6. Specifications

> **Caution**
>
> The following manual uses the metric system, unless specified, **all dimensions are in millimeters**.

The following subsections provide data on the various specifications for the Robotiq 2-Finger 85 and 140 Adaptive Grippers.

- Section 6.1 lists the technical dimensions of the Grippers
    - Dimensions for custom (blank) coupling
    - Dimensions of all available couplings
    - Dimensions for custom fingertip
    - Dimensions of all available fingertips
- Section 6.2 presents the mechanical specifications of the Grippers.
- Section 6.3 gives electrical specifications for the Grippers.

6.1. Technical dimensions

The 2-Finger 85 and 2-Finger 140 share the same basic chassis and thus have the same technical dimensions for everything except the fingers. Figure 6-1 represents the Robotiq 2-Finger 85 Adaptive Robot Gripper's dimensions with axis X, Y, Z and origin referenced for finger motion. Figure 6-3 will show the equivalent with 140 mm fingers (2-Finger 140).

> **Info**
>
> All technical drawings in the present section are shown with silicone flat fingertip option: **AGC-TIP-204-085** (2-Finger 85) or **AGC-TIP-420-140** (2- Finger 140).

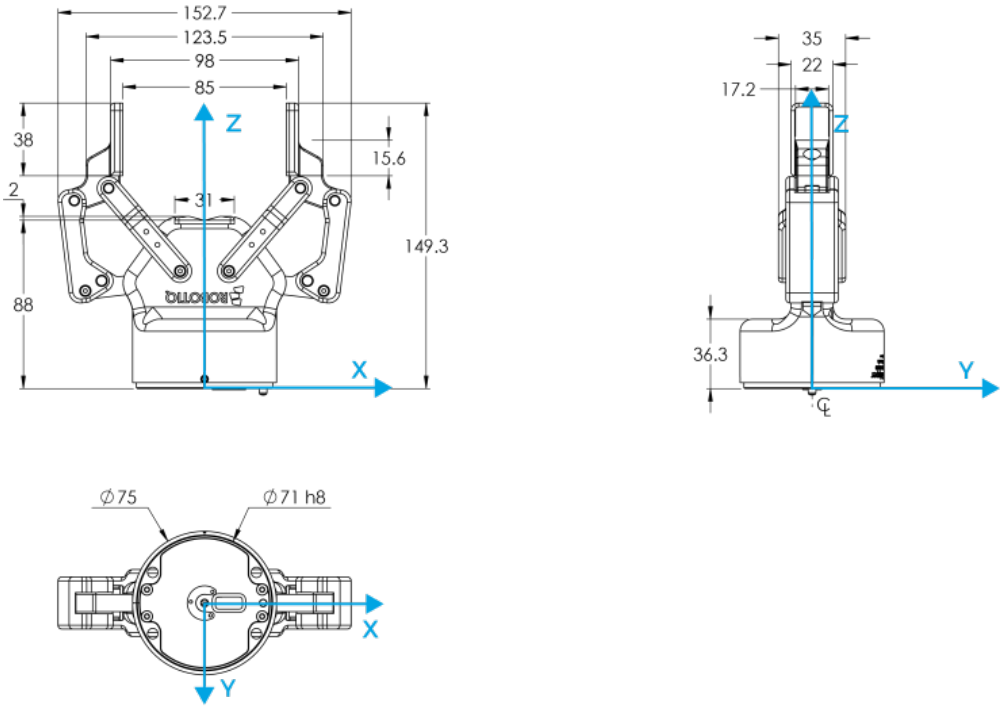


Fig. 6-1: 2F-85 general dimensions (opened).

As mentioned in the figure above, height and width of the fingers vary with opening position. Figure 6-1 represents the 2F-85 Gripper in the opened position (position request = 0), while Figure 6-2 represents the 2F-85 Gripper in the closed position (position request = 255).

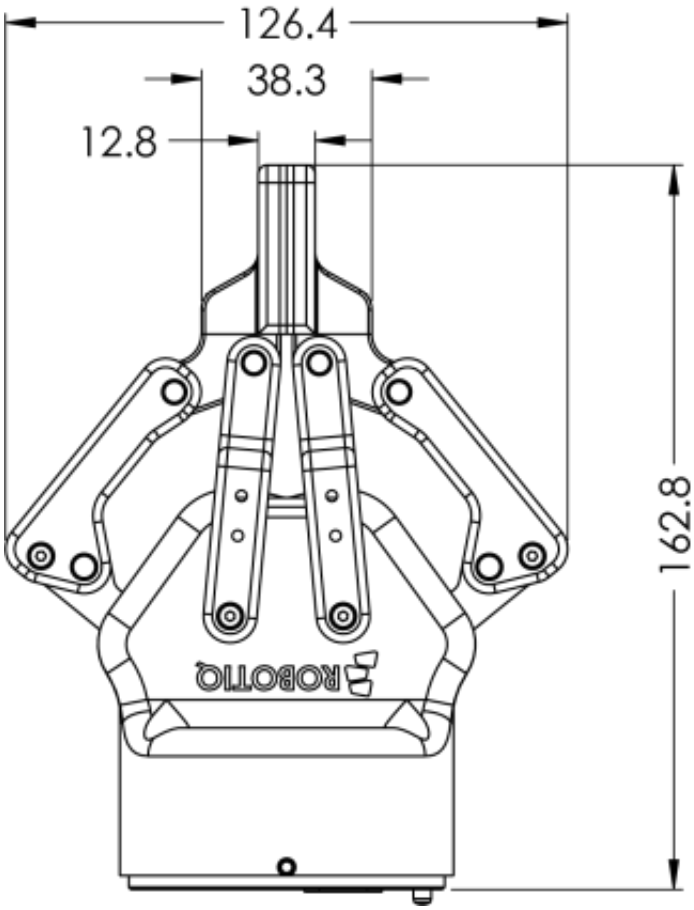


Fig. 6-2: 2F-85 dimensions (closed).

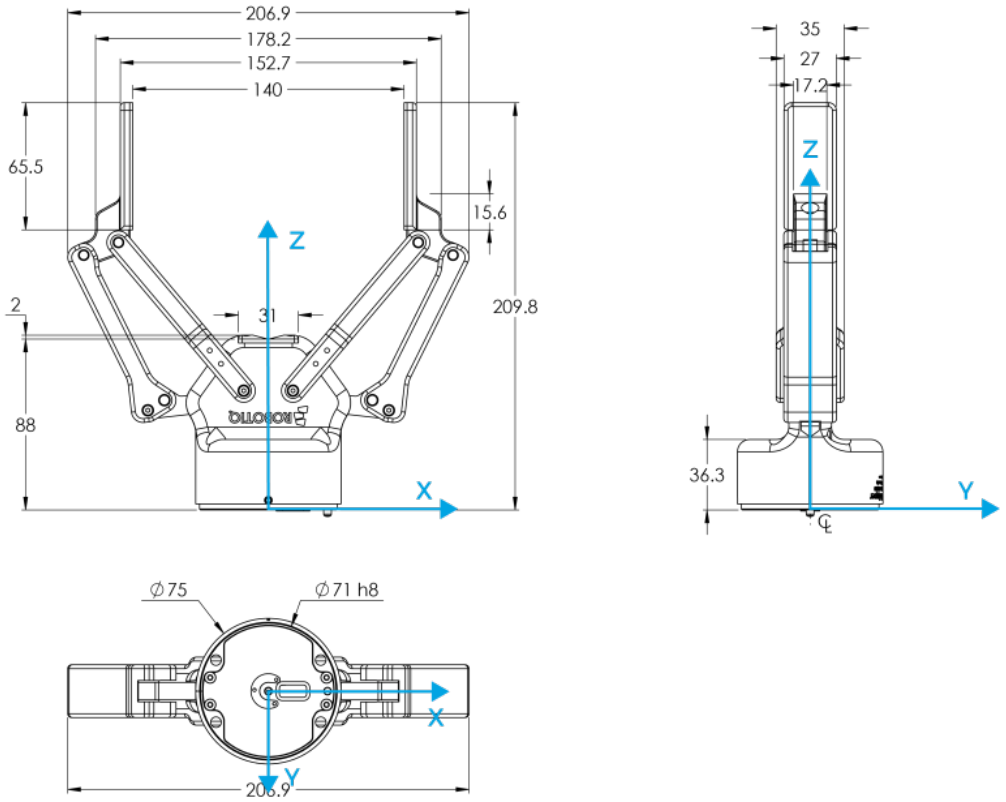


Fig. 6-3: 2F-140 general dimensions (opened).

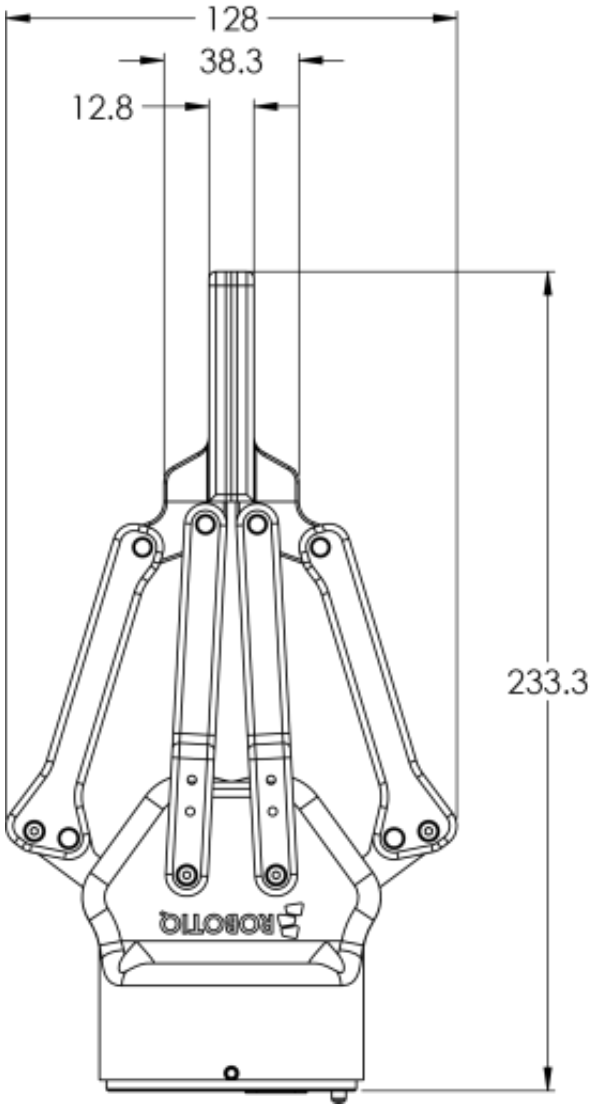


Fig. 6-4: 2F-140 dimensions (closed).

As mentioned in the figure above, the height and width of the fingers vary with opening position. Figure 6-3 represents the 2F-140 Gripper in the opened position (position request = 0), while Figure 6-4 represents the 2F-140 Gripper in the closed position (position request = 255).

6.1.1. Couplings

The Robotiq 2-Finger Adaptive Robot Gripper requires a coupling provided by Robotiq to operate. The coupling is mandatory since it integrates electronics and electrical contacts.

> **Info**
>
> The coupling is common to both the 2F-85 and the 2F-140.

6.1.1.1. Blank coupling

Below are the dimensions of the blank coupling, **AGC-CPL-BLANK-002** (refer to the **Spare Parts, Kits and Accessories** section), available to

create a custom bolt pattern. Blue section can be fully customized (holes can be place in any part of this section) while the grey section can only be worked to a depth of 3 mm.

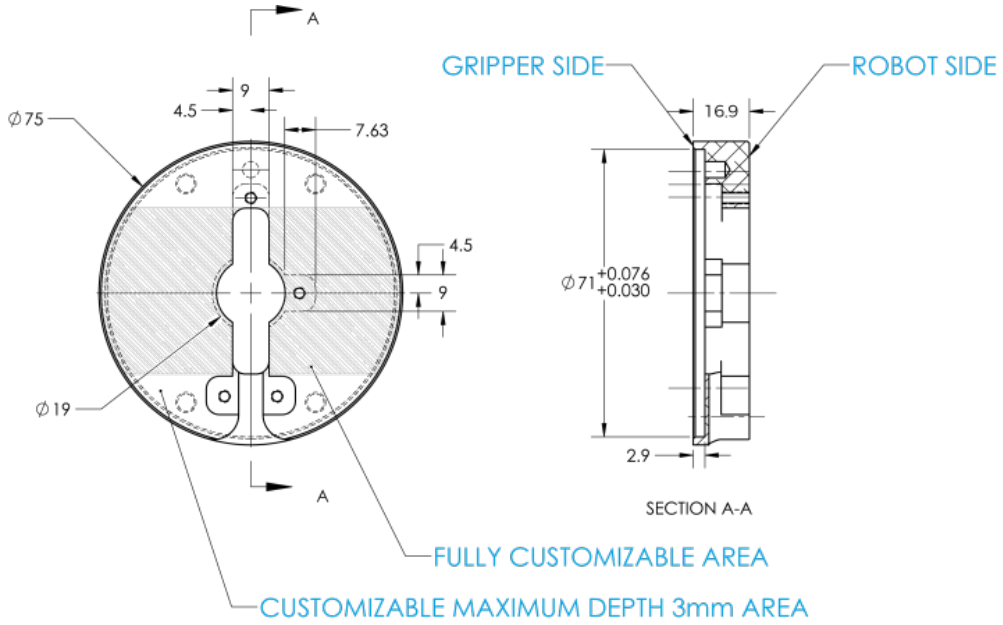


Fig. 6-5: Blank coupling AGC-CPL-BLANK-002 workable area dimensions.

6.1.1.2. Coupling for ISO 9409-1-50-4-M6

Bolt pattern for coupling **AGC-CPL-062-002** (refer to the **Spare Parts, Kits and Accessories** section) is compatible with :

- 50 mm pitch circle diameter :
    - (4) M6-1.0 low head socket cap screw clearance
    - (1) M6 indexing pin
    - ISO 9409-1 standard 50-4-M6

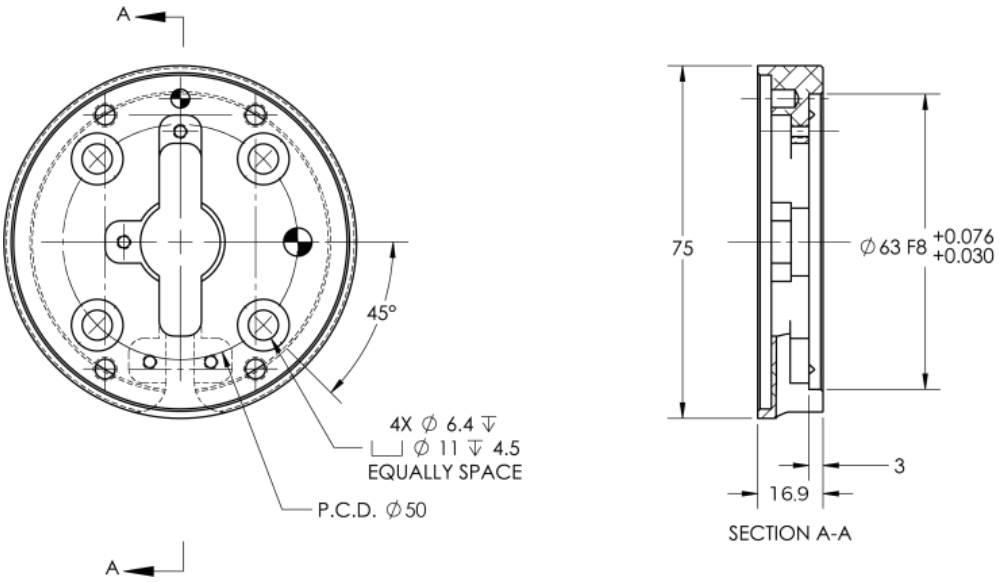


Fig. 6-6: Coupling for ISO 9409-1-50-4-M6.

6.1.1.3. Coupling for ISO 9409-1-31.5-4-M5

Bolt pattern for coupling **AGC-CPL-063-002** (refer to the **Spare Parts, Kits and Accessories** section) is compatible with :

- 31.5 mm pitch circle diameter :
    - (4) M5-0.8 low head socket cap screw clearance
    - (1) M5 indexing pin
    - ISO 9409-1 standard 31.5-4-M5

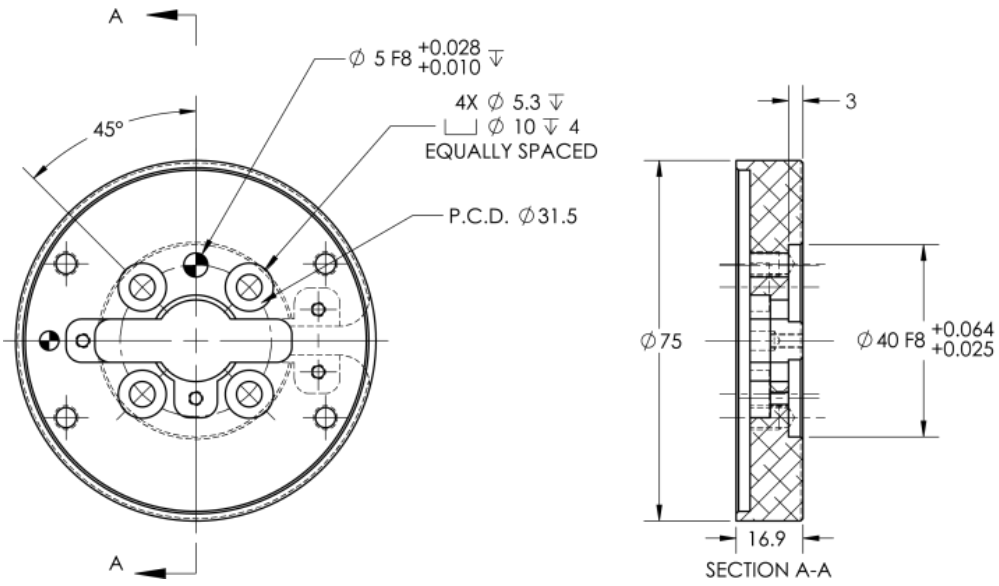


Fig. 6-7: Coupling for ISO 9409-1-31.5-4-M5.

6.1.1.4. Coupling for ISO 9409-1-40-4-M6

Bolt pattern for coupling **AGC-CPL-064-002** (refer to the **Spare Parts, Kits and Accessories** section) is compatible with :

- 40 mm pitch circle diameter :
    - (4) M6-1.0 low head socket cap screw clearance
    - (1) M6 indexing pin
    - ISO 9409-1 standard 40-4-M6

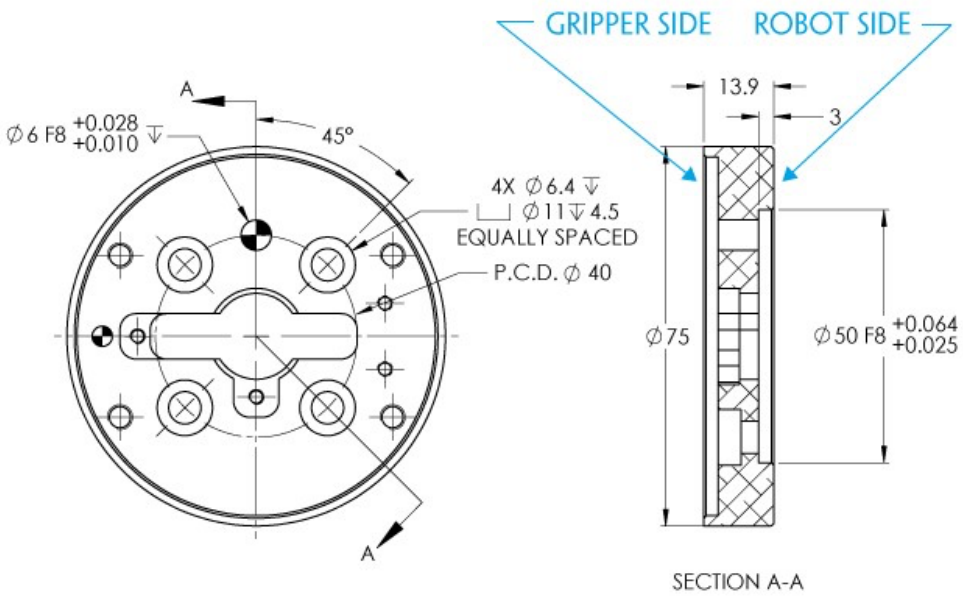


Fig. 6-8: Coupling for ISO 9409-1-40-4-M6.

6.1.1.5. Coupling for PCD 56 with 8 x M4

Bolt pattern for coupling AGC-CPL-065-002 (refer to the **Spare Parts, Kits and Accessories** section) is compatible with :

- 56 mm pitch circle diameter :
    - (8) M4-0.7 low head socket cap screw clearance
    - (1) M4 indexing pin
    - 62 mm diameter internal insert

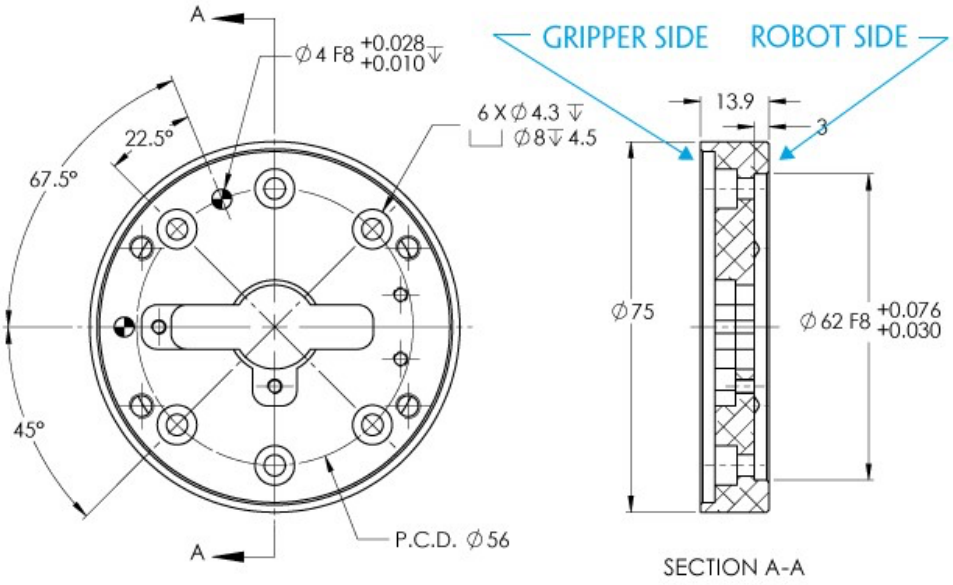


Fig. 6-9: Coupling for PCD 56 mm with 8 x M4 clearance.

Info

Although coupling AGC-CPL-065-002 is compatible with 8 x M4 threads on a 56 mm PCD it uses only 6 of the 8 normally present holes.

6.1.1.6. Coupling for PCD 56 with 6 x M4

Bolt pattern for coupling **AGC-CPL-066-002** (refer to the **Spare Parts, Kits and Accessories** section) is compatible with:

- 56 mm pitch circle diameter:
    - (6) M4-0.7 low head socket cap screw clearance
    - (1) M6 indexing pin
    - 42 mm diameter external insert

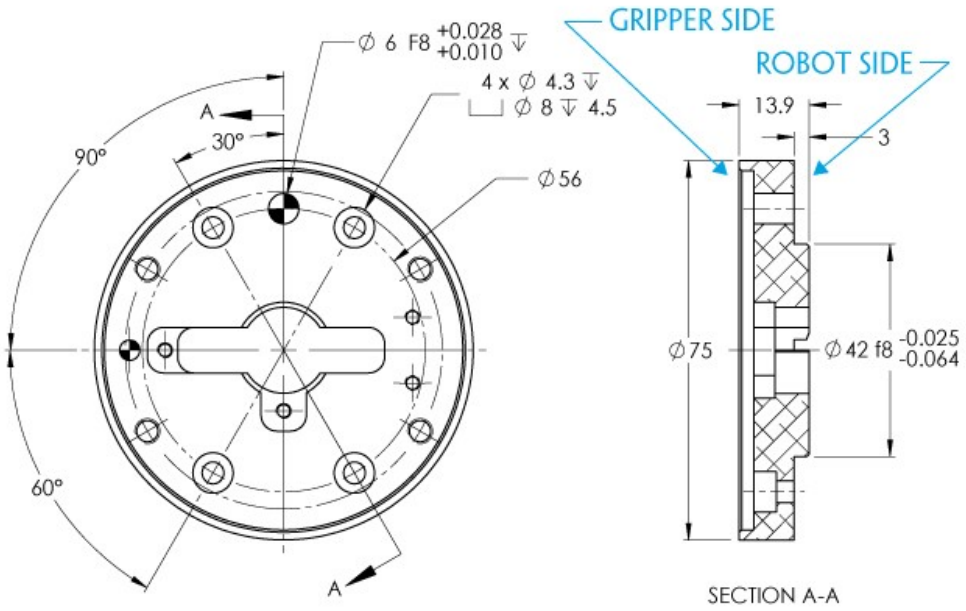


Fig. 6-10: Coupling for PCD 56 mm with 6 x M4 clearance.

6.1.1.7. Coupling for PCD 60 with 4 x M5

Bolt pattern for coupling **AGC-CPL-067-002** (refer to the **Spare Parts, Kits and Accessories** section) is compatible with :

- 60 mm pitch circle diameter :
  - (4) M5-0.8 low head socket cap screw clearance
  - (1) M5 indexing pin
  - 34 mm diameter external insert

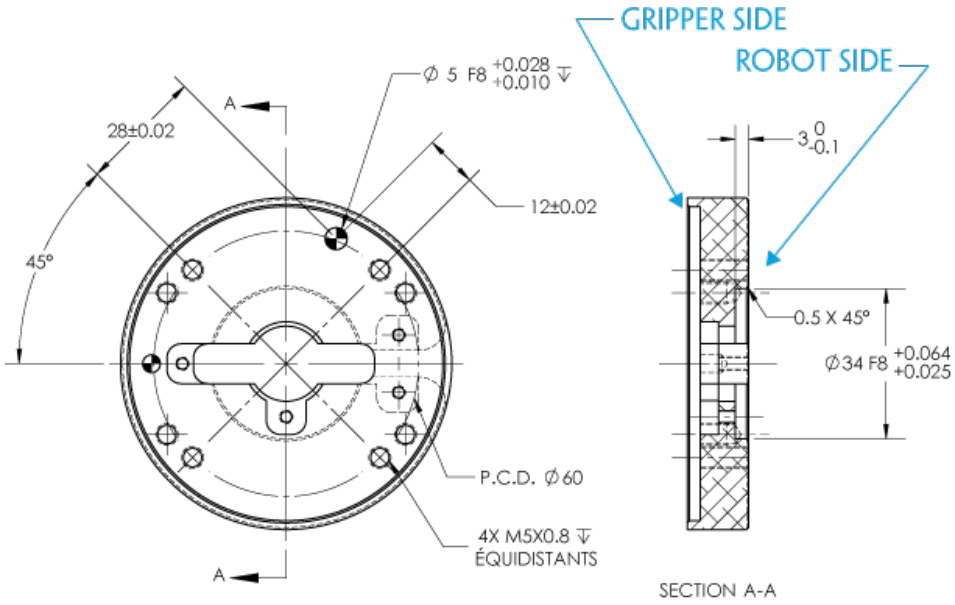


Fig. 6-11: Coupling for PCD 60 mm with 4 x M5 clearance.

6.1.1.8. Coupling for PCD 63 with 6 x M6

Bolt pattern for coupling AGC-CPL-068-002 (refer to the **Spare Parts, Kits and Accessories** section) is compatible with :

- 63 mm pitch circle diameter :
  - (6) M6-1.0 low head socket cap screw clearance
  - (2) M6 indexing pins

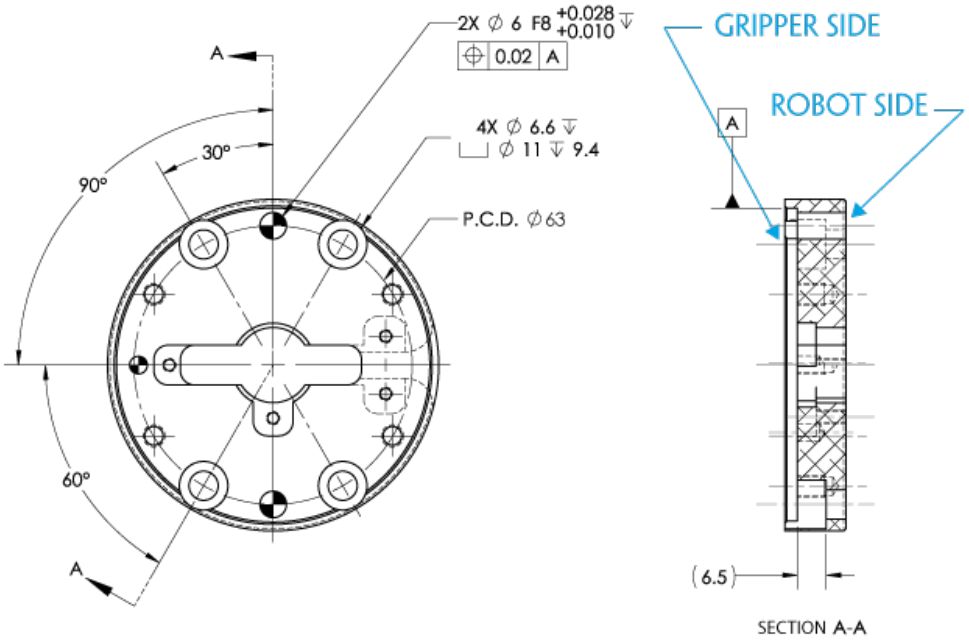


Fig. 6-12: Coupling for PCD 63 mm with 6 x M6 clearance.

6.1.2. Fingertips

The contact grasp points for the Robotiq 2-Finger Adaptive Robot Gripper are its two fingertip pads and palm pad. Many fingertips are available from Robotiq (refer to the **Spare Parts, Kits and Accessories** section). The user can customize their own fingertips from blanks or create them from scratch. The figure below represents the distal phalanx (which acts as the fingertip holder) the permanent, non customizable part of the Gripper finger on which the fingertip must be mounted.

Custom fingertip designs must abide by the following:

- Fingertip must not exceed 100 mm in height from the fingertip's base.
- Fingertip must not exceed 100 mm in width from the fingertip's base (refer to Y axis from figure 6-18).
- Refer to the **Mechanical specifications** section to evaluate the grasp force according to your fingertip design.
- Applied forces to the gripper must not exceed moment and force limits detailed in the **Moment and force limits** section.

Info

Both 2-Finger 85 and 2-Finger 140 use the same fingertips and finger holder.

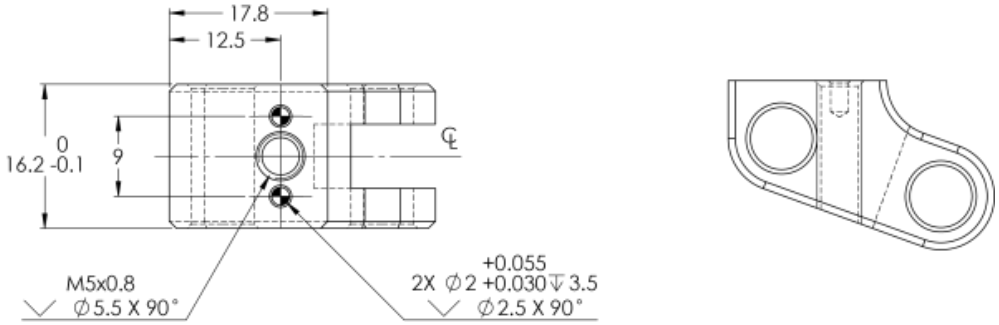


Fig. 6-13: Distal phalanx for holding standard or custom fingertips.

Tip

Custom fingertips will still be subject to the equilibrium line rule for proper actuation of the Gripper, see General Presentation section.

6.1.2.1. Flat silicone fingertip

The figure below represents a flat silicone fingertip **AGC-TIP-204-085** (2F-85) and **AGC-TIP-420-140** (2F-140); please refer to the **Spare Parts, Kits and Accessories** section. This fingertip has a flat silicone surface with an optimal friction coefficient for picking objects while the other surface will mount onto the fingertip holder shown in the **Fingertips** section.

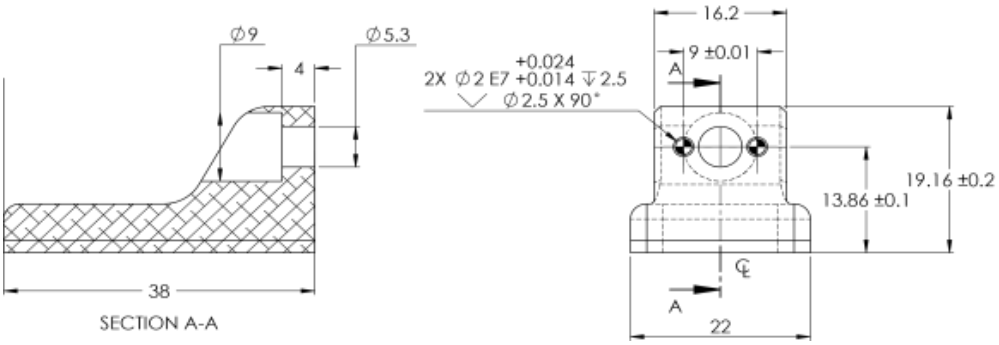


Fig. 6-14: Flat silicone fingertip AGC-TIP-204-085

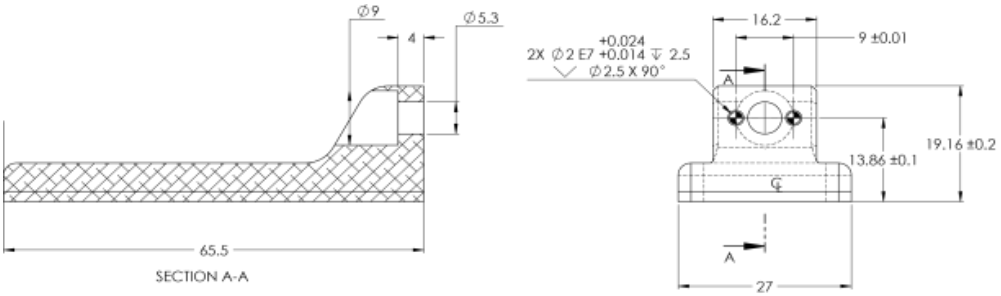


Fig. 6-15: Flat silicone fingertip AGC-TIP-420-140

6.1.2.2. Grooved fingertip

The figure below represents the available grooved fingertip **AGC-TIP-205-085** (2-Finger 85) and **AGC-TIP-421-140** (2-Finger 140); please refer to the **Spare Parts, Kits and Accessories** section. This fingertip has a grooved surface with an optimal shape for picking cylindrical objects (with its horizontal and vertical grooves) while the other surface will mount onto the fingertip holder shown in the **Fingertips** section.

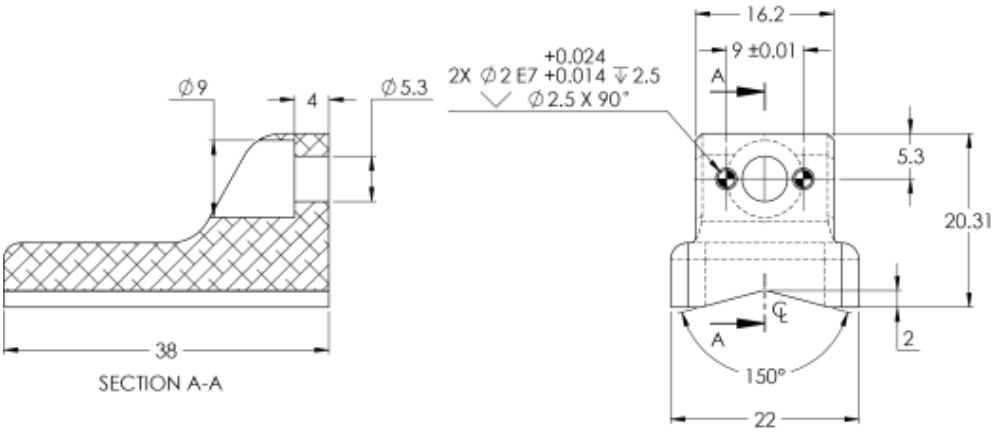


Fig. 6-16: Grooved fingertip AGC-TIP-205-085

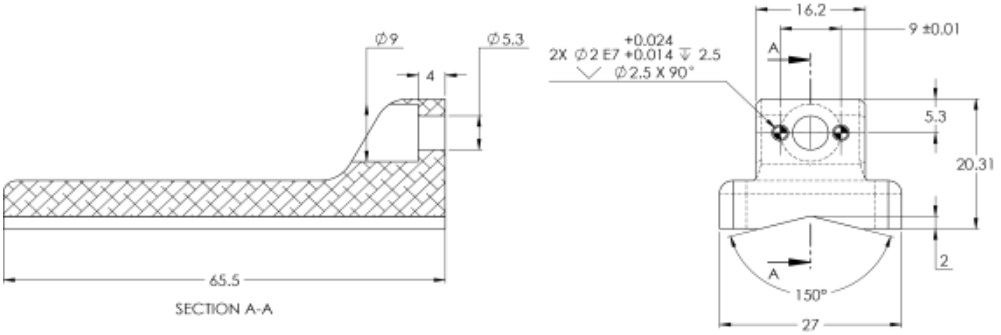


Fig. 6-17: Grooved fingertip AGC-TIP-421-140

6.2. Mechanical specifications

Specification	2-FINGER 85		2-FINGER 140	
	Metric Units	Imperial Units	Metric Units	Imperial Units
Gripper Opening	85 mm	3.35 in	140 mm	5.5 in
Minimum object diameter (for encompassing)	43 mm	1.69 in	90 mm	3.5 in
Maximum height	162.8 mm	6.4 in	232.8 mm	9.15 mm
Maximum width	148.6 mm	5.85 in	202.1 mm	8.0 in
Weight	925 g	2.04 lbs	1,025 g	2.25 lbs
Grasp Force	20 to 235 N	4.5 to 52.8 lbf	10 to 125 N	2.2 to 28.1 lbf
Finger speed	20 to 150 mm/s	0.8 to 5.9 in/s	30 to 250 mm/s	1.2 to 9.8 in/s
Position repeatability[1]	0.05 mm	0.002 in	0.08 mm	0.003 in
Force repeatability	+/- 10%			
Position resolution[2]	0.4 mm	0.016 in	0.6 mm	0.022 in
Grasp force resolution	Maximum force calculation below; refer to the **Force control** section			

Info

All specs are measured with coupling **GRP-CPL-062** and fingertip **AGC-TIP-204-085** (2-Finger 85) or **AGC-TIP-420-140** (2-Finger 140).

[1]Repeatability is defined as the positional deviation resulting from the average displacement determined when picking an object with a parallel grasp using standard silicone fingertips. For more details see the blog.robotiq.com article on repeatability. Position repeatability varies depending on the product wear and operating conditions. The presented values are typical for the newly-manufactured products.

[2]Resolution is the increment modified from a 1 bit difference of position/speed/force request (from 0 to 255).

6.2.1. Payload and force

Actuation force model used to calculate recommended payload is described in the figure below, the user must not exceed the force and torque limits:

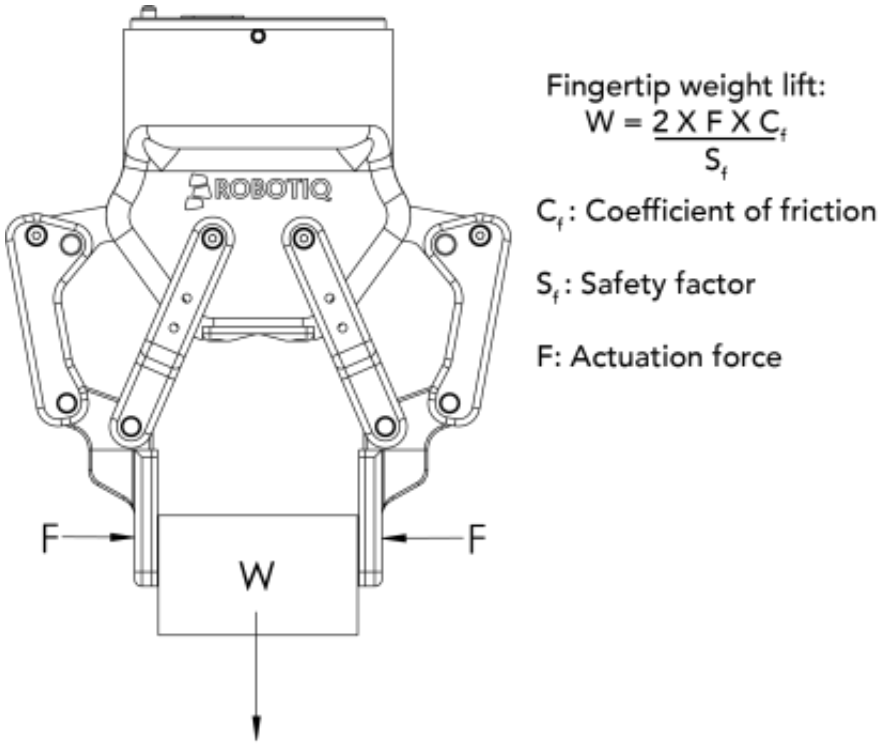


Fig. 6-18: Actuation force on the fingertip of the Adaptive Gripper 2-Finger (see charts below for 2-Finger 85 and 2-Finger 140 force).

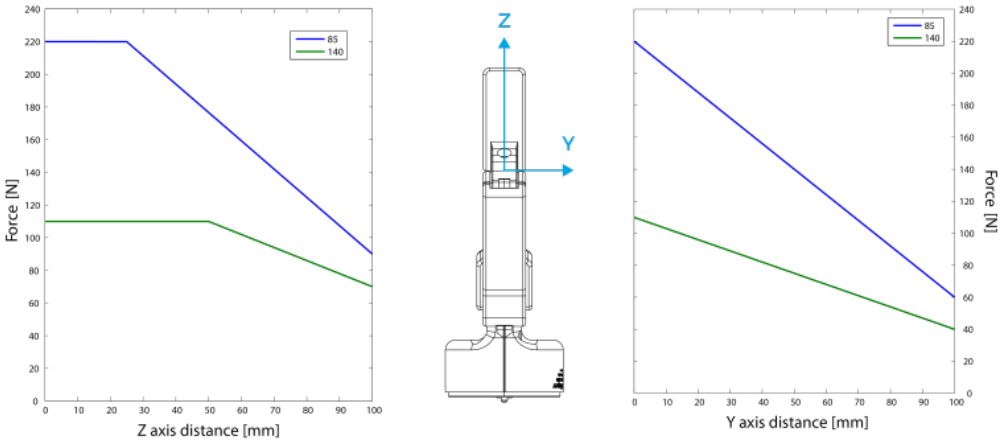


Fig. 6-19: Grasp force in the Y and Z axis for the 2-Finger 85 and 2-Finger 140.

Info

- The "Actuation Force" is the force that can be applied to an object by the motor of the Gripper.
- The Gripper is self-locking.

Info

The user of the Gripper must always ensure that the result of the forces against the finger is always lower than the maximum holding force as seen in figure 6-18.

As defined in figure 6-18, the weight that can be lifted is defined by :

- *F* is the force that is applied to the load by the Gripper.
- *Cf* is the friction coefficient between the fingertip and the object load.
- *Sf* is a safety factor to be determined by the robot integrator.

Info

For example, if the silicone fingertips **AGC-TIP-204** are used to lift a lubricated steel object (machine tending with cutting oils), the friction coefficient would be 0.3 (tested static

coefficient of friction).
Maximum weight with a safety factor of 2.4 would be :

W = (2 x 200 N x 0.3) / 2.4 = 50 N

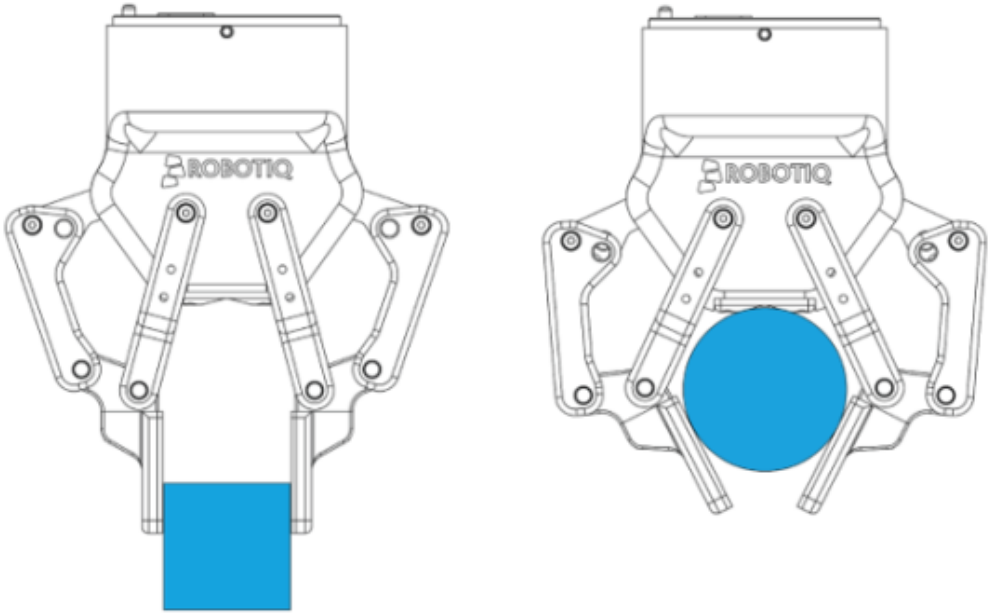
This calculation means that a 5 kg object will be held by the Gripper when not moving (standing still). When accelerating, the payload will decrease.
For example, if your robot accelerates at 2g then the 5 kg object would weigh 100 N and would therefore be dropped.

The biggest factor in such calculations will always be the friction coefficient, we recommend testing the coefficient.

Warning

You must consider the **robot acceleration** in your payload calculations.
Robot emergency stops will lead to major deceleration velocities.

6.2.1.1. Friction grasp and form-fit grasp



Maximum payload by grasp type

Grasp Type	2F-85	2F-140
Friction grasp	5 kg	2.5 kg
		2.5

Form-fit grasp	5 kg	kg

6.2.2. Equilibrium Line

Equilibrium line position (explained in the **General Presentation section**) is detailed in the figure below, where:

- q is the opening angle between the Gripper proximal bar and center line
- d is the distance between the bottom of the finger pads and the equilibrium line as seen on the Z axis in figure 1-5.

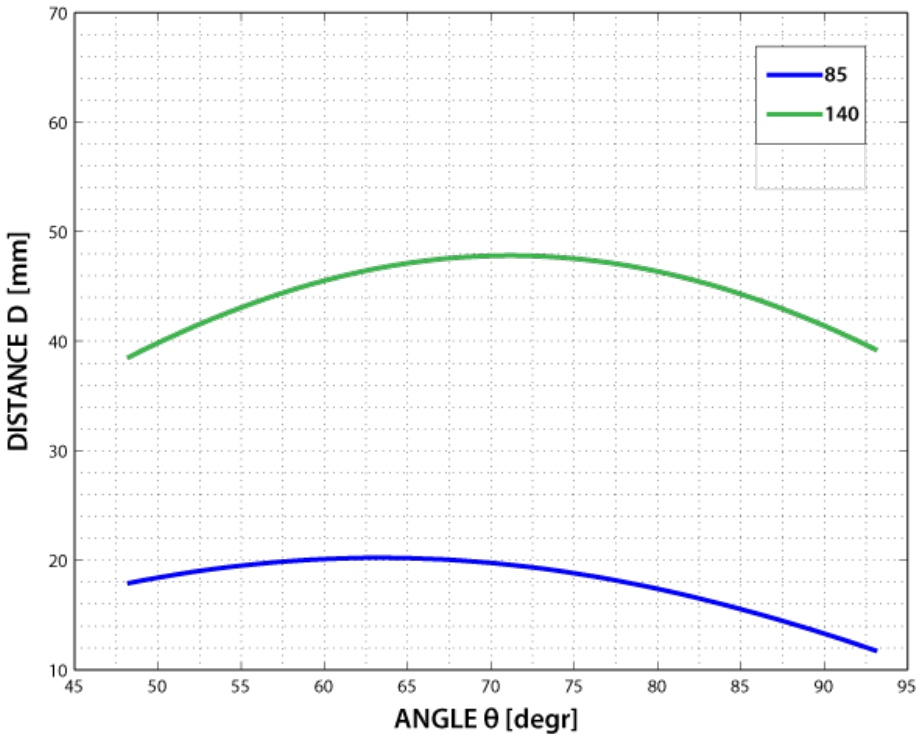


Fig. 6-20: Position of the Gripper equilibrium line according to the opening angle for 2-Finger 85 and 2-Finger 140 options.

6.2.3. Center of mass, tool center point and moment of inertia

Coupling is included when Gripper is not mounted on the Camera. Dual Gripper adapter plate included where appropriate.

Products	Center of mass (mm)			TCP (mm)						Mass (g)
				Gripper 1			Gripper 2			
	X	Y	Z	X	Y	Z	X	Y	Z	
FT Sensor	-3.0	0.0	17.0	0.0	0.0	37.5	-	-	-	300.0
Camera	-3.0	4.5	9.0	0.0	0.0	23.5	-	-	-	245.0
2F-85	0.0	0.0	58.0	0.0	0.0	174.0	-	-	-	925.0
2F-140	0.0	0.0	73.0	0.0	0.0	244.0	-	-	-	1025.0
Hand-E	0.0	0.0	57.5	0.0	0.0	157.0	-	-	-	1090.0
Dual grippers plate	0.0	0.0	15.5	-	-	-	-	-	-	265.0
FT Sensor + 2F-85	-0.7	0.0	76.3	0.0	0.0	211.5	-	-	-	1225.0
FT Sensor + 2F-140	-0.7	0.0	89.3	0.0	0.0	281.5	-	-	-	1325.0
FT Sensor + Hand-E	-0.6	0.0	78.2	0.0	0.0	194.5	-	-	-	1390.0
Camera + 2F-85	-0.7	1.2	57.1	0.0	0.0	175.5	-	-	-	975.0
Camera + 2F-140	-0.7	1.1	72.4	0.0	0.0	246.5	-	-	-	1075.0
Camera + Hand-E	-0.6	1.0	57.4	0.0	0.0	159.5	-	-	-	1135.0
FT Sensor + Camera + 2F-85	-1.3	0.9	76.3	0.0	0.0	213.0	-	-	-	1275.0
FT Sensor + Camera + 2F-140	-1.2	0.8	89.6	0.0	0.0	284.0	-	-	-	1375.0
FT Sensor + Camera + Hand-E	-1.1	0.8	78.6	0.0	0.0	197.0	-	-	-	1435.0
Hand-E/Hand-E	0.0	0.0	62.0	154.0	0.0	138.0	-154.0	0.0	138.0	2445.0
Hand-E/2F-85	5.9	0.0	61.7	154.0	0.0	138.0	-166.0	0.0	150.0	2280.0
Hand-E/2F-140	-2.4	0.0	66.6	154.0	0.0	138.0	-215.5	0.0	199.5	2380.0
2F-85/2F-85	0.0	0.0	61.4	166.0	0.0	150.0	-166.0	0.0	150.0	2115.0
2F-85/2F-140	-8.7	0.0	66.6	166.0	0.0	150.0	-215.5	0.0	199.5	2215.0
2F-140/2F-140	0.0	0.0	71.4	215.5	0.0	199.5	-215.5	0.0	199.5	2315.0
Camera + Hand-E/Hand-E	-0.3	0.4	78.5	154.0	0.0	161.5	-154.0	0.0	161.5	2690.0
Camera + Hand-E/2F-85	5.0	0.4	77.8	154.0	0.0	161.5	-166.0	0.0	173.5	2525.0
Camera + Hand-E/2F-140	-2.5	0.4	82.5	154.0	0.0	161.5	-215.5	0.0	223.0	2625.0
Camera + 2F-85/2F-85	-0.3	0.5	77.0	166.0	0.0	173.5	-166.0	0.0	173.5	2360.0
Camera + 2F-85/2F-140	-8.1	0.4	82.1	166.0	0.0	173.5	-215.5	0.0	223.0	2460.0
Camera + 2F-140/2F-140	-0.3	0.4	86.7	215.5	0.0	223.0	-215.5	0.0	223.0	2560.0
FT Sensor + Hand-E/Hand-E	-0.3	0.0	90.5	154.0	0.0	175.5	-154.0	0.0	175.5	2745.0
FT Sensor + Hand-E/2F-85	4.9	0.0	89.7	154.0	0.0	175.5	-166.0	0.0	187.5	2580.0
FT Sensor + Hand-E/2F-140	-2.5	0.0	94.3	154.0	0.0	175.5	-215.5	0.0	237.0	2680.0
FT Sensor + 2F-85/2F-85	-0.4	0.0	88.8	166.0	0.0	187.5	-166.0	0.0	187.5	2415.0
FT Sensor + 2F-85/2F-140	-8.0	0.0	93.7	166.0	0.0	187.5	-215.5	0.0	237.0	2515.0
FT Sensor + 2F-140/2F-140	-0.3	0.0	98.4	215.5	0.0	237.0	-215.5	0.0	237.0	2615.0
FT Sensor + Camera + Hand-E/Hand-E	-0.5	0.4	106.1	154.0	0.0	199.0	-154.0	0.0	199.0	2990.0
FT Sensor + Camera + Hand-E/2F-85	4.2	0.4	104.9	154.0	0.0	199.0	-166.0	0.0	211.0	2825.0
FT Sensor + Camera + Hand-E/2F-140	-2.5	0.4	109.4	154.0	0.0	199.0	-215.5	0.0	260.5	2925.0
FT Sensor + Camera + 2F-85/2F-85	-0.6	0.4	103.5	166.0	0.0	211.0	-166.0	0.0	211.0	2660.0
FT Sensor + Camera + 2F-85/2F-140	-7.6	0.4	108.4	166.0	0.0	211.0	-215.5	0.0	260.5	2760.0
FT Sensor + Camera + 2F-140/2F-140	-0.6	0.4	112.9	215.5	0.0	260.5	-215.5	0.0	260.5	2860.0

Info

The angle to calculate the TCP for Grippers mounted on a dual gripper assembly is as follows:

- Rx = 0
- Ry+/Ry- = 0.7854
- Rz = 0

The moment of inertia are calculated for a configuration where the fingers are fully open. Here is the approximate moment of inertia matrix for the Gripper:

2-FINGER 85 OPTION

$$I = \begin{bmatrix} I_{XX} & I_{XY} & I_{XZ} \\ I_{YX} & I_{YY} & I_{YZ} \\ I_{ZX} & I_{ZY} & I_{ZZ} \end{bmatrix} = \begin{bmatrix} 4180 & 0 & 0 \\ 0 & 5080 & 0 \\ 0 & 0 & 1250 \end{bmatrix} = \begin{bmatrix} 14.3 & 0 & 0 \\ 0 & 17.4 & 0 \\ 0 & 0 & 4.3 \end{bmatrix}$$
$$kg * mm^2 \qquad lb * in^2$$

2-FINGER 140 OPTION

$$I = \begin{bmatrix} I_{XX} & I_{XY} & I_{XZ} \\ I_{YX} & I_{YY} & I_{YZ} \\ I_{ZX} & I_{ZY} & I_{ZZ} \end{bmatrix} = \begin{bmatrix} 7400 & 0 & 0 \\ 0 & 9320 & 0 \\ 0 & 0 & 2260 \end{bmatrix} = \begin{bmatrix} 25.3 & 0 & 0 \\ 0 & 31.8 & 0 \\ 0 & 0 & 7.7 \end{bmatrix}$$
$$kg * mm^2 \qquad lb * in^2$$

Fig. 6-21: Robotiq 2-Finger inertia matrix.

6.2.4. Moment and force limits

The 2-Finger Adaptive Gripper has maximum moments and force limit. The listed moments and forces are independent to the force applied by the Gripper itself on it's payload. For payload calculation, refer to the **Mechanical specifications** section.

> **Warning**
>
> The following limits must be respected at all time. Calculation of maximum moment and force should include the robot acceleration and a safety factor.

Parameters	Finger Option	
	2-Finger 85	2-Finger 140
Fx, Fy, Fz	50 N	25 N
Mx*	5 Nm	5 Nm
My*	5 Nm	5 Nm
Mz	3 Nm	3 Nm

* Moments in x and y are calculated from the base of the fingertips as shown in figure 6-19.

Example usage of the listed limit :

- After picking it's normal payload, the robot can use the 2-Finger 85 Gripper to apply up to 50 N of force in any direction. Applying more then 50 N could damage the Gripper or result in payload loss.
- The Gripper can pick a screwdriver and apply 3 Nm of torque to screw (such moment would be in the Z axis).

6.3. Electrical specifications

SPECIFICATION	VALUE
Operating supply voltage	24 V DC ±10%
Absolute maximum supply voltage	28 V DC
Quiescent power (minimum power consumption)	< 1 W
Peak current	1 A