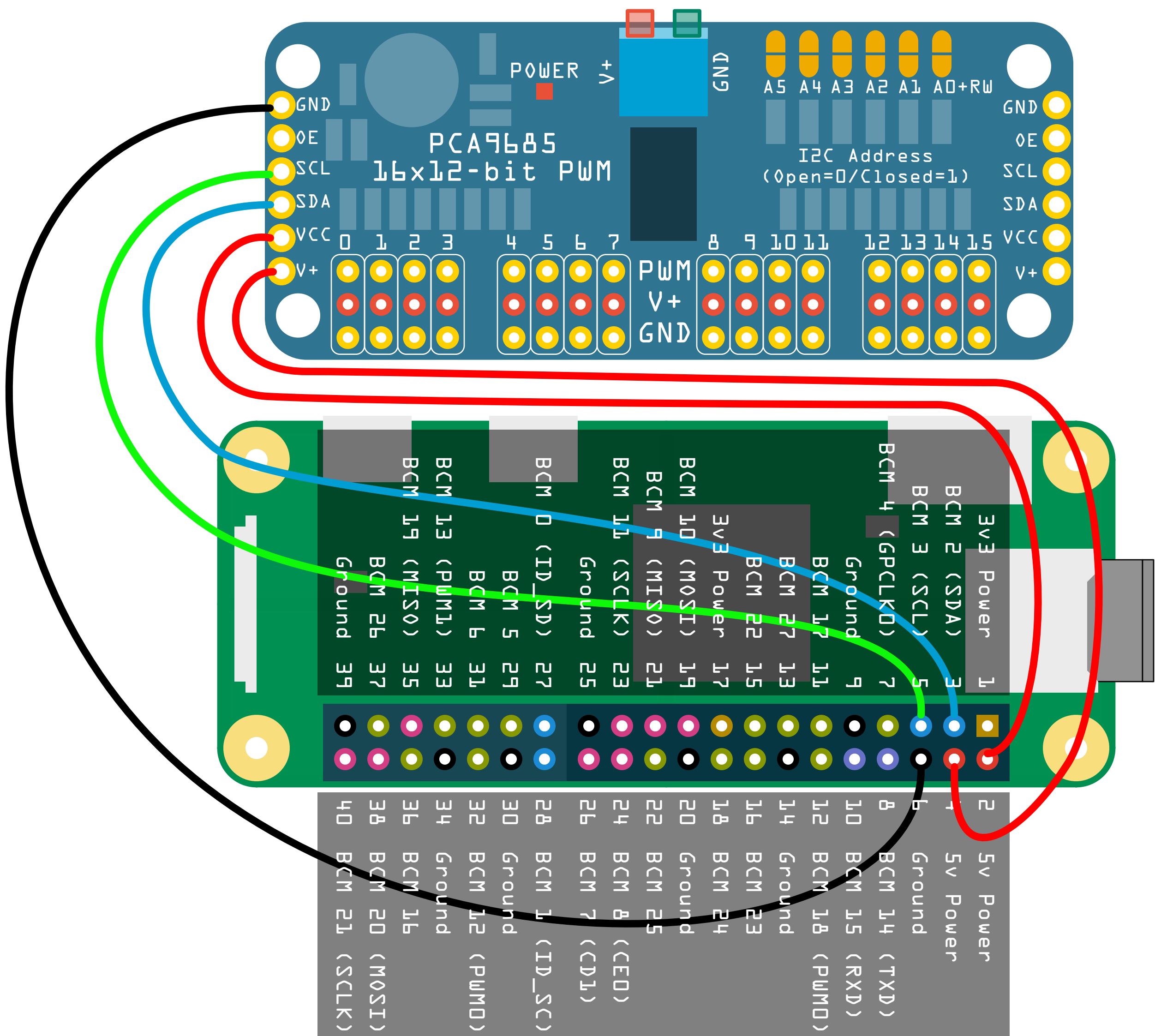
QUAD ROBOT
RANGE OF MOTION
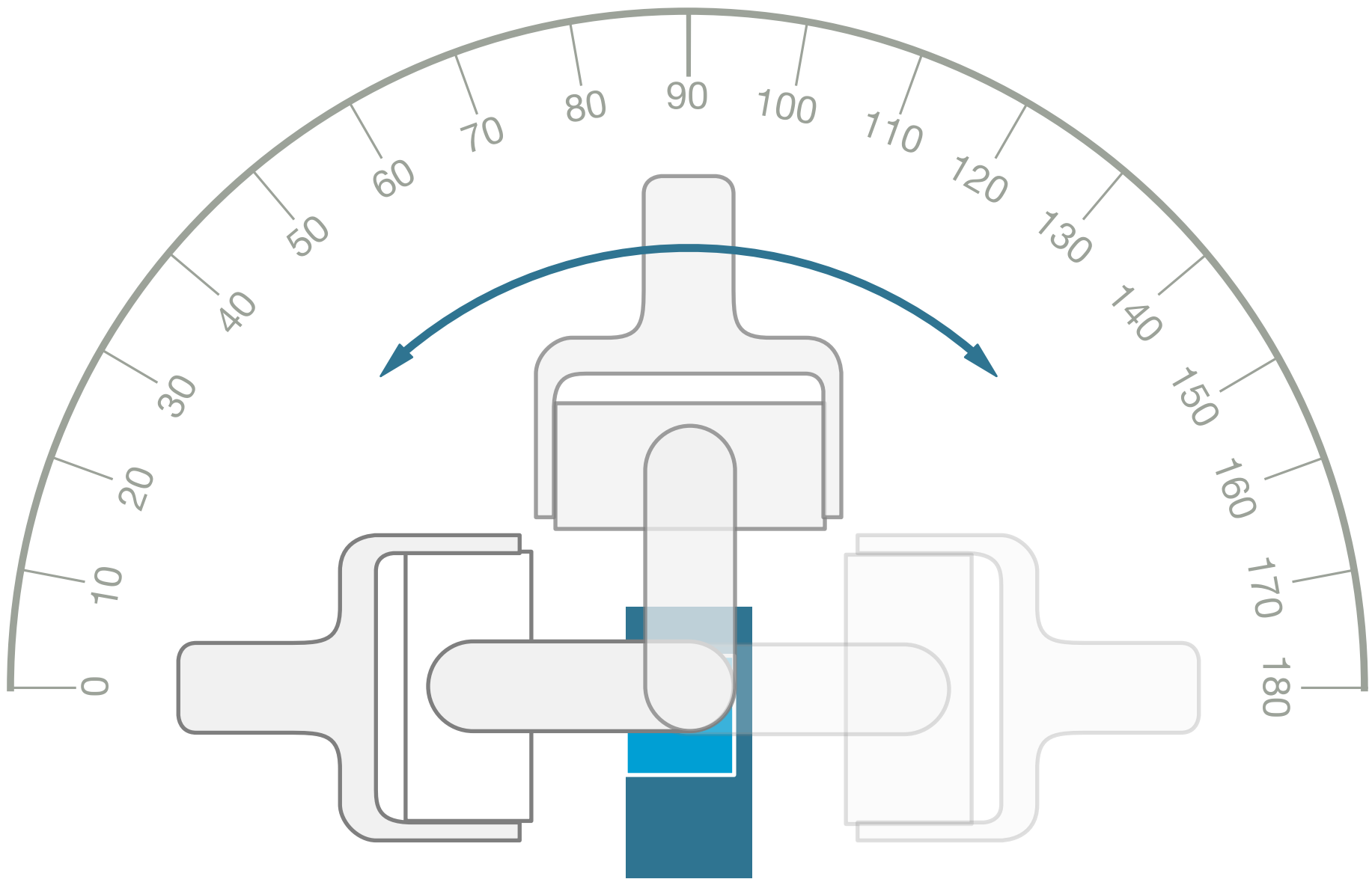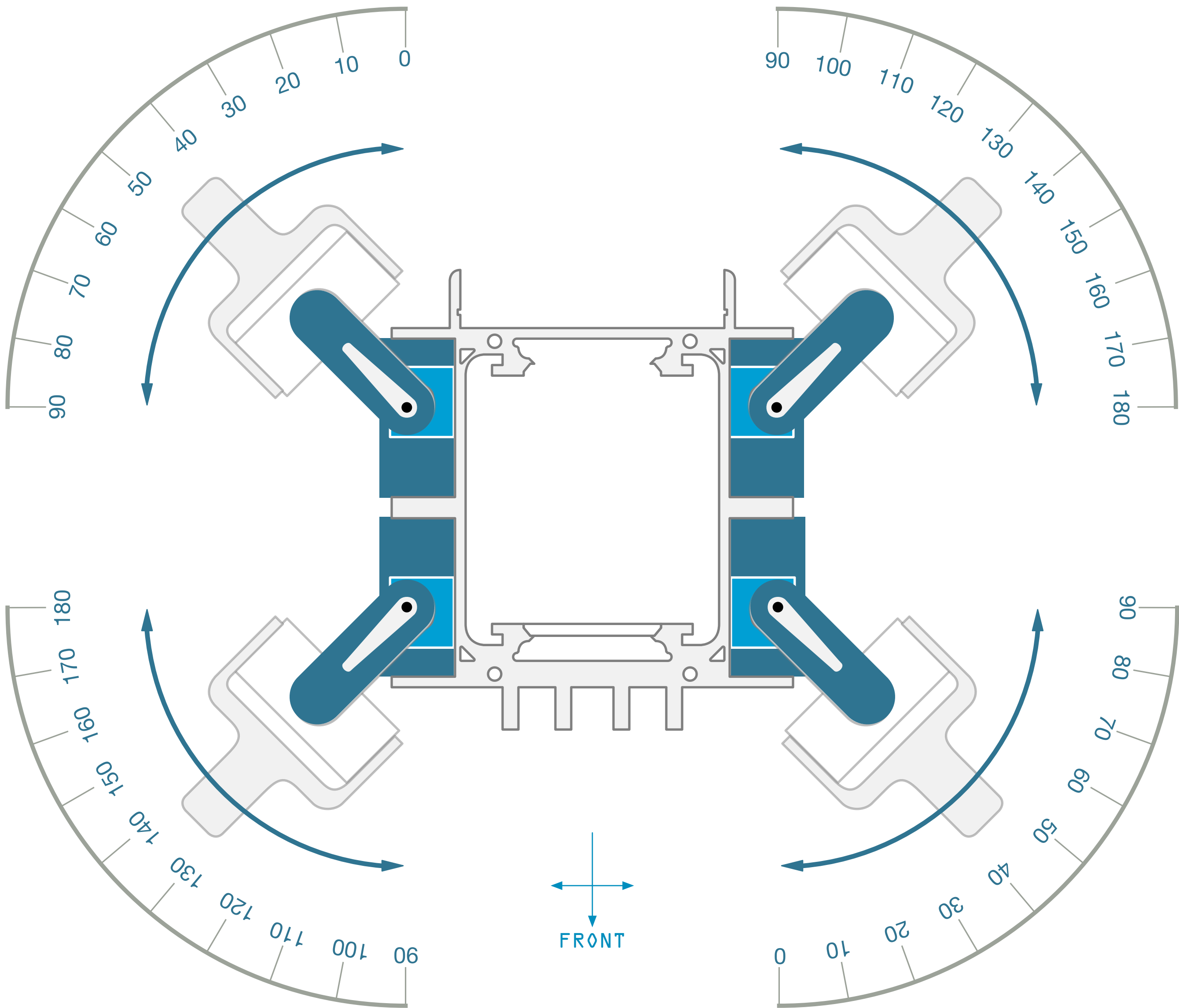
Each servo has a range of motion between 0° and 180° degrees. However the each robot leg only needs between 0 and 90 degrees of rotation.

The servos are oriented differently for each leg, so the degrees of rotation for each needs to be understood and set correctly in the code.

Range of Motion
Front Left = 0 to 90
Front Right = 90 to 180
Back Left   = 90 to 180
Back Right = 0 to 90

FRONT

QUAD ROBOT
SOFTWARE SETUP

Python environment setup

The PCA9685 servo driver library is provided by Adafruit and needs to be installed before setup and using the SMARS Quad robot.

To download the adafruit servo library first logon to the Raspberry Pi and then type:

```
sudo apt-get install git build-essential python-dev
cd ~
git clone https://github.com/adafruit/
Adafruit_Python_PCA9685.git
cd Adafruit_Python_PCA9685
sudo python setup.py install
```

Python is now setup for the servo driver.

Quad Robot Software Configuration

Once you've downloaded the python code you can begin checking the configuration of the servos:

```
python limb_setup.py
```

Use the menu to select the channel you want to configure. There are 16 channels, one for each servo.

The channels start at 0, and end at 15.

```
Menu
----

1) select channel
2) select angle
0) quit

current channel is: 0
current angle is: 0
enter number
```

Type '1' to change the current channel.

```
Select Channel
--------------

currently selected channel is: 0
type channel number:, or q to return to the main menu
```

Next, type 0 to configure channel 0

Type '1' to change the current channel.

```
Select Channel
--------------

currently selected channel is: 0
type channel number:, or q to return to the main menu
```

Next, type '0' to configure channel 0

Then type 'q' to return to the main menu.

```
Menu
----

1) select channel
2) select angle
0) quit

current channel is: 0
current angle is: 0
enter number
```

Type '2' to set the angle for the current channel.

```
Select Angle
------------

current angle is: 0
Type angle to set servo to, or press q to exit90
90
Angle is: 90
Angle =  90
Angle as a percentage =  50.0
pulse =  375
map Max =  450
current angle: 90
Type angle to set servo to, or press q to exit
```

Type '90' to set the angle to 90 Degrees.

Then type 'q' to return to the main menu.

Repeat this until you have set each limb correctly.

Finally type '0' to quit the limb setup programme.

SMARS

8

About this Guide
This guide was written by Kevin McAleer and is provided freely to the SMARS community.

Social Media
If you haven't already, please join the facebook community -
https://www.facebook.com/groups/141101273276325/